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Role of MRI in Evaluation of Patients with Rotator Cuffinjuries and Labral Tears with Arthroscopic Correlation

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Abstract: ***Introduction: MRI can depict the endurance between rotator cuff degeneration or tendinopathy &full or partial thickness rotator cuff injuries. So careful observation to the bursal, intrasubstance, and articular surface morphology of the tendon is required. Aim &Objective: The aim of the study is to analyse and describe spectrum of MRI findings in a suspected cases of labral and rotator cuff injuries with arthroscopic correlation. Materials and methods: An analytical study conducted in the department of radio diagnosis MIMS, Nellimarla, Vizainagaram between January 2017 to march 2018. Our study included a total of 34 patients who have been referred for shoulder MRI following injury to shoulder. We used Philips Ingenia1.5 Tesla MR Imaging unit. Patients underwent arthroscopy in case of failure of nonsurgical techniques, and the affected shoulder joint was inspected and MRI findings were correlated. Followed by calculation of specificity, sensitivity, negative predictive and positive predictive values. Results: Rotator cuff injuries affected the supraspinatus muscle in 46% followed by the infraspinatus 37%, subscapularis in 16% and 1% injuries has been reported to teres minor in our study. Most rotator cuff injuries were strains (48%), followed by partial thickness tears (29%) full thickness tears (22%) and labral tears in (1%) subjects. Conclusion: Supraspinatus muscle is the most involved muscle with sprains & PTT being the most frequently encountered injuries in rotator cuff. Thus MRI has an ultimate precision for the characterization of rotator cuff injuries, with relatively high sensitivity and specificity rates.***

Keywords: Rotator cuff, Partial tear, Complete tear, MRI, sensitivity

1. Introduction

The gleno-humeral joint is relatively shallow, with the humeral head being large when compared to the glenoid fossa. This configuration allows mobility at the expense of stability. The labrum is a fibrocartilaginous structure which increases the depth of glenoid, providing more contact area and stability to the joint.MRI can depict the endurance between rotator cuff degeneration or tendinopathy & full or partial thickness rotator cuff injuries. MRI findings in tendon degeneration and mild partial tears can overlap, consituted by the fact that the conditions tend to coexist. Reported sensitivities for imaging full-thickness rotator cuff tears ranged from 80% to 100%, and specificities from 94% to 100% [1,2,3,4].MR arthrography has a sensitivity, specificity, and accuracy of 96%,99%, and 98%, respectively, for full-thickness tears. [5]For partial thickness tears, it has a sensitivity, specificity, and accuracy of 80%,97%, and 95%, respectively. [6,7]Because non arthrographic MRI of the shoulder already has a high degree of accuracy, particularly for full thickness tears, any substantial gain in accuracy with MR arthrographyis in the diagnosis of partial tears. [8]Thus MRI is been considered as one of the major investigation of choice in the diagnosis of shoulder joint injuries.

2. Materials and Methods

An analytical study conducted in the department of radio diagnosis MIMS, Nellimarla, Vizainagaram between January 2017 to march 2018. Our study included a total of 34 patients who have been referred for shoulder MRI following injury to shoulder. We used Philips Ingenia 1.5 Tesla MR Imaging unit. Patients underwent arthroscopy in case of failure of nonsurgical techniques, and the affected shoulder joint was inspected and MRI findings were correlated. Followed by calculation of specificity, sensitivity, negative predictive and positive predictive values.

Inclusion Criteria

1) Patients who have been referred for shoulder MRI following fall on outstretched hand or after any rapid accelerating injury to the shoulder joint.
2) Patients with failure of nonsurgical techniques & who underwent arthroscopy of the affected shoulder joint.

Exclusion Criteria

1) Patients who could not undergo arthroscopy.
2) Age less than 18 years.

MRI shoulder evaluation doneusing surface coil. Patients were placed in dorsal decubitus position, with an arm in supine and the shoulder rotated slightly external.

In MRI shoulder protocol we included oblique coronal, sagittal and axial T1WI; T2 FS and PD FS weighted images. T2 FS and PD FS sequences were used for labrum characterization. In case of failure of nonsurgical techniques, patients underwent arthroscopy of the affected shoulder joint& the joint was inspected and MRI findings were correlated. Microsoft excel software was used for data

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analysis. Followed by calculation of sensitivity, specificity, positive predictive and negative predictive values.

3. Results

The final study group incorporated 34 subjects. Majority of them were men with a mean age 48 years. The right shoulder was affected in 70%, while the left shoulder in 30% subjects. Supraspinatus muscle affected in 46% followed by the infraspinatus in 37%, subscapularis in 16% and 1% injuries been reported to the teres minor. Most rotator cuff injuries were strains (48%), followed by partial thickness tears (29%) full thickness tears (22%) and labral tears (1%).A total of three partial thickness tears were over diagnosed on MR imaging which were not appreciated on arthroscopic imaging. We got that MRI is 100% sensitive and 97.5% specific for the detection ofPTT and is 100% sensitive and 100% specific for FTT and glenoid labral tears. Thus there was a considerable gain in precision with MRI in the detection of labral tearsandrotator cuff injuries.

4. Discussion

Rotator cuff injuries most commonly involve the supraspinatus tendon in the form of full thickness or partial thickness tears [9]. The MRI plays a major role to produce reliable, simple and management orientated conclusions [10].Rotator cuff injuries usually graded as strains (grade 1), partial thickness tears (grade 2), and full thickness tears (grade 3) [11,12].Focal areas of deficiencies are noted in case of tendon tears [13]. Careful scrutiny on sagittal, coronal oblique planes is required for the identification of small rim rent tears [14]. Articular-sided tears are much commoner when compare to bursal side [15].Thus MRI is helpful to precisely delineaterotator cuff injuries, which are noted in the form of altered SI & muscle fiber discontinuity centered around the rotator cuff [16,17]mostly affecting the tendon attachment site [18,19].

Imaging of rotator cuff injuries are mostly done with the arm in abduction & with slight external rotation (ABER imaging) to assess the tendons, ligaments & shoulder joint congruity [20].Superior labral tears result due to abnormal traction on biceps anchor that usually extend posteriorly.They are frequentlydenoted to as superior labral tears anterior to posterior (SLAP tears) [21]

Pitfalls

One of the major reasons for the false positives on MRI are attributed to the "magic-angle effect". On T1-weighted coronal oblique images, the supraspinatus tendon can present with an area of apparently increased signal intensity approximately 1 cm proximal to the insertion site of the tendon. It may represent subclinical degenerative change in the tendon [22,23,24].Erickson and co-worker's noted this increased signal intensity on T1WI are due to the "magic-angle effect," in which an artifactual focus of increased signal intensity occur on short-TE images of a tendon oriented 55 degrees to the constant magnetic field. [25]

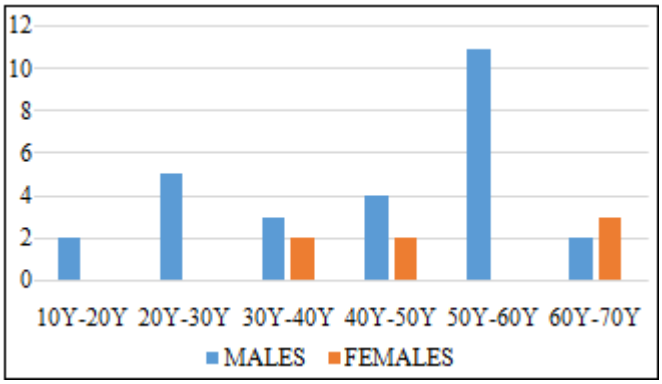
5. Conclusion

Supraspinatus muscle is the most involved muscle with sprains & PTT being the most frequently encountered injuries in rotator cuff. Thus MRI has an ultimate precision for the characterization of rotator cuff injuries, with relatively high sensitivity and specificity rates.

Comparison of performance of MRI in diagnosis of rotator cuff tears

Study	Number of patients	Full Thickness Tear Sensitivity/ specificity/ accuracy (%)	Partial Thickness Tear Sensitivity/ specificity/ accuracy (%)
Evancho et al.,1988[26]	31	80/94/89	---
Raii et al., 1990[27]	80	97/94/95	89/84/85
Palmer et al.,1993[28]	42	100/100/100	100/100/100
Quinn et al., 1995[29]	100	85/99/96	82/99/97
Burk et al.,1989[30]	38	92/100/94	---
Robertson et al.,1995[31]	82	81-100/89-98/—	19-57/85-93/—
Sonin et al.,1996[32]	26	89/94/92	—
Magee and Williams, 200633	150	98/96/—	92/100/—
Sahin-Akyar etal.,1998[34]	39	83-100/—	/—
Traughber et al.,1992[35]	28	100/100/100	5 of 9 partial tears diagnosed with MRI

	MRI (n)	Arthroscopy (n)	Sensitivity	Specificity	PPV	NPV
partial thickness tears	21	18	100	97.5	85.7	100
Full thickness tears	11	11	100	100	100	100
Labral tears	3	3	100	100	100	100



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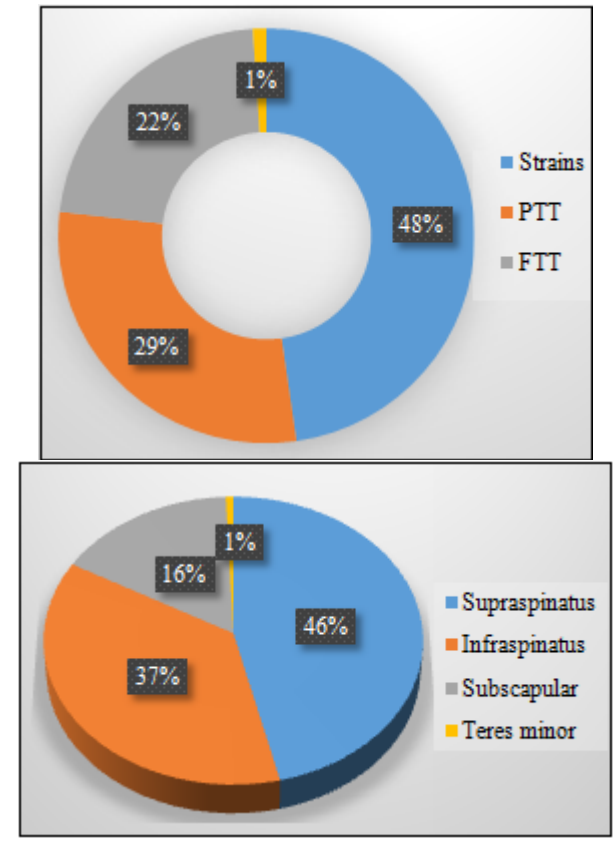

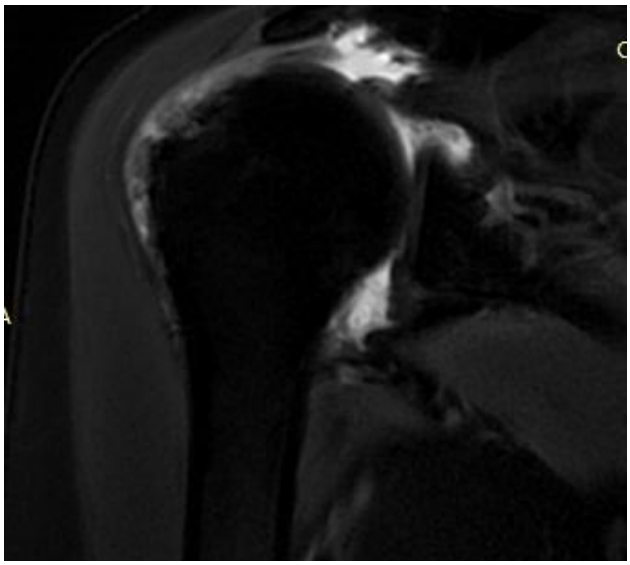

Figure 1: Coronal PD FS shows a patient with FTT of the supraspinatustendon with retraction of its muscle fibers.

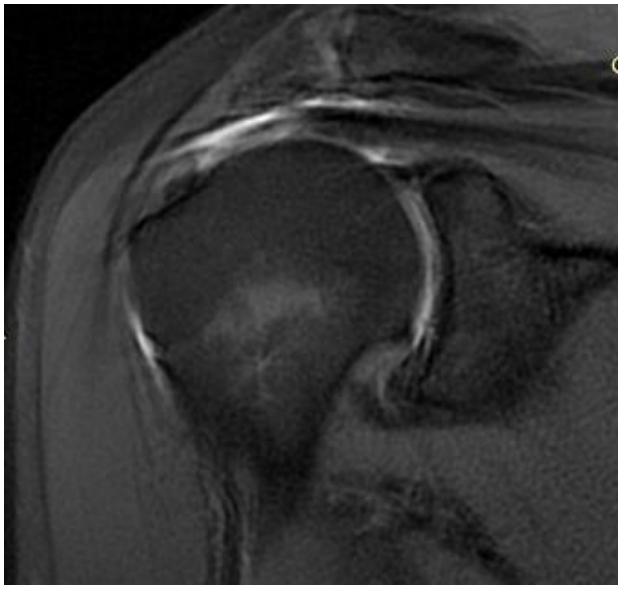

Figure 2: Coronal PD FS image showing PTT of supraspinatus tendon

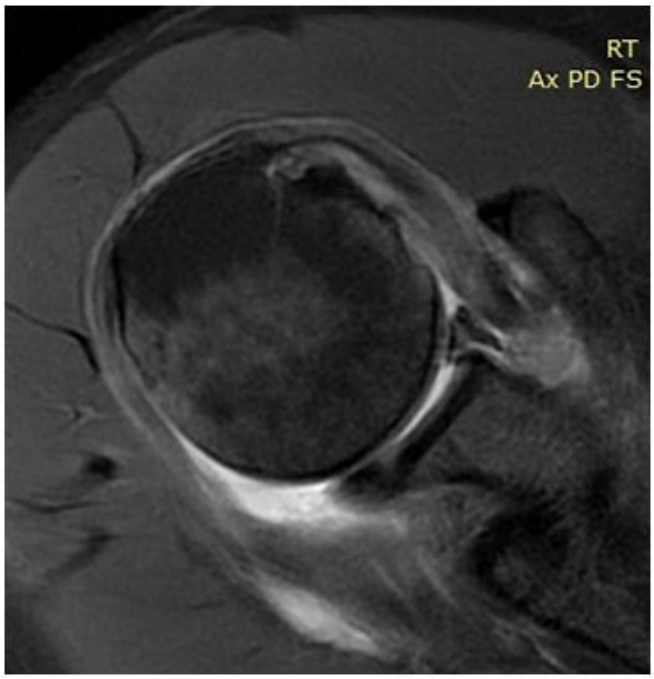

Figure 3: Axial PD FS MR shows a PTT of SSC and infraspinatus with antero-inferior labral tear

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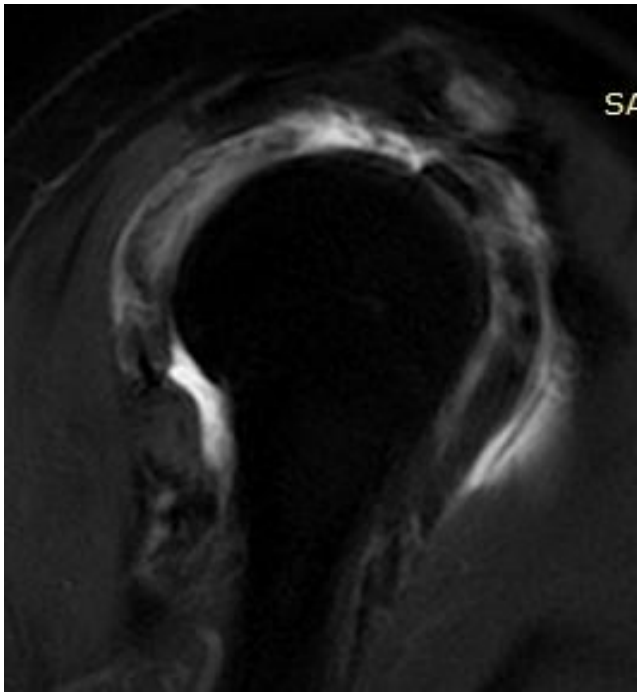

Figure 4: SAG PD FS showing extensive tears involvement of almost all the tendons of rotator cuff.

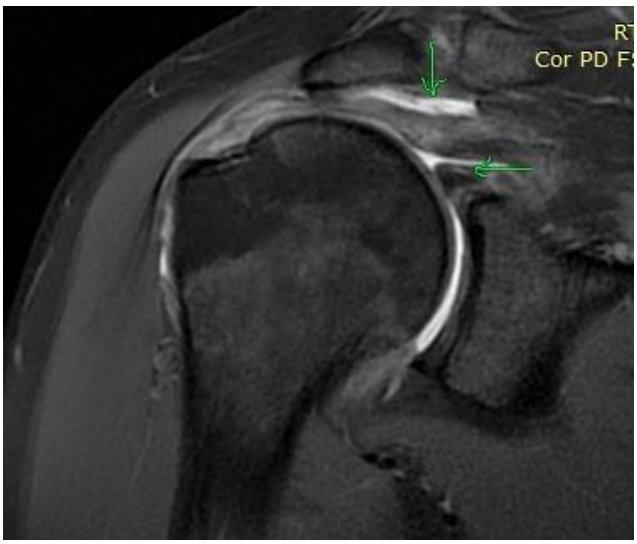

Figure 5: Coronal PD FS showing PTT of supraspinatus and SLAP tear

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