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Research Article

ULTRASOUND AND MAGNETIC RESONANACE IMAGING CORRELATION OF ROTATOR CUFF TEARS

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ABSTRACT

Introduction: Rotator cuff disease is one of the most common causes of shoulder pain. . In addition to history and physical examination, several radiological techniques have been used to detect tears of the rotator cuff. Each has limitations and no clear consensus on the optimum diagnostic study has emerged. The radiological diagnosis of rotator cuff tears has traditionally been performed with arthrography and more recently with non-invasive techniques like ultrasonography and MRI.

Objective: Correlation of ultrasound findings with MRI findings.

Materials and Methods: Proportional analysis of 30 patients referred to the department of Radio diagnosis, J.J.M. Medical College, Davangere with clinically suspected rotator cuff injuries were subjected to undergo USG and MRI after thorough history taking and clinical examination. USG was carried out on IU22 Philips machine using a high frequency transducer of 5-17 MHz. The rotator cuff tendons, muscles, ACJ, joint cavity and bursae were examined in various positions. Dynamic examination of shoulder were also carried out for impingement. Comparison with opposite shoulder was also done. MRI was performed on 1.5 Tesla MRI scanner (Achieva, Philips), using a dedicated.

Interpretation and Results: Increasing age, male gender, dominant arm, history of trauma and type II/III acromion are predisposing factors for rotator cuff tears. Peribicipital tendon fluid, joint effusion, bursal fluid and acromio-clavicular joint hypertrophy have significant association with rotator cuff tears. Pain is the most common presenting complaint with decreased range of motion a common manifestation of rotator cuff tears. Most commonly involved tendon is supraspinatus. Partial tears are more common than the full thickness tears. Among the partial tears most common are articular surface tears.

No single clinical examination test has both a high specificity and a high sensitivity, therefore the diagnostic accuracy of shoulder examination is overestimated and these exams are only rarely useful to differentiate rotator cuff tears.

Conclusion: USG is less reliable in detecting rotator cuff tears than previously reported and a positive sonographic reading is more reliable than a negative one.

MRI is more sensitive and has highest diagnostic accuracy in detecting rotator cuff tears as compared to USG and clinical diagnosis.

INTRODUCTION

The shoulder joint is an incongruous ball and socket joint without any fixed axis of rotation, which has a wide range of motion in multiple planes; hence stability is compromised for mobility. To compensate for the unstable bony anatomy the shoulder is protected anteriorly, posteriorly and superiorly by a capsule and the tendons that form the rotator cuff. The tendon is subject to "wear and tear" during the day to day activities. Spectrum of etiologies that can give rise to shoulder pain are acute trauma to a gamut of degenerative disorders associated with impingement syndrome. .

Patients presenting for imaging fall broadly into one of the following categories: Specific pain and restricted movements on abducting the arm and symptoms of instability.

The radiological diagnosis of rotator cuff tears has traditionally been performed with arthrography and more recently with ultrasonography and MRI 2

Rotator cuff disease is one of the most common causes of shoulder pain. In addition to history and physical examination, evaluation of a patient with shoulderpain often involves assessment of the rotator cuff with a diagnostic test such as high resolution ultrasonography or MRI3

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High resolution ultrasound is non invasive, less expensive and non-ionizing modality with good sensitivity in detecting both rotator cuff and non rotator cuff disorder.4 On ultrasonography the size of the tears can be classified and the findings used as a basis for management decisions1.Ultrasonography can also reveal the presence of other abnormalities that may mimic rotator cuff tear including tendinosis, calcific tendinitis, subacromialsubdeltoid bursitis, greater tuberosity fracture and adhesive capsulitis5.

MRI has become the "gold standard" for detecting both subtle and obvious internal derangement and assessing overall joint structure4. MRI can provide information about rotator cuff tears such as tear dimensions, tear depth or thickness and tear shape, involvement of adjacent structures (eg, rotator interval, long head of biceps brachii tendon etc) and muscle atrophy, all of which have implications for rotator cuff treatment and prognosis

Arthrography is quite accurate in detecting complete tears but it is an invasive procedure with some associated risk and discomfort, in addition it is insensitive to partial tears involving superficial surface or substance of the cuff. The diagnosis of partial tears, however, is important because many orthopedic surgeons will operate to relieve impingement of supraspinatus tendon before it progresses to full thickness tear.

Objective

Correlation of ultrasound findings with MRI findings.

MATERIALS AND METHODS

Source of Data

The main source of data for the study were patients from the following teaching Hospital attached to Bapuji Education Association, J.J.M. Medical College, Davangere.

1. Bapuji Hospital.
2. Chigateri General Hospital.

Method of Collection of Data

30 patients referred to the department of Radio diagnosis, J.J.M. Medical College, Davangere with clinically suspected rotator cuff injuries were subjected to undergo USG and MRI after thorough history taking and clinical examination.

Study Period: June 2015 to December 2016
Study Design: Proportion study
Inclusion criteria:

The study includes

- All patients with clinical suspicious of rotator cuff injuries.
- Cases of all age groups irrespective of sex

Exclusion criteria

The study will exclude

- Patient having history of claustrophobia.
- Patient having history of metallic implants insertion, cardiac pacemakers and metallic foreign body insitu.

Data Acquisition

After clinical evaluation, once a patient satisfied the inclusion and exclusion criteria for this study, he or she would undergo USG and MRI examination after giving consent.

Ultrasound examination of the shoulder*:* was carried out on IU22 Philips machine using a high frequency transducer of 5-17 MHz. The rotator cuff tendons, muscles, ACJ, joint cavity and bursae were examined in various positions. Dynamic examination of shoulder were also carried out for impingement. Comparison with opposite shoulder was also done.

MRI examination of the shoulder: was performed on 1.5 Tesla MRI scanner (Achieva, Philips), using a dedicated surface coil for shoulder. Patient was placed in supine position with external rotation of affected shoulder wherever possible.

The following sequences were used

- Short T1inversion recovery (STIR) in the axial plane, a slice thickness of 3mm, a FOV of 150mm and TR/TE – 7913/170.
- Proton density images in the oblique coronal plane, a slice thickness of 3mm, a FOV of 140mm and TR/TE – 4500/30.
- T2 weighted images in the oblique coronal plane, a slice thickness of 3mm, a FOV of 140mm and TR/TE – 4375/100.
- T2 weighted images with fat suppression (SPAIR) in the oblique coronal plane, a slice thickness of 3mm, a FOV of 140mm and TR/TE – 4000/50.
- Proton density images in the oblique sagittal plane, a slice thickness of 3mm, a FOV of 140mm and TR/TE – 4500/30.
- Short T1 inversion recovery (STIR) in the oblique sagittal plane, a slice thickness of 3mm, a FOV of 140mm and TR/TE – 3443/60.

Statistical Methods7,8,9,10,11

Data was entered into Microsoft excel sheet and was analyzed using EPI Info 7 version software. Qualitative data was represented in the form of Frequency and Proportions. Chi-square was the test of significance to find the association between qualitative data. Validity of the diagnostic test was measured by Sensitivity, Specificity, Positive predictive value, Negative predictive value and Diagnostic accuracy. Kappa statistics was computed to find the Degree of agreement between two diagnostic tests. p value < 0.05 was considered as statistically significant.

OBSERVATIONS AND RESULTS

Table 1: Age distribution of the subjects

		Frequency	Percent
Age	<40yrs	9	30%
	41 to 50 yrs	9	30%
	>50 yrs	12	40%
	Total	30	100%

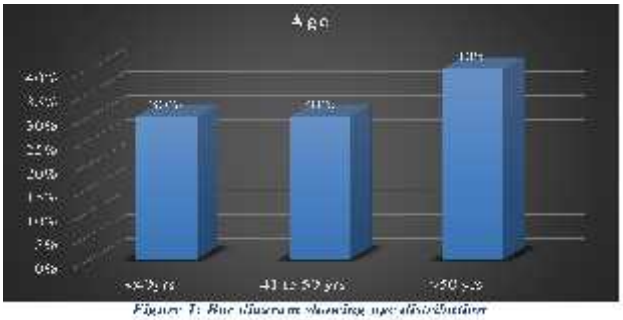


Figure 1: Bar diagram showing age distribution

Table 2: The following chart shows the various abnormalities in the rotator cuff tendons and the age range of occurrence in our study group

Status of rotator cuff tendon	Age range in years			Total
	<40	41-50	>50	
Normal	1		3	4
Tendinosis	4		1	5
Partial tear	1	2	9	12
Full thickness tear	1	5	8	9
Total	6	9	15	30

Table 3: Sex distribution of subjects

		Frequency	Percent
Sex	Female	5	16.7%
	Male	25	83.3%
	Total	30	100%

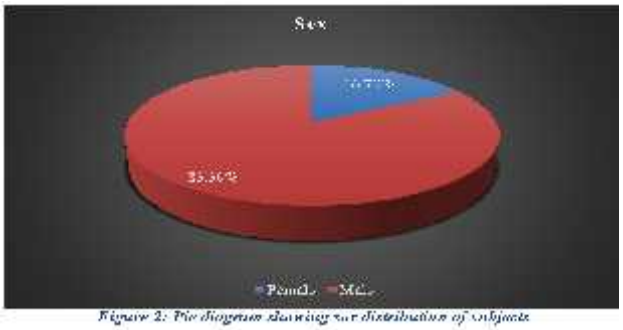


Figure 2: Pie diagram showing sex distribution of subjects

Table 4: Association between Dominant side and affected side

		Affected side		Total
		Left	Right	
Dominant hand	Left	1	1	1
	Right	5	21	26
Total		9	21	30

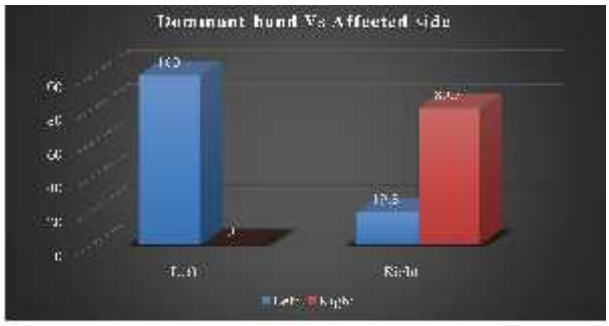


Figure 3: Bar diagram showing Association between Dominant side and affected side

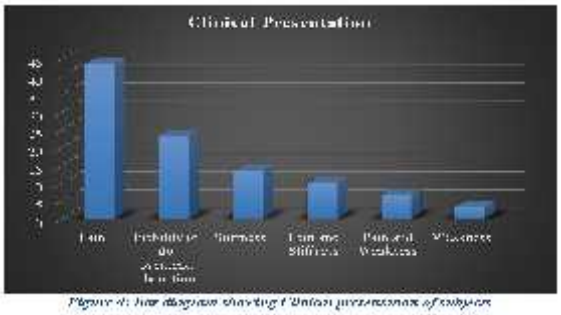


Figure 4: bar diagram showing Various presentation of subjects

Table 6: History of Trauma in subjects

		Frequency	Percent
History of trauma	Absent	11	36.7
	Present	19	63.3
	Total	30	100.0

In our study 26.7% of patients had history of trauma.

Figure 5: Pie diagram showing History of trauma

Table 9: USG findings in Tendon injuries

		SS	IP	SUB	TM	BT
Tendons	No tear	17	29	26	30	30
	Articular surface partial tear	5	0	2	0	0
	Bursal surface partial tear	2	0	0	0	0
	Full thickness tear	3	1	2	0	0
	Intrasubstance tear	1	0	0	0	0
	Tendinosis	2	0	0	0	0
	Total	30	30	30	30	30

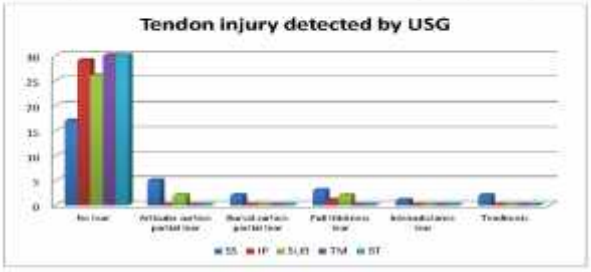


Figure 8: Tendons injuries diagnosed by USG

Table 10: MRI findings in Tendon injuries

		SS	IP	SUB	TM	BT
Tendons	No tear	8	28	24	30	30
	Articular surface partial tear	10	1	4	0	0
	Bursal surface partial tear	2	0	0	0	0
	Full thickness tear	3	1	2	0	0
	Intrasubstance tear	1	0	0	0	0
	Tendinosis	6	0	0	0	0
	Total	30	30	30	30	30

Figure 9: Bar diagram showing MRI findings in Tendon Injuries

Table 11: Validity of USG findings with MRI findings in Tendon Injuries

	Sensitivity	Specificity	Positive Predictive value	Negative Predictive value	Diagnostic Accuracy	Kappa Degree of agreement
SS	25.00%	100%	100%	47.06%	70.[illegible]	0.45
IP	50%	100%	100%	[illegible]	[illegible]	[illegible]
SUB	66.67%	100%	100%	[illegible]	93.33%	0.76
TM		100%		100%	100%	
BT		100%		100%	100%	

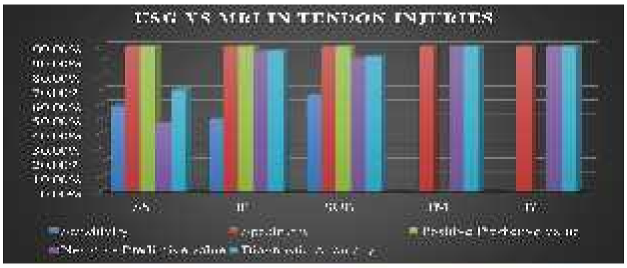


Figure 10: Validity of USG findings of tendon injuries in comparison to MRI findings

Table 20: Validity of USG findings with MRI findings in detecting PTT, Bursal fluid, Joint Effusion, ACJH and Impingement

		Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy	Kappa Degree of agreement
	PTT	[illegible]	100%	100	[illegible]	[illegible]	[illegible]
Bursal	SASD	[illegible]	100%	100	[illegible]	100%	[illegible]
	SC	[illegible]	100%	[illegible]	[illegible]	[illegible]	0.5
	Joint Effusion	[illegible]	100%	[illegible]	[illegible]	[illegible]	[illegible]
	ACJH	100%	100%	100%	100%	100%	1
Impingement	SA	[illegible]	100%	100	[illegible]	[illegible]	[illegible]
	SC	100%	100%	100%	100%	100%	1

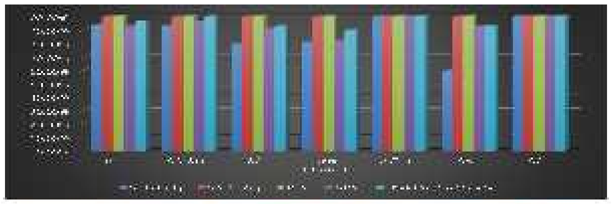


Figure 16: Bar diagram showing validity of USG in detecting PTT, Bursal Fluid, Joint Effusion, ACJH and Impingement

Table 24: Other Findings on MRI in Rotator Cuff Injuries

		Frequency	Percent
OTHERS	Axillary LN	1	14.3
	Comminuted Fracture Of Humeral Head	1	[illegible]
	[illegible]	1	[illegible]
	[illegible]	1	[illegible]
	[illegible]	1	14.3
	Humeral Head Fracture With Marrow Edema	1	[illegible]
	Multiple Fractures [illegible] Humeral Head, Neck and Shaft	1	[illegible]
	Total	7	100

Table 26: Comparison of Final Diagnosis with MRI, USG and Clinical diagnosis

	Sensitivity	Specificity	Positive Predictive value	Negative Predictive value	Diagnostic accuracy	Kappa Degree of agreement
MRI Vs Final diagnosis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USG Vs Final diagnosis	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Clinical diagnosis Vs Final diagnosis	[illegible]	0	[illegible]		[illegible]	0

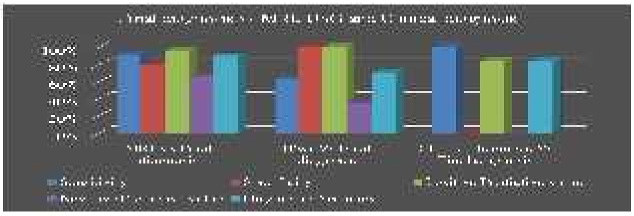


Figure 22: Bar diagram showing comparison of MRI, USG and Clinical diagnosis with Final diagnosis

DISCUSSION

Various techniques are used for evaluating patients with rotator cuff tears including clinical examination, X-ray, Arthrography, USG, CT scan and MRI. The gold standard is arthrography but has the disadvantage of being invasive. MRI is sensitive and specific but is expensive and cannot be used as a first line of investigation. However, USG is a non-invasive, relatively inexpensive modality that can be used as a first line of investigation.

The soft tissue structures supporting the shoulder are arranged in multiple planes, hence the direct multiplanar imaging capability of MRI is superior to the single plane capability of computed tomography. The rotator cuff is well visualized in MRI and the individual central tendons of the four rotator cuff muscles can be separately identified 11. Thus allowing precise localization and quantification of rotator cuff abnormalities. MRI can demonstrate the rotator cuff excellently including the subacromial portion, which is hidden from view on ultrasonography.

This was a prospective study in which 30 patients referred to the department of Radio diagnosis, J.J.M.Medical College, Davangere with clinically suspected rotator cuff injuries were subjected to undergo USG and MRI after thorough history taking and clinical examination.

Age wise distribution of rotator cuff diseases

In our study the age of the patients with rotator cuff disorders ranged from 23 to 76 years with the mean of 46.6 +/- 2.08. Majority of Rotator cuff injures were observed in patients above 50 yrs of age (40%). Various literatures have pointed out that the incidence of rotator cuff tendon degeneration and injury increases with the age. Rotator cuff diseases is multi factorial both extrinsic and intrinsic factors have been implicated. Intrinsic factors like poor vascularity, alteration in the material composition & properties with aging have been studied12,13,14.

In our study tears appeared to be more common in the age group more than 50 years (36.7%) compared with age group less than 50 years of age (30%).Tendinosis appeared to be more common in the age group less than 50 years (13.3%) compared with age group more than 50 years of age (3%).

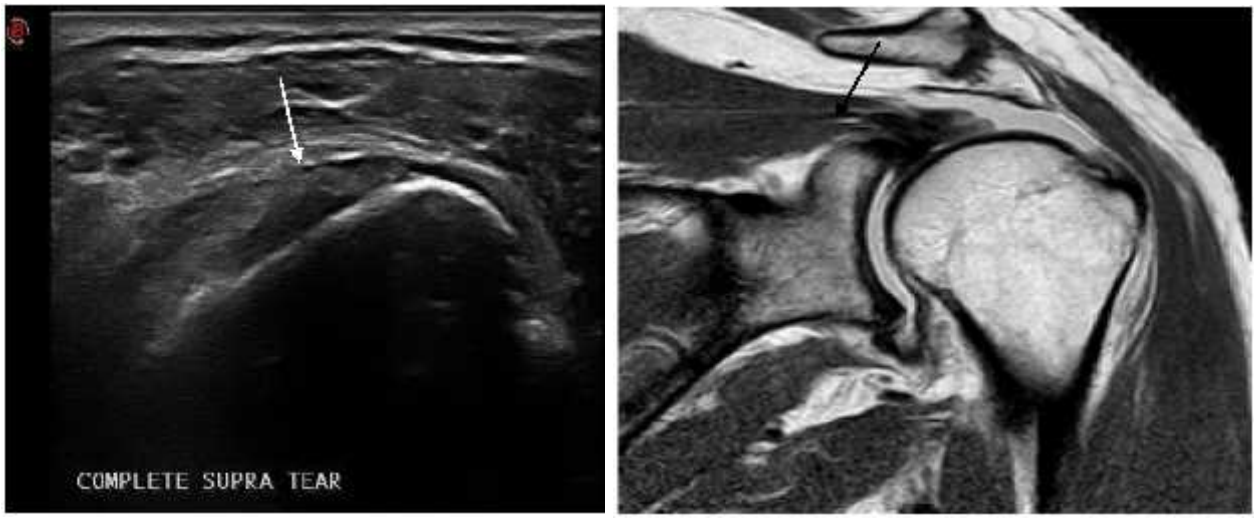
Gender distribution of rotator cuff disease

In our study rotator cuff diseases was seen in 25 male patients (83.3%) and 5 female patients (16.7%), thus showing male preponderance among the study population correlating with study of David W.S *et al* 15

Cases

Case-1

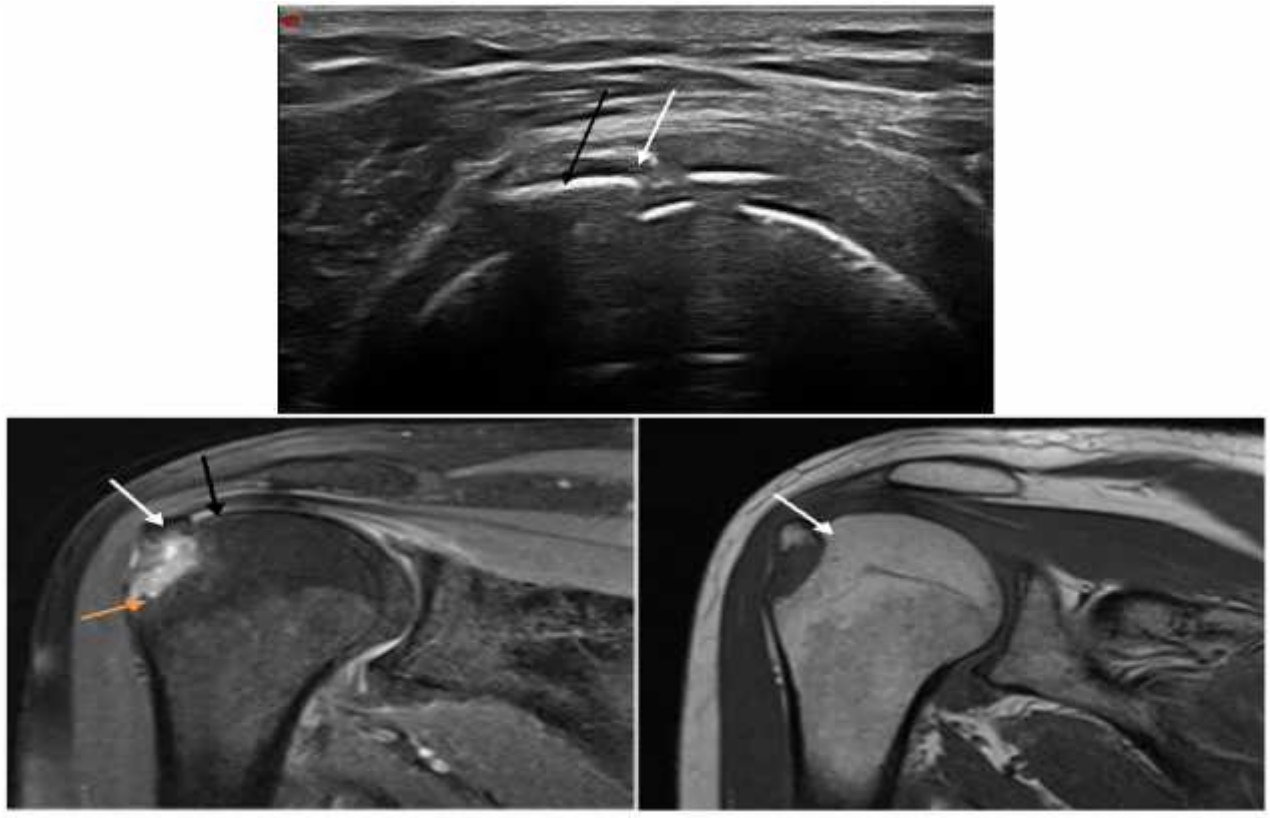
Full thickness Supraspinatus tendon tear with retraction of tendon



USG and T2w CORONAL MRI images: show discontinuity of supraspinatus tendon with retraction from its insertion site (arrow).

CASE-2

Greater tuberosity avulsion fracture with partial articular side supraspinatus tendon tear



USG, T2w and T1w CORONAL MRI images: show avulsed greater tuberosity fracture fragments (white arrow) with partial articular side supraspinatus tendon tear (black arrow) with adjacent bone contusion (orange arrow).

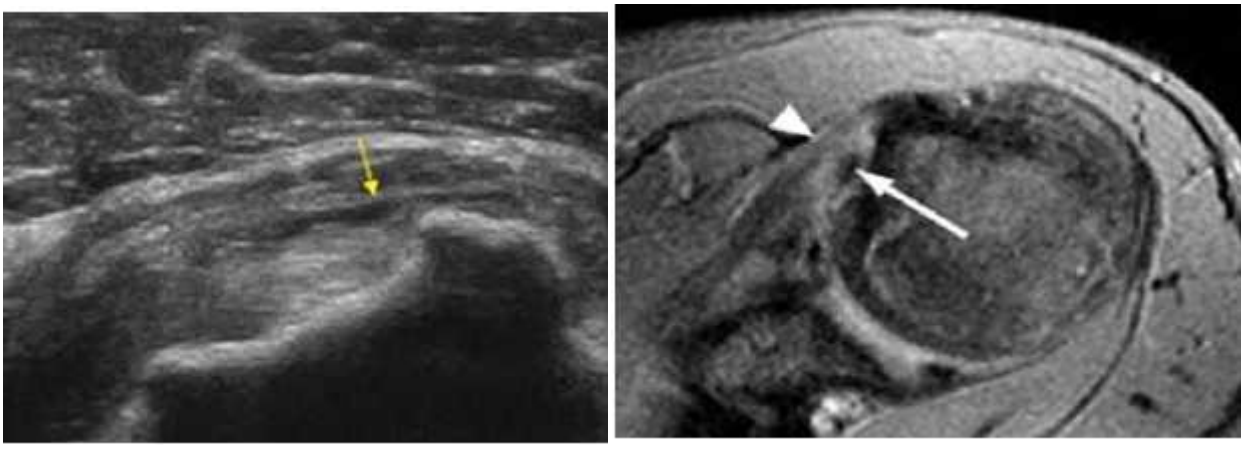
Case-3

Massive Tear: full thickness tear of subscapularis, supraspinatus, infraspinatus tendons with joint effusion

USG and T2w AXIAL and CORONAL MRI images: show complete discontinuity of fibers of supraspinatus, infraspinatus and subscapularis tendon (white arrow in A,C and yellow arrow in B) with retraction of tendon of supraspinatus and infraspinatus (black arrow).

Case-4

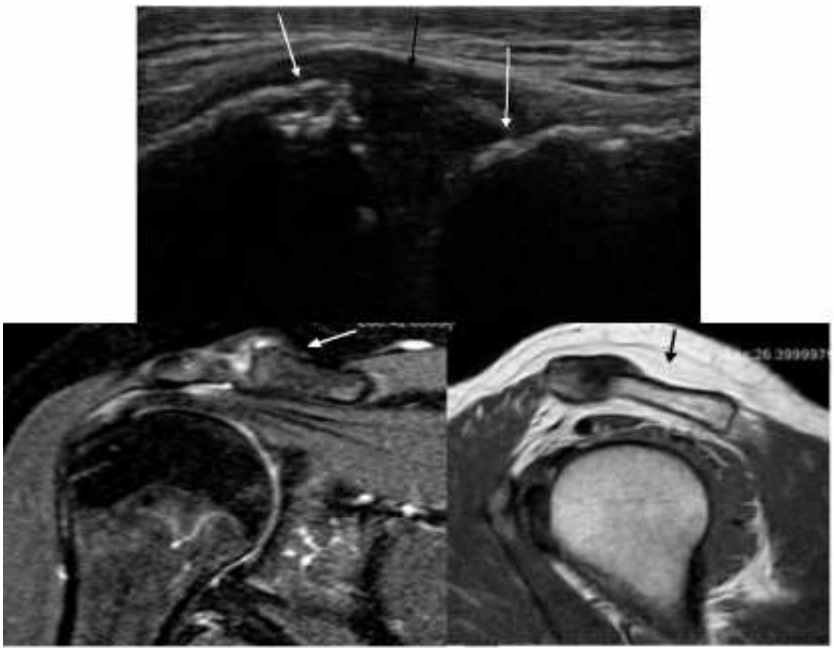
Partial tear of subscapularis tendon with lesser tuberosity avulsion fracture
USG image: shows hypoechoic area within thesubscapularis tendon (yellow arrow).



AXIAL T2w MRI image: shows hyperintensity within the subscapularis tendon (arrowhead) with avulsed lesser tuberosity (white arrow).

Case-5

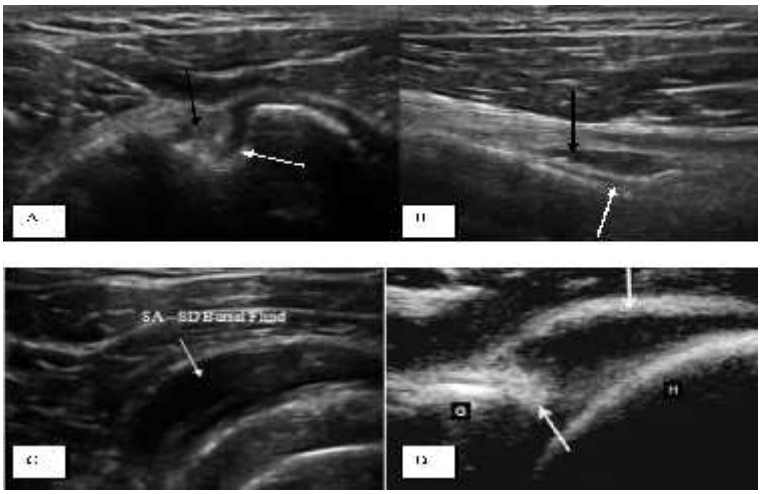
Acromio-calvicular joint hypertrophy



USG and MRI T2w (SPAIR) CORONAL and T2w SAGITTAL images: show synovial hypertrophy (black arrow) with irregularity of articular surfaces (white arrow).

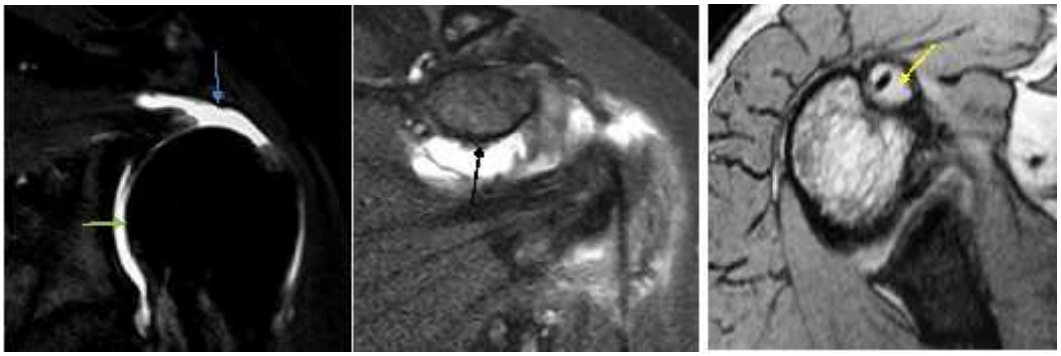
Case-6

Subacromial-subdeltoidbursal fluid, subcoracoid bursal fluid, joint effusion and peribicipital tendon fluid



AXIAL (A) and LONGITUDNAL (B) USG images: show fluid (white arrow) around the biceps tendon (black arrow).
AXIAL (C) USG image: shows fluid in the subacromial-subdeltoid bursa (white arrow).

AXIAL (D) USG image: shows glenohumeral joint effusion (white arrow)



MRI T2w (SPAIR) CORONAL, T2w AXIAL images: show fluid in the subacromial-subdeltoid bursa (blue arrow), subcoracoid bursa (black arrow), joint effusion (green arrow) and peribicipital tendon fluid (yellow arrow).

Association between Dominant side and affected side

In our study majority were right handed subjects i.e 86.6% and 13.4 % were left handed subjects. All the 4 left handers (100%) had Rotator cuff injuries on left side and 80.7% of right handers had injuries on right side showing statistically significant association between dominant hand and affected side correlating with study of Yamamoto *et al* 16 and Urwin M *et al* 17.

Clinical presentation among the subjects with Rotator cuff injuries

Pain is the most frequently associated complaint with rotator cuff pathology. It is usually located over the anterior, superior, and lateral aspects of the shoulder18. True weakness often presents as an inability to raise the arm above the shoulder level. Stiffness may be secondary to pain or weakness of the rotator cuff. Our study showed pain as the most common presenting complaint (43.3%) of rotator cuff disorders, which is consistent with the literature15,19. Many studies have showed disorders of the rotator cuff are the most common causes of a painful shoulder.

History of Trauma

In our study 8 out of 30 patients (26.7%) had history of trauma. 6 out of 8 patients (75%) with history of trauma had rotator cuff tear making it a predisposing factor for rotator cuff tears consistent with literature20,16.

Range of Movements in patients with Rotator cuff Injuries

Decreased range of motion is usually secondary to pain because of rotator cuff tear or weakness of the rotator cuff16,18. In our study 23 out of 30 patients (76.6%) had decreased range of movements. Out of 23 patients with decreased range of motion 15 (65.21%) had rotator cuff tear depicting the fact that decreased range of motion is a manifestation of rotator cuff tear which is consistent with the literature21.

USG findings in Tendon injuries

In our study most commonly involved tendon was supraspinatus (43.3%), followed by subscapularis (13.3%), infraspinatus (3.3%) with teres minor and biceps tendon least commonly affected (0%). This is consistent with the study conducted by Jerosch *et al* 22.

MRI findings in Tendon injuries

In our study most commonly involved tendon was supraspinatus (73.3%), followed by subscapularis (20%), infraspinatus (6.67%) with teres minor and biceps tendon least commonly affected (0%). This is consistent with literature22, 23

Correlation of USG findings with MRI findings in Tendon Injuries

USG findings in comparison to MRI findings showed that Sensitivity of USG was low in detecting the Tendon injuries of supraspinatus (59.09%), infraspinatus (50%) and subscapularis muscle (66.67%). Highest sensitivity was observed for Subscapular tendon injuries (66.67%). Specificity was 100% at all the sites. Diagnostic accuracy was low in Supraspinatus tears (70%) and Highest for Teres minor and Biceps tendon injuries(100%).

Correlation of USG with MRI in detection of calcification of rotator cuff tendon

In our study 1 out of 30 patients (3.33%) had calcification of supraspinatus tendon which was detected by both USG and MRI indicating that USG and MRI are equivalent to each other for detecting calcification of rotator cuff tendons.

Correlation of USG with MRI in detection of Peribicipital tendon fluid (PTF)

In our study MRI showed 16 positive for PTF out of 30 patients (53.33%) whereas USG detected 15 cases (50%) and did not detect PTF in one case. There was significant association between USG and MRI findings (p value< 0.0001). i.e. MRI was better in detecting PTF than USG.

In our study, peribicipital tendon fluid was found in 16 patients (53.33%). Of these, tear seen in 12(75%), tendinosis was seen in 2(12.5%) and normal tendon seen in 2(12.5%). This was consistent with study done by Doughlas *et al*. They concluded peribicipital tendon fluid had a statistically significant association with tears of the supraspinatus and subscapularis components of the rotator cuff 24.

Correlation of USG with MRI in detection of Bursal fluid / Joint effusion

In our study MRI showed 15(50%), positive for SA-SD bursal fluid out of 30 patients whereas USG detected 14 cases (46.67%) and did not detect SA-SD in one case. There was significant association between USG and MRI findings (p value<0.0001). I.e. MRI was better in detecting SA-SD bursal fluid than USG.

Similarly MRI showed 10 positive for S-C bursal fluid out of 30 patients (33.33%) whereas USG detected 8 cases (26.67%) and did not S-C in two cases. There was significant association between USG and MRI findings (p value<0.0001). I.e. MRI was better in detecting S-C bursal fluid than USG.

In our study MRI showed 16 positive for joint effusion out of 30 patients (53.33%) whereas USG detected in 13 cases (43.33%) and did not detect joint effusion in three cases. There was significant association between USG and MRI findings (p value<0.0001). i.e. MRI was better in detecting joint effusion than USG.

In our study joint effusion was found in 16(53.33%) and bursal fluid noted in 20(66.67%).Of the 16 patients with effusion 13(81.25%) had tears and 1 (6.25%) hadtendinosis and 2(12.5%) had normal tendon. Of the 20 patients with bursal fluid, 17(85%) showed tear in the cuff tendon and 3 (15%) showed tendinosis in the cuff tendon. Thus presence of joint effusion or bursal effusion is a marker of abnormal cuff tendon especially tears.

Correlation of USG with MRI in detection of Acromio-clavicular joint hypertrophy (ACJH)

In our study MRI showed 9(30%), positive for ACJH out of 30 patients.USG also detected all the 9 cases of ACJH. There was significant association between USG and MRI findings (p

value<0.0001). I.e. USG was equivalent to MRI in detecting ACJH.

Out of 9 patients with ACJH 7 had tear (77.77%), 1 had tendinosis (11.11%) and 1 had normal tendon (11.11%).Thus abnormal tendon was common in patients with AC joint hypertrophy and tear being more frequent in these patients 25.

Correlation of USG with MRI in detection of impingement

In our study MRI showed 5(16.67%) positive for SA impingement out of 30 patients whereas USG detected 3 cases (10%) and did not detect SA impingement in two cases. There was significant association between USG and MRI findings (p value<0.0001).. I.e. MRI was better in detecting SA impingement than USG.

Similarly MRI showed 1(3.33%) positive for SC impingement out of 30, USG also detected 1 case of SC impingement. There was significant association betweenUSG and MRI findings(p value<0.0001).. I.e. USG was equivalent to MRI in detecting SC impingement.

In our study sensitivity of dynamic USG for detecting impingement was 66.67% as compared to MRI (100%). This was consistent with the study done by John W *et al* 26.

Acromian type and rotator cuff disease

Acromion are classified as type I to IV , flat, curved inferior surface, hooked and convex near the distal end, respectively according to Bigliani and colleagues27. Type II & III are the most common types and are usually associated with shoulder impingement16.

In our study done in 30 patients with rotator cuff pathologies, most common was type II in 12 (40%) followed by type III in 8 (22%) then type I in 6 (20%) and least common type IV in 4 (13.3%). In this study it was found 66.67% of patients (20 out of 30) had either type II or III acromion. Of these patients 14 (70%) had tears (partial and complete), 3(15%) had tendinosis and 3 (15%) had normal supraspinatus tendon. Thus in this study rotator cuff pathologies were common with type II /III acromion which is consistent with literature16,28,29.

Labrum and rotator cuff tears

An overlap of symptoms exists among patients with a glenoidlabral lesion and those with a rotator cuff disorder or glenohumeral instability30.A labral tear can result as a result of trauma like in patients who engage in over head throwing athletic sport activities, or secondary to degenerative changes in the labrum leading on to tear. Rotator cuff tears and long head of the biceps tendinopathy may accompany a superior labral tear. Both chronic overuse tears of the posterosuperior labrum and articular-side partial tears of the supraspinatus and infraspinatus tendons may result from internal impingement in the overhead position.

In our study out of the 30 patients, 6 (20%) patients showed glenoid labrum tear. This smaller number may be because of the limitation of magnetic resonance imaging without arthrogram in detecting labral tears31.

Adjacent bone changes

Humeral head or greater tuberosity cysts have been associated with shoulder impingement. This is a very common finding on MR exam. These cysts are often posteriorly located, at the greater tuberosity, or at its junction with humeral head near the capsular insertion. Cysts may also occur more superiorly or anteriorly. In our study 13 out of 30 patients (43.33%) showed changes in the adjacent bones like edema ,contusion,geodes or subchondral cysts and erosion depending upon the mechanism causing rotator cuff disease or as changes secondary to the rotator cuff disease itself.

Other findings

In our study associated findings included axillary lymph node (14.3%), greater tuberosity avulsion fracture (14.3%), hill sach lesion (14.3%), hill sach lesion with lesser tuberosity fracture (14.3%), humeral head fracture with muscle edema (14.3%) and multiple exostosis arising from humeral head,neck and shaft (14.3%).

Rotator cuff tears

Partial tears of tendon can be intrasubstancei.e without involvement of the surface or with involvement of surface only on one side i.e either on the bursal or the articular surface of the tendon. Among our study of 30 patients totally 20 patients had partial tear (66.67%) - 13(65%) in the supraspinatus tendon, 5 (25%) in the subscapularis tendon and 2(10%) in the infraspinatus tendon.

The articular surface of the cuff is hypovascular compared to the bursal surface, resulting in a higher incidence of partial-thickness rotator cuff tears on the articular surface of the cuff 17, 33. Articular surface tears are found more common than the bursal surface tears98. Jacobson *et al* in a study conducted in 50 patients with surgical correlation found among the partial tears, articular surface tears occurred in 70%.

In our study 20 patients had partial tear of the rotator cuff tendons, of these most common were articular surface tears in 85% followed by bursal tears in 10% and intrasubstance tears in 5%, which is consistent with literature16,32,33.

In our study full thickness tear was seen in 7 out of 30 patients (23.33%), of which 4(57.14%) occurred in the supraspinatus tendon, consistent with the available literature18. Of these 7 tears 4(57.14%) showed retraction as a consistent finding which can be correlated with the study by Farley *et al* in which 31 patients had full thickness tear which was proven on open surgery/ arthroscopy out of which 18(58.06%) showed retraction 34.

Comparison of Final Diagnosis with MRI, USG and Clinical diagnosis

Final diagnosis was made by arthroscopy/surgery keeping them as gold standard. In our study clinical diagnosis had sensitivity of 100%, specificity of 0%, PPV of 83.33%, NPV of 0%, diagnostic accuracy of 83.33% with kappa degree of agreement 0. This is consistent with a meta-analysis (2012) which suggests that the diagnostic accuracy of orthopedic shoulder exams is overestimated, and that these exams are only rarely useful to differentiate RC tears. While some shoulder examination tests had high sensitivities and others had high specificities, no single test had both a high specificity and a high sensitivity. Further, the lack of precise techniques and subjective interpretation of these exams leads to substantial interobserver variability.35

In our study USG had a sensitivity of 64%, specificity of 100%, PPV of 100%, NPV OF 35.71%, diagnostic accuracy of 70% and kappa degree of agreement of 0.37.This is consistent with study done by Cynthia L. Miller *et al* 36.

In our study MRI had a sensitivity of 92%, specificity of 80%, PPV of 95.83%, NPV of 66.67%, diagnostic accuracy of 90% and kappa degree of agreement of 0.66. This is consistent with study done by Vlychou M *et al*. (2009) 37.

CONCLUSION

- Majority of the rotator cuff tears were seen in patients above 50 yrs of age (40%) with males affected more than females (M:F ratio - 5:1), dominant arm (83.3%) affected more than the non dominant arm with 75% of the cases with history of trauma showing rotator cuff tears depicting the fact that increasing age, male gender, dominant arm and history of trauma are predisposing factors for rotator cuff tears.
- Pain was the most common clinical complaint (43.3%) followed by inability to do overhead abduction (23.3%) in our study in patients with rotator cuff tears.
- Patients with decreased range of motion had rotator cuff tear in 65.21% of the cases depicting the fact that decreased range of motion is a manifestation of rotator cuff tear.
- In our study most commonly involved tendon was supraspinatus (43.3%), followed by subscapularis (13.3%), infraspinatus (3.3%) with teres minor tendon least commonly affected (0%).
- In our study among the rotator cuff tears, partial tears (66.67%) were more common than the full thickness tears (23.33%). Among the partial tears most common were articular surface tears in 85% followed by bursal tears in 10% and intrasubstance tears in 5%.
- In our study 75% of the patients with peribicipital tendon fluid had rotator cuff tears showing significant association between peribicipital tendon fluid and rotator cuff tears.
- In our study, 81.25% of patients with joint effusion and 85% of patients with bursal fluid showed tear in the cuff tendon depicting the fact that presence of joint effusion or bursal fluid is a marker of rotator cuff tears.
- In our study 77.77% of patients with acromio-clavicular joint hypertrophy had rotator cuff tear showing significant association between the two.
- In our study most common acromion type was II and III (66.67%), with 70% of these patients showing rotator cuff tears. Thus in this study rotator cuff tears were common with type II /III acromion.
- MRI is more sensitive than USG for detecting peribicipital tendon fluid, joint effusion, SA-SD and S-C bursal fluid and SA impingement.
- MRI is equivalent to USG in detecting calcification of the rotator cuff tendon, acromio-clavicular joint hypertrophy and S-C impingement.
- Labral tears, acromion type and adjacent bone changes were detected only by MRI.
- In our study clinical diagnosis had sensitivity of 100%, specificity of 0%, PPV of 83.33%, NPV of 0%, diagnostic accuracy of 83.33% with kappa degree of agreement 0. While shoulder examination tests had high sensitivities but no single test had both a high specificity and a high sensitivity. This suggests that the diagnostic accuracy of shoulder examination is overestimated, and that these exams are only rarely useful to differentiate rotator cuff tears.
- In our study USG had a sensitivity of 64%, specificity of 100%, PPV of 100%, NPV OF 35.71%, diagnostic accuracy of 70% and kappa degree of agreement of 0.37. These results suggest that USG is less reliable in detecting rotator cuff tears than previously reported and a positive sonographic reading is more reliable than a negative one.
- In our study MRI had a sensitivity of 92%, specificity of 80%, PPV of 95.83%, NPV of 66.67%, diagnostic accuracy of 90% and kappa degree of agreement of 0.66. These results suggest that MRI is most sensitive and has highest diagnostic accuracy in detecting rotator cuff tears as compared to USG and clinical diagnosis.

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