Assessment of Common Shoulder Pathologies using MRI in a Tertiary care center

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Abstract
Background: *As MRI allows for direct visualization of the rotator cuff tendons, their tears and abnormalities, their relationship to the underside of the acromion, and their relationship to the labrum, acromioclavicular (AC) joint as well as labro-ligamentous complex tears. Shoulder MRI is now regarded as the gold standard among imaging methods to diagnose the cause of shoulder pain.*
Materials and Methods: *The present study was descriptive cross sectional study under taken to evaluate the role of MRI in the determining the causes of shoulder pain in a tertiary care center where both indoor and outdoor patients are referred to department of Radiology at NRI MEDICAL COLLEGE & GH with complaint of shoulder pain. All the study patients were investigated on 1.5 Tesla GE SIGNA EXPLORER MRI machine.*
Results: *The current study included 50patientswho presented with shoulder pain. 86% of patients had tendinosis, 32% had partial tear and 32% had complete tear of supraspinatus respectively, 2% had tendinosis, 32% had partial tear and 2% had complete tear of Infraspinatus respectively; 10% had tendinosis, 8% had partial tear and 2% had complete tear of subscapularis respectively; 28% were seen having acromio clavicular joint hypertrophy; Labral injury was seen in 8% of patients; Adhesive capsulitis alone was seen in 1 patient, bursitis was seen in 1 patient, bankarts defect was seen in 8 patients and hill sach's lesion in 8 patients.*
Conclusions: *MRI is most preferred imaging modality for evaluation disorders of shoulder. Understanding these disorders, along with optimal imaging techniques for evaluation plays vital role in the diagnosis and treatment of patients. New advances and research in MRI can provide potential additional uses in determining shoulder derangements.*
Keywords: Shoulder pain, range of movements, rotator cuff tears, tendinosis, magnetic resonance imaging (MRI).

I. Introduction:

A painful shoulder is a common condition in patients. Apart from acute trauma causing lesions such as fractures, dislocations, contusions, sprains and tendon ruptures, adhesive capsulitis, acute or chronic calcific tendinitis, bursitis, biceps tendonitis, muscle Rotator cuff lesions can also cause shoulder pain. The shoulder is complex in anatomy and function. The etiology of shoulder pain is diverse, and many conditions share similar symptoms and signs. MRI provides excellent multi-planar imaging without the use of contrast agents or radiation hazards. In addition to detailed information on cuff defects, additional information on adjacent structures, muscle size, cross-sectional area and adipose tissue is recorded. Therefore, this study was designed to assess the role of her MRI in assessing the cause of shoulder pain.

II. Materials and Methods:

Method of data collection: The present study is a cross-sectional, observational study undertaken to evaluate the role of MRI in evaluation of shoulder pain for patients being referred to the department of radiology, the NRI Medical College, and GH Chinnakakani.
Study design: Cross-sectional, observational study
Study location: Department of radiology, the NRI Medical College, and GH Chinakakani.
Study duration:24 months from November 2020 – November 2022.
Sample size: 50

Sample size calculation:
The sample size is calculated as:
$N=Z^2PQ/E^2$
N- Sample size
P-Prevalence
P=22.9%
Q=1-P
E-Error: 10%,
90% confidence limits
N=49(minimum sample size)
So, we included 50 patients in this study, considering few lost to follow up cases. All 50 patients provided consent for the study .

Subjects and selection method: All the study patients were investigated on a 1.5-Tesla GE Signa Excite MRI system. Age, gender, range of movements, rotator cuff involvement and other findings were assessed for all patients.

Inclusion criteria:
1.	Patients with shoulder pain
2.	Any gender.
3.	Patients of any age
4.	Patients who provided informed consent to participate in the study.

Exclusion criteria:
1.	Pregnant and lactating women
2.	Patients with cardiac pacemakers, prosthetic heart valves, cochlear implants or any metallic implants (contraindications for MRI)
3.	Patients having history of claustrophobia.
4.	Patients with incomplete data
5.	Patients with severe acute medical conditions that might interrupt the data collection.

Imaging protocol: The scanning was done in standard orthogonal planes, Axial, Coronal and Sagittal.
3 plane localizer, Proton density (PD) Fat saturation. Gradient echo (GRE) on axial. Short tau inversion recovery (STIR), T1 & T2 weighted images on coronal. Proton density (PD) fat saturation and T1 weighted images on sagittal.

Statistical analysis: The data collected was entered in Excel 2019 and analysis was done by excel and software Epi info. The results were expressed in the form of descriptive and inferential statistics. Probability value below 0.05, was considered statistically significant. Frequencies, percentages were also used. Continuous variables were calculated by using mean and SD. Categorical parameters were determined using chi-square test. Numerical values were assessed using T test. \

## III.	Results

Mean age: The mean age was 43 years. Age ranged from 12 years to 76 years.

Obs	Total	Mean	Variance	Std Dev
50.0000	2152.0000	43.0400	211.0188	14.5265

| Minimum	Median	Maximum	Mode
12.0000	42.5000	76.0000	39.0000

Table 1: Mean age

Age distribution: 26% of patients belonged to age group 31-40 years. 22% of patients were aged 51-60 years, 20% of patients were aged 21-30 years and 20% were aged 41-50 years.

Age group	Frequency	Percent	Cum. Percent

11-20	1	2.00%	2.00%
21-30	10	20.00%	22.00%
31-40	13	26.00%	48.00%
41-50	10	20.00%	68.00%
51-60	11	22.00%	90.00%
61-70	3	6.00%	96.00%
71-80	2	4.00%	100.00%
Total	50	100.00%	100.00%

Table 2: Age group
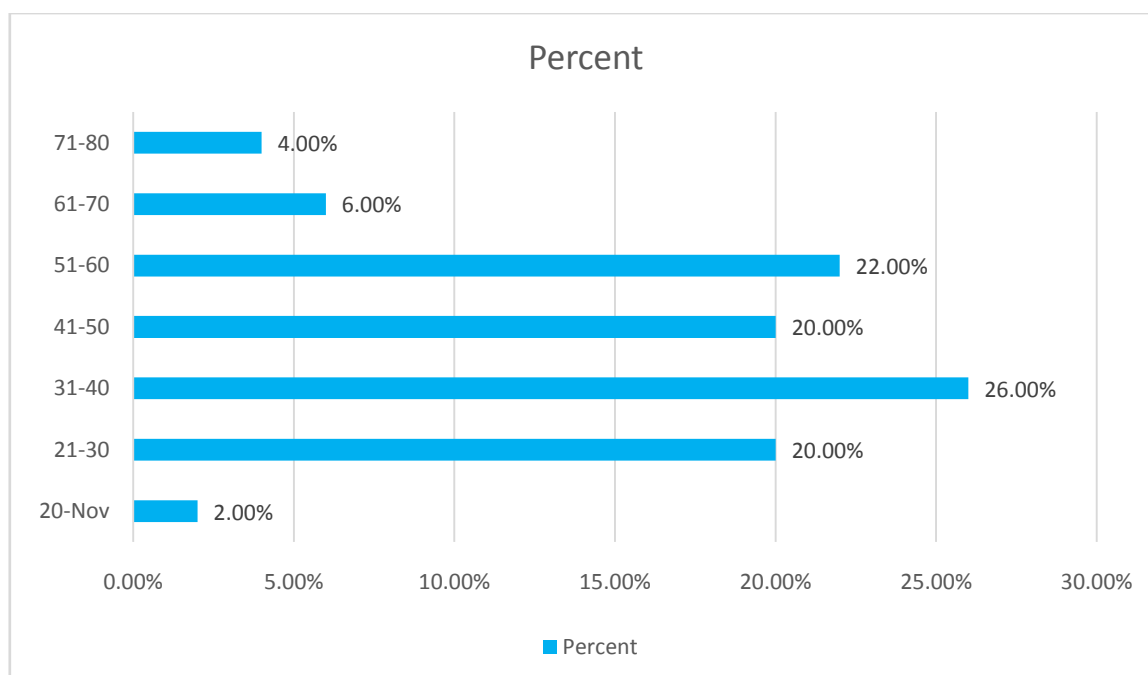
Graph 1: Age group

Gender:74% were males and 26% were females.

| SEX	Frequency	Percent	Cum. Percent
Female	13	26.00%	26.00%
Male	37	74.00%	100.00%
Total	50	100.00%	100.00%

Table 3: Gender of patients
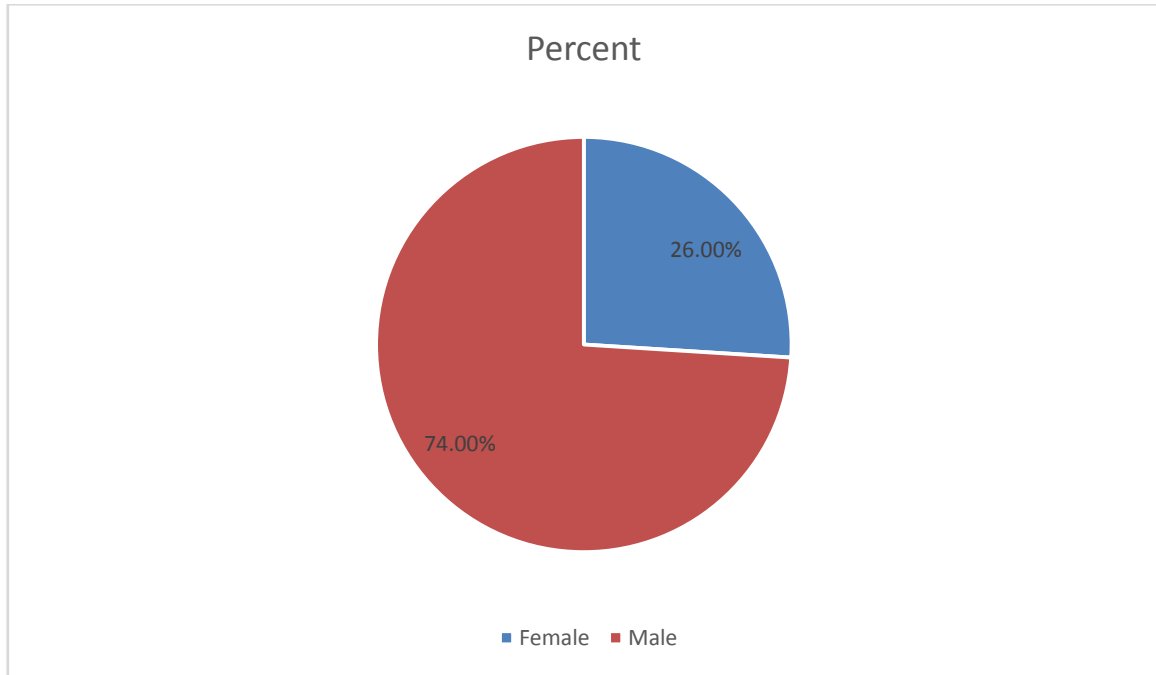
Graph 2: Gender of patients

Range of Movement: The range of movement was decreased for 64% of patients and normal for 36% of patients.

| ROM	Frequency	Percent	Cum. Percent
Decreased	32	64.00%	64.00%
Normal	18	36.00%	100.00%
Total	50	100.00%	100.00%

Table 4: Range of movement
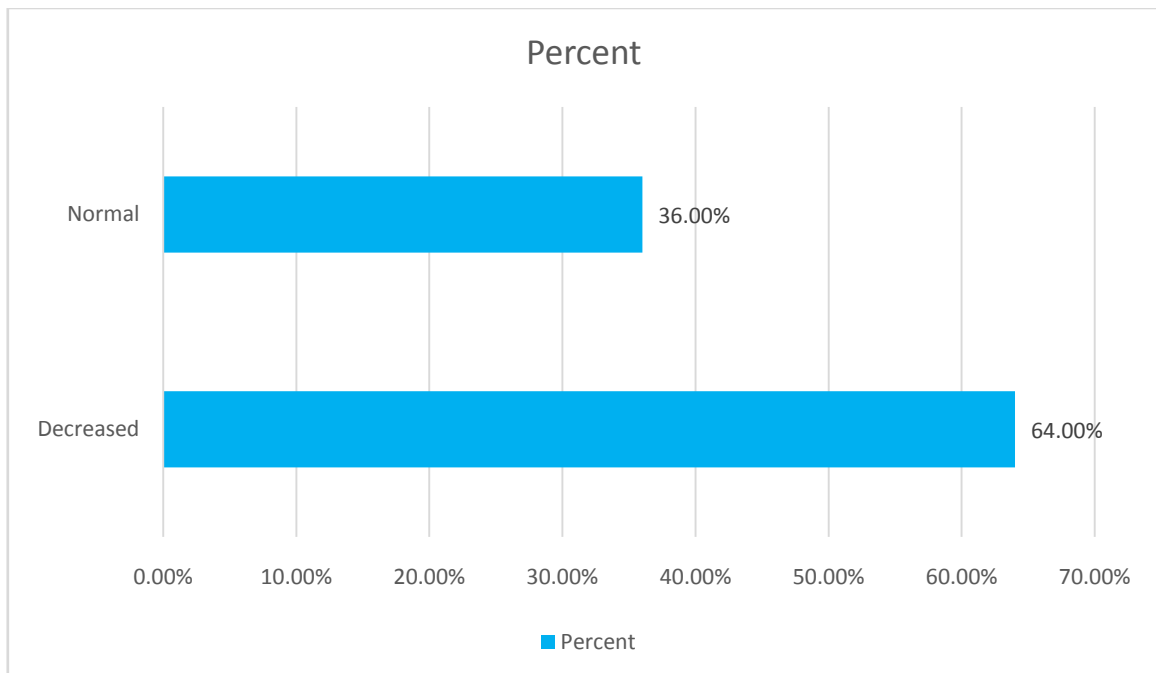
Graph 3: Range of movement

Rotator cuff tendon involvement:
- 86% had tendinosis, 32% had partial tear and 32% had complete tear of supraspinatus respectively.
- 2% had tendinosis, 32% had partial tear and 2% had complete tear of Infraspinatus respectively.
- 10% had tendinosis, 8% had partial tear and 2% had complete tear of subscapularis respectively.

Rotator cuff tendon	Pathology	Number of cases (More than one muscle tendon involvement can be seen in one patient)	Percentage
Supraspinatus			
	Tendinosis	43	86%
	Partial tear	16	32%
	Complete tear	16	32%
Infraspinatus			
	Tendinosis	1	2%
	Partial tear	16	32%
	Complete tear	1	2%
Subscapularis			
	Tendinosis	5	10%
	Partial tear	4	8%
	Complete tear	1	2%
Teres Minor		Nil	Nil

Table 5: Rotator cuff tendon involvement
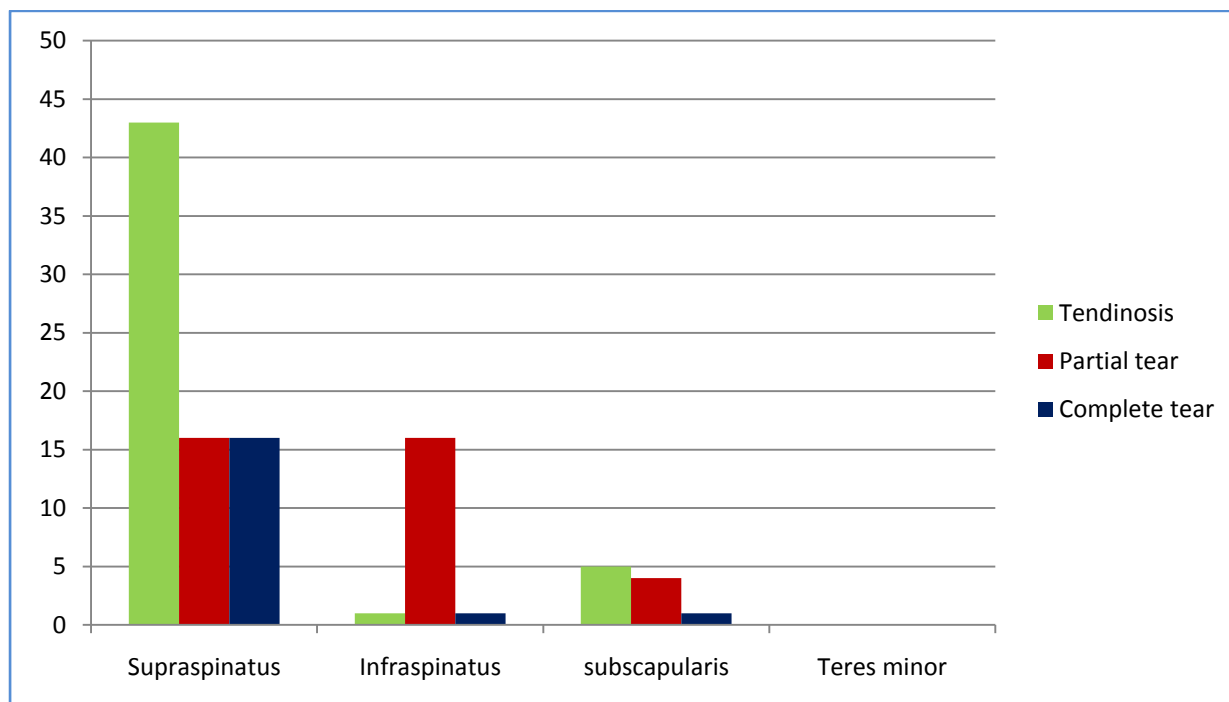
Graph 4: Rotator cuff tendon involvement

Others: 28% were seen having acromio clavicular joint hypertrophy; Labral injury was seen in 8% of patients; Adhesive capsulitis alone was seen in 1 patient, bursitis was seen in 1 patient, bankarts defect was seen in 8 patients and hill sach'slesion in 8 patients.

Others	Frequency	Percent
Acromio- clavicular joint hypertrophy	14	28%
Labral injury	4	8%
Adhesive capsulitis	1	2%
Bursitis	1	2%
Hill sach's defect	8	16%
Bankart's defect	8	16%

Table 6: Other findings

IV.   Discussion

This study was a cross-sectional, observational study conducted at NRI Medical College, Chinakakani- a tertiary care centre with well-equipped facilities. Patients of any age presenting with shoulder pain, of any gender were included. 50 patients were included taking into account some losses to follow up.

We screened 78 patients and finally included 50 patients. Convenience sampling was followed to select patients.

Age, gender, range of movements, MRI features, final diagnosis, acromioclavicular joint hypertrophy, and rotator cuff tendon involvement were evaluated.

Normal MRI significantly decreases the chances of a rotator cuff tear, as per certain studies.[1,2,3]

It helps in accurate evaluation of inflammatory processes, biceps tendon disorders.[4]

Diagnosis of labral lesions can be cumbersome due to less sensitivity and NPV in certain trials.[5][6]

The most common appearance of full-thickness Rotator cuff tendonsis is high SI on a T2WI that extends from articular surface of Rotator cuff to the sub acromial-subdeltoid bursa.

Articular-surface partial-thickness tears found to be more common compared to bursal-surface tears and the ratio of incidence was 3:1.[7]

ShrinMahbuba et al [8]determined the role of MRI in detecting shoulder pathologies. The study was done at Dhaka, Bangladesh. Authors evaluated shoulder pathologies using MRI in patients with shoulder pain. Their cross-sectional observational study was done from January 2021 to June 2021. 80 patients were included. The mean age was 41.4 years. The mean age was almost similar to our study.80% were males in their study. In our study, 74% were males. This indicates that shoulder pathologies were common among males and during 4th decade of life. Right shoulder was commonly involved. Bilateral involvement was seen in 15% of patients in their study. In our study, bilateral involvement was not seen. The most common symptom was pain, similar to our study. Common MRI findings include metastasis, sub acromial bursitis, mild joint effusion, biceps & supraspinatus tendinitis, OA of AC joint, adhesive capsulitis. Our study also found almost similar diagnosis but no patient had metastasis in our study.

ShilpaChudasama[9] et al did a study at Jamnagar, India to determine various reasons for long term shoulder pain using MRI. They mainly assessed rotator cuff pathologies and identified the role of MRI in rotator cuff pathologies, their features and associated bony injuries. 150 patients with long term shoulder pain were included. Age of patients ranged from 15 to 70 years, and most of the patients belonged to age group 45 to 54 years. In our study, age ranged from 12 to 76 years and most of the patients were aged 31 to 40 years. It was identified that rotator cuff tears to be commonly seen in non-traumatic causes and supraspinatus was commonly involved tendon followed by subscapularis, infraspinatus and teres minor. In our study also, supraspinatus was most commonly involved followed by subscapularis, infraspinatus. Biceps and teres minor were not involved in any patient.

Anterior instability was commonest type of glenohumeral instability in their study. This was strongly linked to Hill-Sachs and Bankart lesion. Authors concluded that MRI is highly reliable and noninvasive imaging modality in determining rotator cuff disorders like rotator cuff tendinopathy, tears due to multiplanar imaging and better display of soft tissue structures. In our study we had 8 patients with glenohumeral instability due to Hillsachs and Bankarts lesions. These findings also correlated with the study done by ShilpaChudasama et al.

Krief and Huguet[10]et al did a study on 1079 patients and found that 85% had right hand dominance and 15% had left hand dominance. In our study also, right-hand dominance was more commonly seen in 86% of patients.

Vick [11]et al showed that tendinosis as common entity in patients aged 35 to 60 years. Commonest age group affected to be 35-60 years. In our study, 86% of patients seen having supraspinatus tendinosis. 2% of patients had tendinosis of infraspinatus. 10% of patients had tendinosis of subscapularis. Tendinosis was more commonly seen in patients aged above 40 years.

Chandnani[12]et al. study, found that subscapularis damage was always associated with supraspinatus tear.[31]

Tears of supraspinatus tendon are commonest lesions in our study. Partial tears were more common compared to complete tears in our study.

Rotator cuff disorders:

Glenn et al [13] did a study on 41 patients who had labral tears as per arthroscopy. Among them, 15 patients had full thickness rotator cuff tears. 13 had partial tears. 13 had normal rotator cuff. 68% of patients had both labral and rotator cuff tears. In our study, labral injury was seen in 8% of patients and 32% of patients had partial tear of supraspinatus. 32% of patients had complete tear of supraspinatus. 32% of patients had partial tear of infraspinatus, 2% of patients had complete tear of infraspinatus. 8% had partial tear of subscapularis and 2% had complete tear of subscapularis tendon.

Kim J[14] did a study to determine the presence and severity of Hill-Sachs lesions on MR arthrography. MRA was evaluated for 86 patients who already had anterior dislocations. HS lesions were found on MRA in 78 patients. HS lesion surface ranged from 9.3 mm to 29.6 mm. Bankart lesion ranged from one to six o'clock extent. The study concluded that hillsach's lesions were more commonly seen in patients with Bankart lesion and the severity of Hill Sach's lesion was associated with extent of Bankart's lesion.

In our study, on MRI evaluation there is equal incidence of hill sach's and bankart's lesions. Hill Sach's defect was seen in 16% of patients. Bankart's defect was seen in 16% of patients in MRI in our study among 50 patients who presented with shoulder pain.

V. Conclusion

Our study evaluated the role of MRI in detecting various pathologies in patients with shoulder pain. The high prevalence of shoulder pain is commonly due to internal damage to the shoulder, and MRI is the preferred imaging modality for evaluating shoulder damage. An understanding of these disorders, along with the optimal imaging technique for evaluation, knowledge of abnormal MRI findings, normal anatomic variations, and knowledge of the diagnostic limitations of MRI will aid in the diagnosis and treatment of patients with shoulder pain. It plays an important role in management. Emerging advances and research in MRI may offer additional potential applications in determining shoulder injury.

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