

Detection of Subscapularis Tear by MRI with Surgical Correlation

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Abstract: *Objectives of the Study:* To detect the sensitivity and specificity of mri for detecting subscapularis tear and to compare the mri findings with the surgical findings. *Methods:* Proportional analysis of 40 patients performed who ever referred to the Radio diagnosis department, A.J. Institute of Medical Sciences, Mangalore with clinically suspected rotator cuff tears were subjected to undergo MRI through history taking and clinical examination. MRI was performed on 1.5 Tesla MRI scanner (Siemens MagnetomAvanto 1.5 T MRI), using a dedicated surface coil for shoulder. Images were obtained in axial, coronal and sagittal planes. The tendons, muscles, glenohumeral joint, glenoid labrum, bursae, acromio-clavicular joint etc. were then studied. *Results:* In this study the MRI has a good sensitivity and specificity for the detection of subscapularis tendon tears. The sensitivity is 97.2% and specificity is 100.0% for MRI. In MRI the most common finding is focal discontinuity in subscapularis tear. The most common association of subscapularis tear is supraspinatus tendon tear. *Conclusion:* MRI is the best modality for detecting the subscapularis tendon tears both partial and full thickness. MRI have high sensitivity and specificity in identifying all rotator cuff tears.

1. Introduction

The shoulder joint is a ball and socket joint. There is no fixed axis of rotation, and 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 by a capsule and tendons forming rotator cuff by anteriorly, posteriorly and superiorly.

Rotator cuff tendon is more prone to wear and tear during day to day activities. There are a spectrum of aetiologies that can give rise to shoulder pain include acute trauma and degenerative diseases.

Repetitive active and passive forces make these tendons susceptible to degeneration leading to swelling of tendon and a minor degree of subluxation. The space between the humeral head and the acromion is sufficiently restricted that mild swelling of the interposed tendon with or without minor superior subluxation of the humeral heads leads to impingement syndrome and rotator cuff tears.

J.G Smith in 1834 conducted a study in traumatic rotator cuff ruptures in seven patients and he is the one who first published about the rotator cuff tears in London Medical Gazette (1)

In rotator cuff tears mostly involved tendons are supraspinatus and infraspinatus tendons (2). Isolated subscapularis tendon tears are rare and it is usually associated with trauma (3). Subscapularis tendon tears with other rotator cuff tears are also uncommon and seen associated with supraspinatus tendon tear in 2% (4). Mostly subscapularis tears caused by extension of supraspinatus tendon tear or subcoracoid impingement cause narrowing of the static distance between coracoid and lesser tuberosity(5).

Patients with history of fall can present with specific pain and restricted movements. The patients presenting with these complaints has to investigate with further investigations.

Several radiological techniques have been used to detect subscapularis tears. Each has its own limitations. There is no

specific investigation for the optimal diagnosis has been emerged (6).

The radiological diagnosis of subscapularis tear has traditionally been performed with arthrography and more recently with MRI (7). Crass et al (8) and middleton et al (9) in 1984 described that ultrasonography is accurate as MRI for the detection of rotator cuff tears. After history and clinical examination patient with history of shoulder pain should evaluate with diagnostic test such as high resolution USG or MRI (10). MRI is a golden standard for detecting subtle internal derangement and it is useful for the assessment of the joint structures. MRI is helpful for detecting the rotator cuff tear depth, dimension, shape of the tear and involvement of adjacent structures. Even the MRI will give the information about coracoacromial arch and impingement in rotator cuff tears (11).

Arthrography is an accurate technique to detect the rotator cuff tears. But it is an invasive procedure that has associated risks and discomfort. And this is more sensitive to detect full thickness tears than partial thickness. Some orthopaedic surgeons will operate for partial thickness to relieve impingement before it progress to full thickness. So MRI has a definite role in diagnosing rotator cuff tears (7).

USG is an alternative for the detection of rotator cuff tear. It is operator dependent and it will have less sensitivity in unexperienced hands. Hence MRI became the definite role in identifying rotator cuff tears.

In our study of 40 patients came with shoulder pain and clinically suspected case of subscapularis tear underwent MRI, and these results correlated with surgical findings

2. Materials and Methods

Equipment used: Siemens Magnetom Avanto 1.5T MRI

Source of Data: Hospital based study enrolled for study after obtaining an informed consent. Patient coming to the department with suspected subscapularis tendon tear clinically.

Study design: Prospective study

Sample size: 40

Sample: Patients attending AJ Institute of Medical Sciences

Place: A.J. Institute of medical sciences, Mangalore – 575004

Study type: Prospective Study

Inclusion criteria: Patients who are referred for MRI of shoulder suspected of having rotator cuff injury will be included in the study.

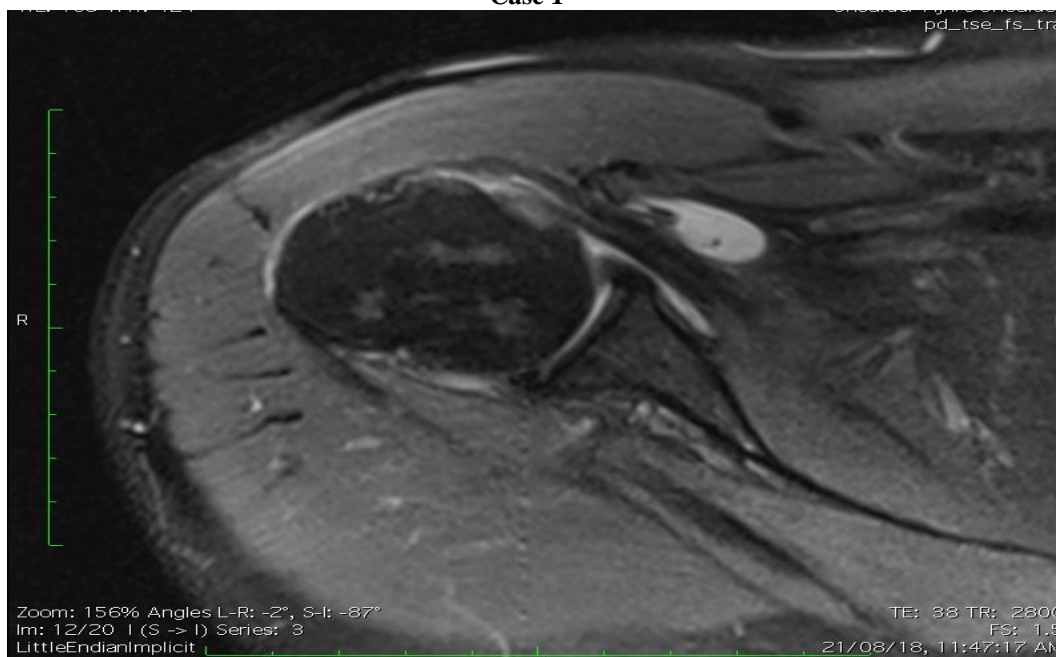
Exclusion criteria: Patients where MRI is absolutely contraindicated.

- A) Heart Pacemakers
- B) Patient with intracranial aneurysmal clips
- C) Implanted hearing aids
- D) Metallic bodies in the eye
- E) Patients with severe claustrophobia

Plan for data analysis: Data was entered in Microsoft Excel sheet and was analysed using SPSS version 22 statistical software. Data was depicted in the form of tables and charts. Appropriate statistical tests like Chi Square test and other non-parametric tests were used.

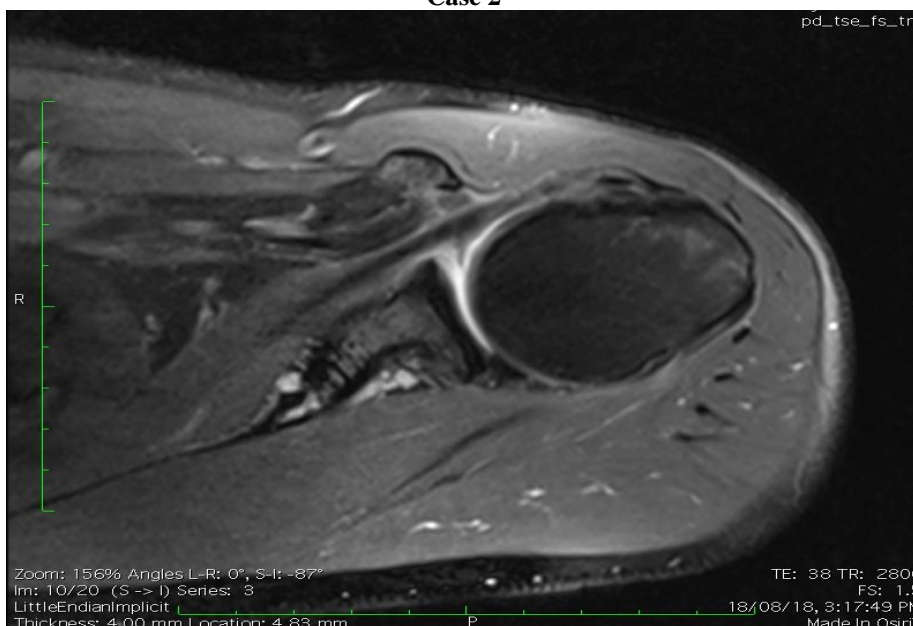
3. Cases

Case 1



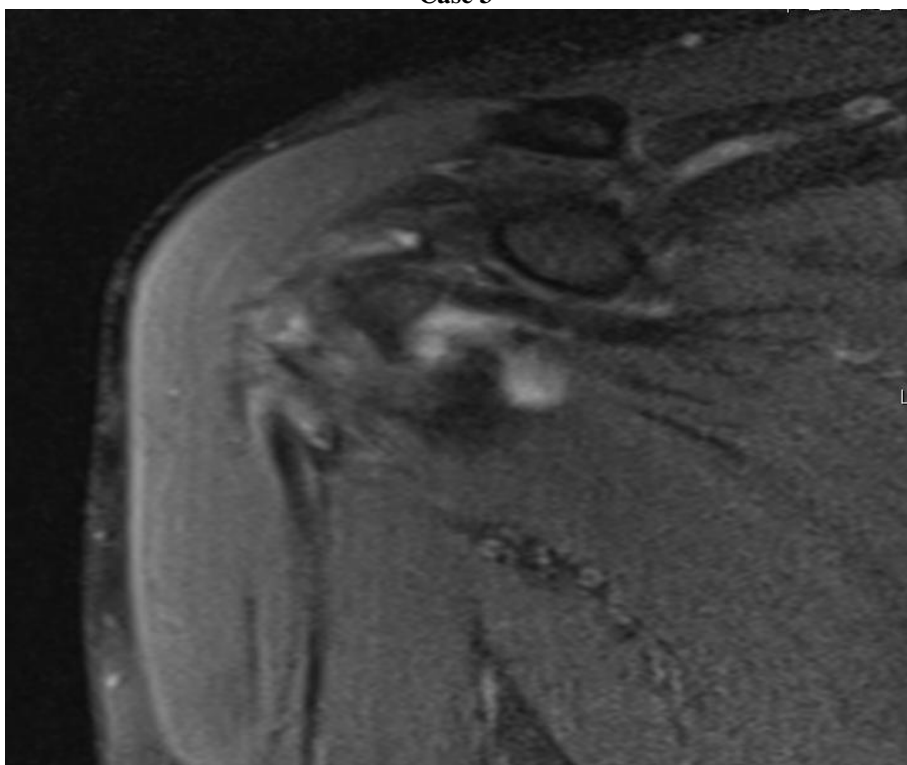
bursal effusion and discontinuity of subscapularis tendon on proton density images.

Case 2



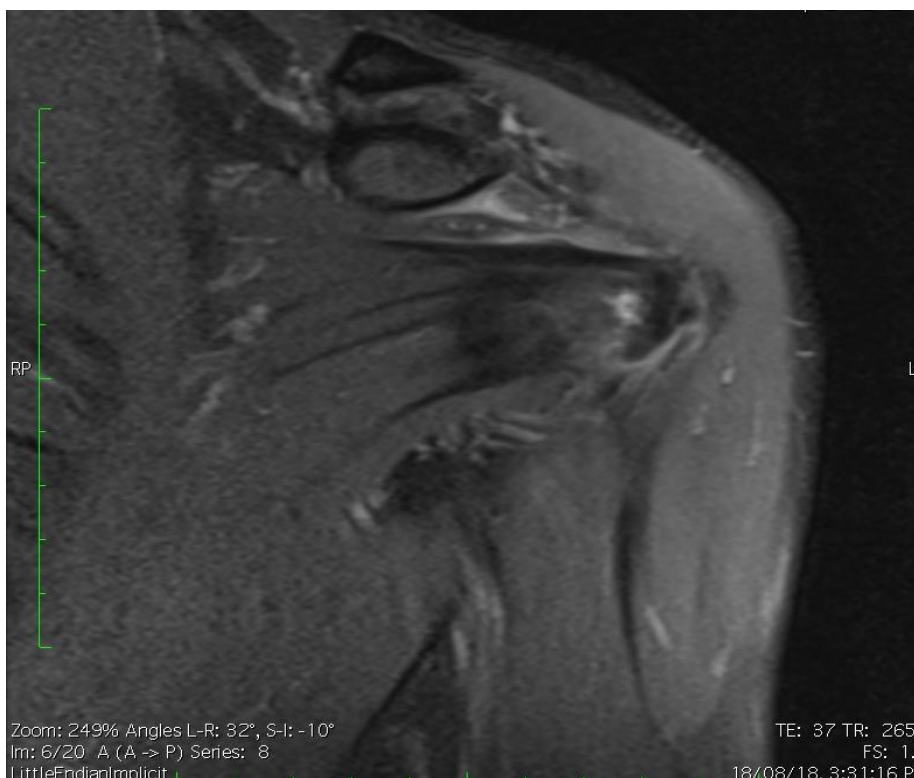
On MRI there is discontinuity in the subscapularis tendon with joint effusion on proton density

Case 3



On MRI there is hyperintensity in the subscapularis tendon in PD sequence

Case 4



On MRI there is hyperintense foci in the subscapularis tendon in PD sequence suggestive of tendon tear.

4. Results

Out of 40 patients 28 patients were male (70.0%) and 12 patients were female (30.0%).

Table 1

Sex	Frequency	Percentage
Male	28	70
Female	12	30
Total	40	100

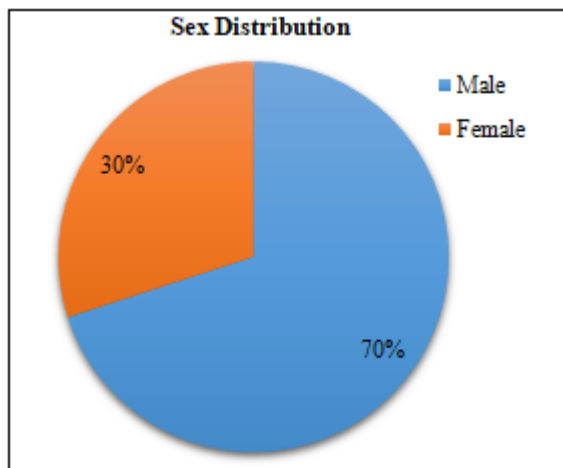
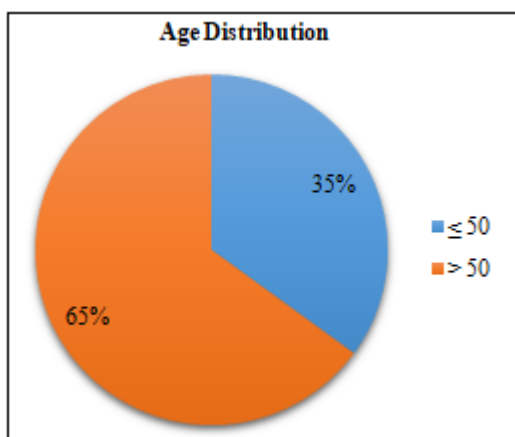


Table 2

Age	Frequency	Percentage
≤ 50	14	35.0
> 50	26	65.0
Total	40	100.0



Out of 40 patients 14 were less than 50 years old and 26 patients were more than 50 years old. Majority of the suspected rotator cuff tear were more than 50 years of age with a percentage of 65%.

Table 3

History	Frequency	Percentage
Pain	40	100.0
Strictness	13	32.5
Restricted range of Movement	32	80.0

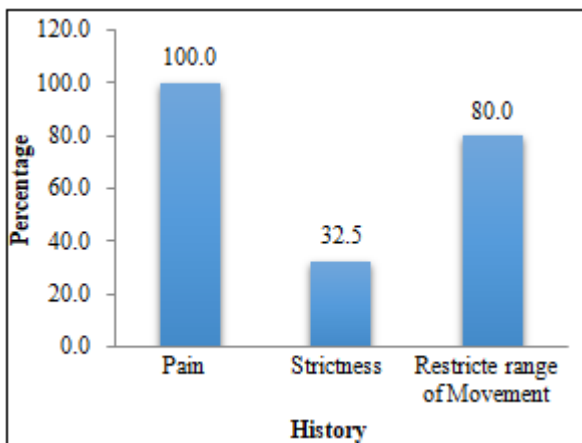


Table 4

Clinical Findings	Frequency	Percentage
Positive Gerber Lift-off Test	40	100.0
Empty can Test	30	75.0
Positive test for infraspinatus and teres minor	13	32.5

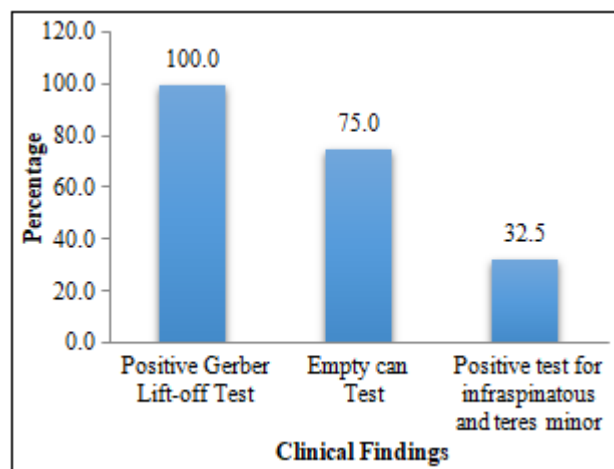


Table 5

MRI Findings	Frequency	Percentage
Discontinuity in tendon (sub tear)	35	87.5
BE	35	87.5
JE	33	82.5
BC	10	25.0
Others	38	95.0

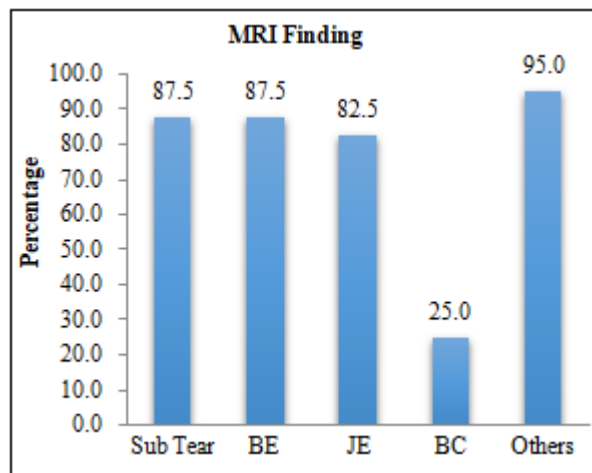


Table 6

Sub Tear	Frequency	Percentage
Full Thickness Tear	10	28.6
Partial Thickness Tear	25	71.4
Total	35	87.5

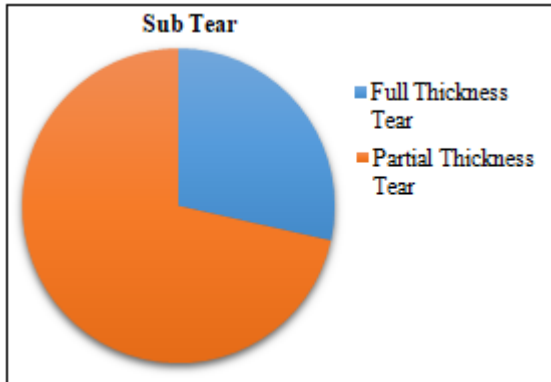


Table 7

Surgical Findings	Frequency	Percentage
Subscapularis	36	90.0
Supraspinatous	36	90.0
Infraspinatous	23	57.5
Teres minor	5	12.5

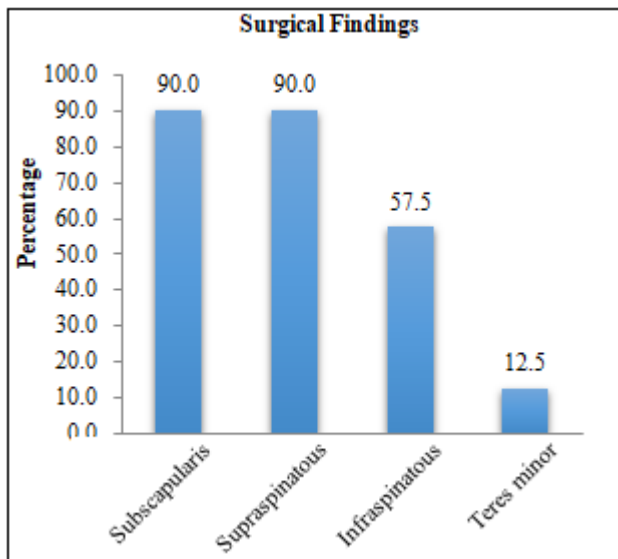


Table 8

SUB TEAR-MRI	Subscapularis-SF				Kappa Value
	Present		Absent		
	n	%	n	%	
Present	35	97.2	0	0.0	0.875
Absent	1	2.8	4	100.0	
Total	36	100.0	4	100.0	

The Subscapularis of MRI Finding is compared with surgical finding the sensitivity is 97.2%, Specificity is 100.0%, PPV is 100.0%, NPV is 80.0% and accuracy is 97.5%. The Kappa value is measured by 0.875 shown that almost perfect agreement between MRI and Surgical Finding.

Table 9

Age	Subscapularis-SF				p Value
	Present		Absent		
	n	%	n	%	
≤ 50 (14)	14	100.0	0	0.0	0.278
>50 (84.6)	22	84.6	4	15.4	

Table 10

Sex	Subscapularis-SF				p Value
	Present		Absent		
	n	%	n	%	
Male (28)	25	89.3	3	10.7	1.000
Female (12)	11	91.7	1	8.3	

Out of 28 male patients 25 patients were Subscapularis present (89.3%) and 3 patients were absent (10.7%) and 12 Female patients 11 were subscapularis present (91.7%) and 1 was absent (8.3%). It is statistically not significant (p=1.000).

Table 11

Strictness	Subscapularis-SF				p Value
	Present		Absent		
	n	%	n	%	
Yes (13)	12	92.3	1	7.7	1.000
No (27)	24	88.9	3	11.1	

Table 12

Restrict range of Movement	Subscapularis-SF				p Value
	Present		Absent		
	n	%	n	%	
Yes (32)	28	87.5	4	12.5	0.566
No (8)	8	100.0	0	0.0	

5. Discussion

For the suspected cases of rotator cuff tears, various techniques are used for the evaluation like radiograph, USG, CT, MRI and Arthrography. Arthrography is considered as a golden standard but its disadvantage is it is an invasive procedure. USG is used as a choice of investigation for the suspected cases of rotator cuff tears as it has high specificity and sensitivity as well as it is cost effective and time consuming. Disadvantage of USG is it is operator dependent and has technical limitations. MRI has more sensitivity and specificity as compared with USG because it is more specific for soft tissue structures. For both modalities there should be a defect in the tendon to diagnose the tear. And MRI can demonstrate the sub acromial portion that is not visualized by the USG.

This was a prospective study in which 40 patients who clinically presented with subscapularis tear were underwent MRI after history and clinical examination in the department of Radio diagnosis, A J Institute of Medical Sciences, Mangalore

Sex Distribution

In our study out of clinically suspected subscapularis tear in 40 patients 28 patients were male (70.0%) and 12 patients were female (30.0%). Out of 28 male patients 25 patients were Subscapularis present and 3 patients were absent and 12 Female patients 11 were subscapularis present and 1 was absent. And thus showing a male predominance. This is correlating with the study of David W.S et al which concludes that there is a male predominance for the tears. (12)

Age Wise Distribution

In our study out of 40 patients who are suspected cases of tears 14 were less than 50 years old and 26 patients were more than 50 years old. Majority of the suspected rotator cuff tear were more than 50 years of age with a 65%. This correlates with the study by Yamamoto et al, they suggested that the risk factors for cuff tears are: history of trauma, dominant arm and older age (13).

Clinical Presentation among Subjects

In our study pain is the most common complaint associated with the tendon tear. All patients came with a history of shoulder pain. This is correlating with the study by Zlatkin MB et al that painful shoulder which reported the rotator cuff tears in 51% of patients included in the study. (14)

MRI Findings

The Subscapularis of MRI Finding is compared with surgical finding the sensitivity is 97.2%, Specificity is 100.0%, and accuracy is 97.5%. This is correlating with the study by Naimark M et al. they stated that MRI diagnosis of Subscapularis tears had a specificity of 70% and sensitivity of 100% (15).

6. Conclusion

- In our study the MRI is compared with the surgical findings
- MRI have a sensitivity of 97.2%, Specificity of 100.0%, accuracy of 97.5%.
- The most common association in subscapularis tear is supraspinatus (90%) followed by infraspinatus (57.5%) and teres minor (12.5%)
- In our study partial thickness of subscapularis tears are more common than full thickness tears with percentage of 71.4 and 27.6 respectively.
- In our study most of the subscapularis tears seen in more than 50 years of age (65%) and males are affected more than females (70% males).
- Pain was the most common finding in subscapularis tendon and followed by decreased range of movement.

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