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Role Of MR Imaging In Rotator Cuff Pathologies.

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ABSTRACT

Our objective was to study MR imaging characteristics of rotator cuff tear and their associated pathologies. An observational cross-sectional study with sample size of 80 patients who underwent MRI shoulder in 1.5 tesla siemens machine for the evaluation of rotator cuff tear and associated pathologies. The age distribution is between 18 to 75 years with male predominance (70%). Most common tendon affected is supraspinatus tendon and most common pathology identified is tendinosis. Partial tear is more commonly identified than full thickness supraspinatus tear. Articular surface tear and intrasubstance tear is commonly seen than bursal surface tear. Most common type of acromion identified is type II (60%) followed by type I type (18%) and type III type in 14%. Acromioclavicular joint arthrosis and subacromial impingement is seen in (56%) of cases. Infraspinatus tendon affected in 15% of subjects. Subscapularis tendon affected in 20% of subjects. Complete subscapularis tendon tear seen in only one patient. Long head biceps tendon pathology seen in 11% of subjects. No teres minor pathology was identified. Trauma history is seen in all the cases of full thickness complete supraspinatus tear. Trauma history is present in 45% of partial thickness supraspinatus tear. Common clinical symptoms with rotator cuff pathology are shoulder pain, difficulty in raising the arm, weakness, combination of pain with stiffness and numbness in lateral aspect of shoulder and arms. MRI is highly valuable tool and modality of choice in assessing and characterizing the rotator cuff pathologies and its associated factors which are necessary for diagnosis and treatment plan.

Keywords: Supraspinatus, rotator cuff tears, acromion, MRI.

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INTRODUCTION

The shoulder joint is one of the complex joint that has greater range of motion than any other joint and at the same time has to remain stable. The glenohumeral joint is a ball and socket type of synovial joint which allows broad range of movements including abduction, adduction, flexion, extension, internal rotation, external rotation and circumduction. The articular surface of humeral head is larger compared to glenoid fossa which is a primary cause of instability. Rotator cuff muscles and biceps tendon are important active stabilizers of shoulder joint. It comprises of four muscles and tendons namely supraspinatus, infraspinatus, subscapularis and teres minor. The other stabilizers are capsular ligaments, glenoid labrum and negative intra-articular pressure which are static stabilizers. Among these rotator cuffs muscles are predisposed to internal and external stress factors. Internal stress factors include acromion anatomical variations, acromioclavicular joint arthrosis/hypertrophy with subacromial impingement, tendon degeneration due to advancing age and zone of critical vascularity. External stress factors include trauma. Over usage causing microtrauma resulting in microtear progressing to tendon degeneration and tear [1].

Ultrasound and MRI are useful in evaluating soft tissue structures around shoulder joint. Even though ultrasound has advantage of real time dynamic imaging it is highly operator dependent. MRI has a high spatial resolution and multiplanar imaging which allows detailed description of rotator cuff tear problems and associated structures, muscle atrophy and fatty degeneration, cross sectional area of muscles which aid in appropriate management making MRI as the modality of choice in evaluating rotator cuff pathologies.

MATERIALS AND METHODS

STUDY DESIGN

This is an observational cross-sectional study with sample size of 80 patients. MRI studies were performed on Siemens 1.5 tesla Avanto machine conducted between January 2020 to December 2021. All the patients were sent to the radiology department for MRI shoulder by the consultant orthopedician on the strong clinical suspicious of rotator cuff tear. No patients were made to undergo MRI for the purpose of the study.

Inclusion Criteria

Patients who were referred for MRI evaluation with suspected rotator cuff pathology are included.

Exclusion Criteria

Postoperative cases and patients with claustrophobia were excluded. Patients who needed MR arthrography were excluded. Patients with infective arthritis/bone lesions were excluded. Patients who are known case of rotator cuff tear on treatment were excluded.

Data Collection

The study included eighty patients who were sent to MRI examination for evaluation of rotator cuff pathologies in a tertiary care hospital. Patients were screened for routine MR contradictions. Relevant clinical information was noted. Physical examination findings written in the referral slip were taken. MRI was performed in 1.5 tesla siemens Sempra machine with flexible shoulder surface coil. Patient was positioned in supine position with mild external rotation. Sequences applied are coronal oblique T1 and oblique coronal T2 weighted images with fat saturation. PD fat saturation images in axial, coronal and sagittal planes. Planning included slice thickness less than 3mm and interslice gap less than 1mm. Coronal oblique images are planned parallel to supraspinatus tendon. Sagittal oblique images include volume lateral deltoid to scapular body. Axial images include volume from above AC joint to below axillary pouch. MRI contrast was not given to any patient.

Image interpretation done for the rotator cuff tendinosis, tendonitis and tears. Tears location, extent and morphology were noted. Rotator cuff muscles were evaluated for any atrophy, fatty

replacement. Biceps tendon evaluated for tenosynovitis, tear and displacement. Acromion morphology, acromioclavicular joint arthrosis, subacromial impingement, acromiohumeral distance were noted.

RESULTS AND OBSERVATION

Eighty patients were included as per inclusion and exclusion criteria. Age of the patients ranged from 18 to 75 years. Of these majority of the patients are males with 70 percentage. Maximum percentage of rotator cuff disease (60%) seen in the age group of 50 to 65 years.

All the patients had the complaints of shoulder pain with varying duration. In decreasing order of frequency other complaints are difficulty in raising the arm with pain (35%), movement restriction (20%), weakness (8%), stiffness and numbness (4%). Significant number of patients had symptoms of night pain (35%).

Supraspinatus is the most commonly affected tendon followed by subscapularis, infraspinatus tendons. In our study no cases of teres minor pathology is identified.

Tendinosis is commonly identified pathology than tears in the rotator cuff tendons. Tears are further characterized as partial thickness tear and full thickness tear.

Supraspinatus tendon is observed as normal in 11 patients. Supraspinatus tendinosis is seen in thirty patients. Partial thickness tears (35 percentage) are common than full thickness tear (13 percentage). Among the partial thickness tear; articular surface tear is seen in 46 percentage (13 out of 28 patients), intrasubstance tear is seen in 32 percentage (9 out of 28 patients) and bursal surface tear seen in 21 percentage (6 out of 28 patients). (Table 1).

All the patients with full thickness supraspinatus tear had history of trauma and most of the patients (71 percentage) age was more than 60 years. Trauma history is present in 45% of partial thickness supraspinatus tear.

Table 1: Supraspinatus tendon pathology

Supraspinatus tendon	Frequency	Percentage
Normal	11	13.75
Tendinosis	30	37.5
Partial tear	28	35
Complete tear	11	13.75
Total	80	100

Among the infraspinatus tendons 68 patients are normal. Tendinosis was seen in 9 patients and partial tear is seen in 3 patients. None of the patients had complete tear of infraspinatus. (Table 2).

Table 2: Infraspinatus tendon pathology

Infraspinatus tendon	Frequency	Percentage
Normal	68	85
Tendinosis	9	11.25
Partial tear	3	3.75
Complete tear	0	0
Total	80	100

Among the subscapularis tendons 64 patients are normal. Tendinosis was seen in 10 patients and partial tear is seen in 5 patients. One patient had complete tear of subscapularis tendon. (Table 3).

All the patients with tears of infraspinatus tendon and subscapularis tendon also had supraspinatus tear either partial or complete. Two patients had tear in supraspinatus, subscapularis and infraspinatus tendons.

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Table 3

Subscapularis tendon	Frequency	Percentage
Normal	64	80
Tendinosis	10	12.5
Partial tear	5	6.25
Complete tear	1	1.25
Total	80	100

Long head of biceps tendon pathology is seen in 12 patients with two of them showing biceps tendon tear and dislocation (table 4)

Table 4

Biceps tendon	Frequency	Percentage
Normal	68	85
Tendinosis	10	12.5
Tear /dislocation	2	2.5

In this study type 2 acromion is seen in 60 percentage of patients. Type 1 flat acromion is seen in around 22 percentage making it as second common. Type 3 acromion is seen in 17 percentage. (table 5). Supraspinatus tear was highest among type 2 acromion.

Table 5

Acromion type	Frequency	Percentage
Type-1 flat	18	22.5
Type-2 curved	48	60
Type -3 hooked	14	17.5
Type-4 convex	0	0

Acromioclavicular joint arthrosis and subacromial impingement is seen in 45 patients which is around 56 percentage. Among 69 patients with supraspinatus tendon pathology 40 patients had acromioclavicular joint arthrosis and subacromial impingement.

Acromiohumeral distance is measured between under surface of acromion and superior articular surface of humeral head and divided into three categories. More than 10mm, 10 to 8mm and less than 7mm. Out of 80 patients 8 patients fall into less than 7mm category all of which had supraspinatus tear (full thickness tear in 7 patients and partial thickness tear in 1 patient). More than 10mm distance is observed in 55 patients. Remaining patients had 10 to 8mm distance.

Fatty atrophy of supraspinatus muscle seen in three patients out of 11 complete supraspinatus tear.

Out of 80 patients joint effusion observed in 29 patients and associated labral tear is seen in 15 patients.

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Figure 1: Coronal PD fat sat image showing supraspinatus tendinosis with hyperintensity at the insertion site.

Figure 2: Coronal PD FAT SAT image showing partial tear of supraspinatus tear at critical zone.

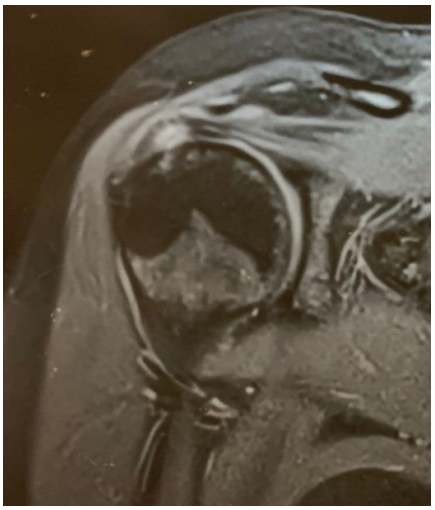

Figure 3: Coronal PD FAT SAT image shows complete tear of supraspinatus tendon with retraction of fibers.

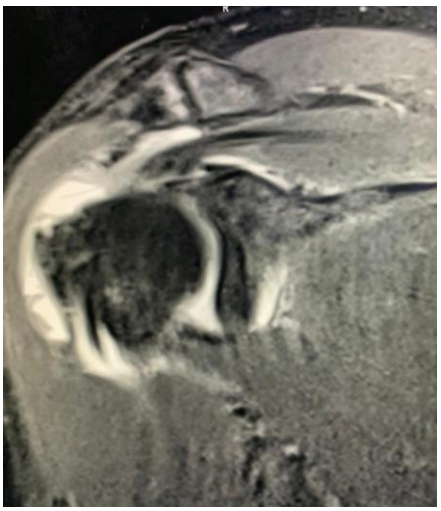

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Figure 4: Axial PD image shows biceps tendinosis with fluid around long head of biceps tendon.

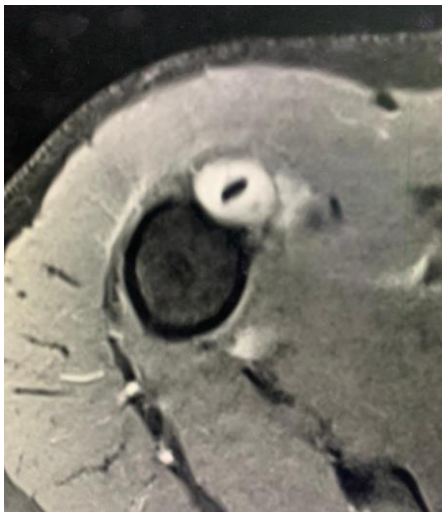

Figure 5: Axial PD FAT SAT image shows infraspinatus tendon tear along with subcapularis tendinosis.

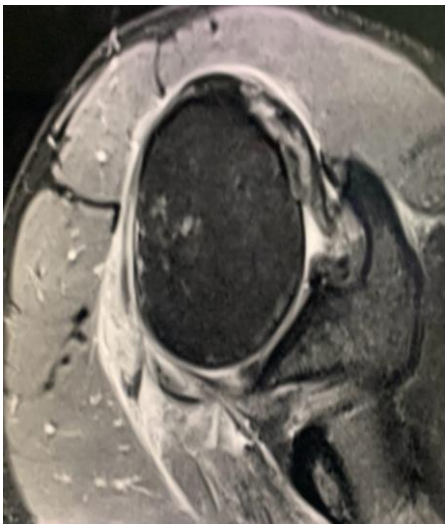

Figure 6: Coronal PD FAT SAT image shows full thickness supraspinatus tear with fluid in subdeltoid subacromial bursa.

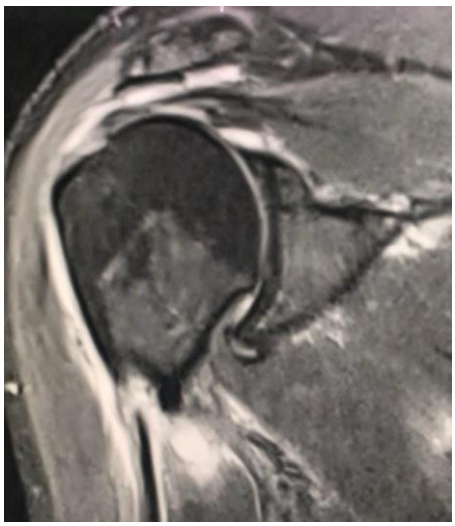

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Figure 7: axial PD FAT SAT image shows subscapularis tear with infraspinatus tendinosis.

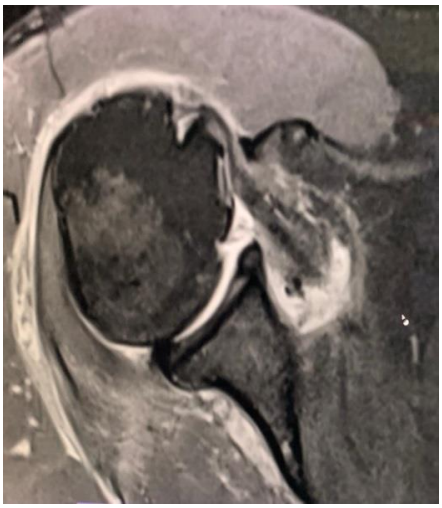

Figure 8: Coronal PD image shows reduced acromiohumeral distance in complete supraspinatus tear.

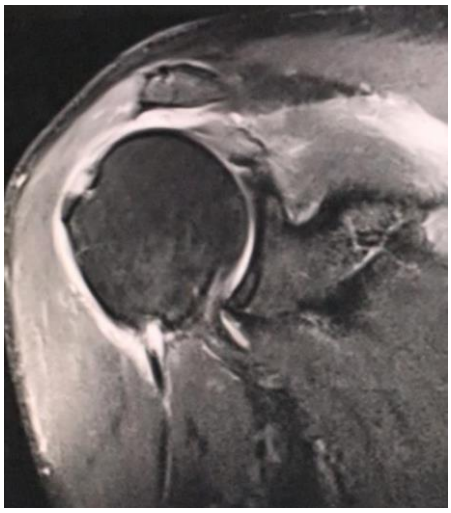

Figure 9: Axial PD FAT SAT image shows partial subscapularis tear with thinning of subscapularis tendon with cyst in the humeral head.

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Figure 10 Sagittal PD image shows supraspinatus muscle atrophy in the case of full thickness supraspinatus tear

DISCUSSION

MRI is the first line imaging modality in all patients with suspected rotator cuff tears. Ultrasound is the alternate investigation in rotator cuff assessment but its sensitivity mainly depends on the experience of the examiner [2].

In our study full thickness tear is more common in patients above 50 years of age. According to several studies, the incidence of rotator cuff tendon degeneration increases with age. Study by Ozaki et al revealed pathogenesis of rotator cuff disease is an intrinsic process. Microvascular investigations show decreased vascularity in the tendons with advancing age which correlates with age related degenerative tendinopathies [3].

In our study rotator cuff pathologies seen more common among males (70%) than females (30%).

Most common symptom linked with rotator cuff disease is pain which is seen in all patients which is consistent with literature. Pain aggravated by overhead abduction, movement restriction, weakness and numbness are more common than Analyzing all the symptoms and clinical information . Age and trauma history is the most important risk factor for prediction of full thickness tear.

In a study of cadaver shoulders De Palma et al found that supraspinatus injury was the most common and its severity increased with age [4]. In our study most common affected tendon is supraspinatus with full thickness tear more common in age above 50 years.

Literature study shows partial tear more common than complete tear as confirmed by our study supraspinatus tendinosis seen in 36 patients; partial tendon tear seen in 32 patients and complete tear seen in 12 patients [5].

Bigilani and collegaues classified acromion into type I to IV, namely flat, curved inferior surface, hooked and convex near the distal end, respectively and in a study found 80% correlation between type II and type III acromion with rotator cuff disease [6]. In the present study most common acromion was type II. In our study abnormal tendons were seen with all types, most commonly seen with type II.

Acromioclavicular joint arthrosis and subacromial impingement is seen in 56% of patients with supraspinatus pathology which shows positive correlation as one of the causes of rotator cuff pathology.

Decrease in the acromiohumeral space can cause impingement on the cuff tendons especially supraspinatus leading to degeneration/ tendinosis and tears. In our study 8 patients had less than 7mm

of AHD and all of those had supraspinatus tendon tear. Saupe, et al. conducted a study in 63 patients where the incidence of supraspinatus tears was less in group III (AHD > 10 mm), and group I (AHD< 7 mm) had highest incidence of tears [7].

Limitation of the study is lack of correlation with arthroscopic findings.

CONCLUSION

MRI is the most sensitive investigation and can be considered as optimal first line imaging modality which provides the detailed evaluation of rotator cuff tendinosis & tendon tears and associated pathologies that helps in the treatment planning and avoiding unnecessary arthroscopic procedures.

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