

Role of Magnetic Resonance Imaging in Internal Derangement of Shoulder

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Abstract:

Background and objectives: Internal derangement is an internal disturbance in the normal resting position of the joint that results in pain and movement restriction.¹ MRI plays an important role as a triage tool in evaluation of shoulder pathologies due to its ability to non-invasively display high resolution images with excellent soft tissue contrast²⁻³. The main objective is to study the Magnetic Resonance Imaging characteristic features and diagnosis of internal derangements of the shoulder joint

Methodology: This is a cross-sectional study carried out at the Radiology department Of KLES Dr Prabhakar Kore Hospital & Medical Research Centre, Belgaum Over A Period Of One Year of 80 patients referred for MRI shoulder clinically suspected of internal derangement of shoulder joint using a dedicated shoulder coil on a Siemens 1.5 Tesla Symphony Magnetom class-MRI scanner.

Results: In the present study 81.25% of the patients were males and 18.75% were females. MRI scan revealed abnormal findings in 73.75% of the patients and normal findings in 26.25% of the patients. Commonest diagnosis of the rotator cuff pathologies was supraspinatus tear which was present in 30 patients (37.5%). Second most common diagnosis was acromioclavicular arthritis (25%). Common bony pathologies noted in this study are Hill-Sachs lesion in 13.75%, AC joint injury in 2 (2.50%), dislocation in 3 (5.5%), and fractures in 12 (15.0%) patients. Glenohumeral joint and rheumatoid arthritis were noted in 3 (7.50%) and 1 (1.25%) patients. Labral lesions were noted in 16 (20.0%). SLAP tears were noted in 6 patients (7.50%). Perthes lesion was noted in 3 (3.75) and 1 (1.25%) with anterior labral tear. Bankart pathologies were present in 6 patients (7.50%).

Conclusion: Magnetic resonance imaging of the shoulder is an excellent non invasive investigation tool of triage for shoulder pain and depiction of internal derangement of shoulder due to excellent contrast resolution and multiple imaging planes.

Keywords: shoulder; magnetic resonance imaging; internal derangement of shoulder

I. Introduction

Internal derangement is an internal disturbance in the normal resting position of the joint that results in pain and movement restriction.¹ Shoulder pain which is a common symptom frequently consulted for in primary care has a prevalence rate ranging from 6.7 to 46.7% per year in the general population.^{4,5} Internal derangement of the shoulder is a blanket term used to cover a group of disorders involving destruction of the normal functioning mechanism of the complex assembly of muscles, tendons, ligaments, cartilage and bones comprising the shoulder joint.

Most of the shoulder derangements fall into three major categories: soft tissue disorders which includes tendon tears and labroligamentous lesions, articular injury or instability, and arthritis. The incidence of shoulder pathologies increases with age due to progressive tendon tissue degeneration and weakening, although repeated microtrauma or overuse from professional or athletic activity can also cause shoulder problems in all age groups. Internal derangement of shoulder is evaluated with radiography, CT, MRI, arthrography and arthroscopy.

MRI plays an important role as a triage tool in evaluation of rotator cuff pathologies due to its ability to non-invasively display high resolution anatomy images with excellent soft tissue contrast. Numerous radiological-surgical correlation studies have shown that with the development of new arthroscopic techniques, MRI has played an increasingly important role as a non-invasive test for determining which patients may benefit from surgery and which ones can be managed conservatively. Hence, MRI is demonstrated as a cost effective tool by reducing unnecessary surgical and arthroscopic interventions.^{2,3}

MRI provides multiplanar imaging in different anatomic planes without contrast and absence of radiation hazards and provides excellent soft tissue contrast. With the introduction of special closely coupled extremity coils, high field systems, open systems extremity units, and other technical advances the utility of MRI has expanded dramatically. Because of these numerous advantages MRI has become the modality of choice for imaging of shoulder pathology. Some structures, such as the contour of humeral head, rotator cuff,

and glenoid shape, are very well appreciated and evaluated. MRI in addition to detailed information regarding cuff pathologies, also provides information about adjacent structures such as, muscle atrophy, size of muscle cross-sectional area, and fatty degeneration which have significance for the physiologic and mechanical status of the rotator cuff.⁶ MRI is also provides excellent information in assessment of non-rotator cuff abnormalities such as shoulder instability, axillary pouch, synovial joint diseases and labroligamentous pathologies.

II. Materials And Methods

Preparation Of Patients:

All patients, of different age groups presenting with history of painful shoulder and clinically suspected with internal derangement of shoulder joint were included in the study once confirming that they did not have history of ferromagnetic implants, cardiac pacemakers, cochlear implants and aneurysm clips, previous surgery, infections and neoplasms of shoulder joint and after signing an informed consent. The patient is placed in the supine position with the shoulder in close relation to the shoulder coil with the shoulder and arm placed alongside and parallel to the body, positioned in neutral to mild external rotation and stabilized using small sandbag and tape to reduce motion artifacts. The patients were then briefed about the procedure i.e. about the noise of the gradient coils and need to control the body movements for successful image acquisitions.

Technique

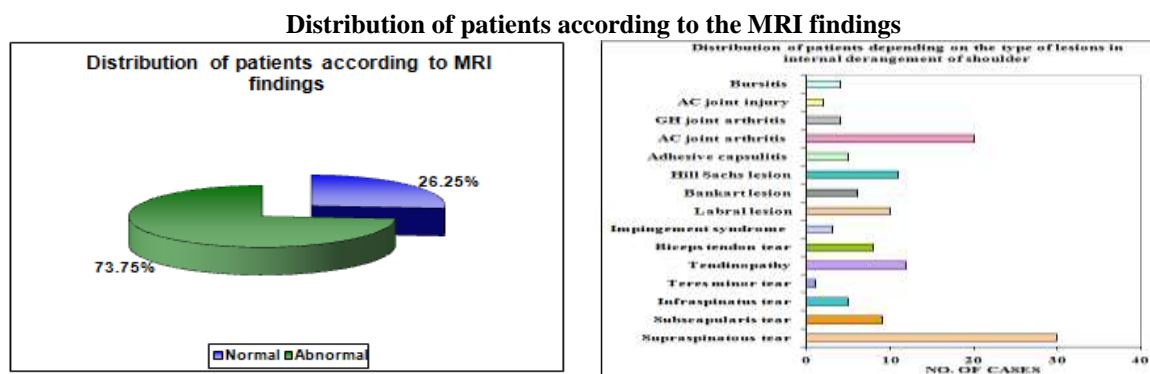
All patients underwent MRI of the shoulder joint using a using a dedicated shoulder coil on a Siemens 1.5 Tesla Symphony Magnetom class-MRI. Routine shoulder evaluations were performed with an axial localizer to identify the anatomic area of the acromioclavicular joint through the glenohumeral joint.

III. Statistical Analysis

The data obtained was coded and entered into Microsoft Excel Worksheet. The categorical data was expressed as percentages and ratios.

IV. Results

The present one year cross-sectional study was conducted in the Department of Radiodiagnosis, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum. A total of 80 patients with history of painful shoulder and clinically suspected with internal derangement of shoulder joint referred for MRI scan during the study period that is, January 2014 to December 2014 werestudies. A review of all the cases had been done and the results were presented in the form of tables and graphs to fulfill the objectives of the study.



In this study 73.75% of the patients MRI findings revealed significant pathologies.

Supraspinatus tendon		No. of cases	Percentage (%)
Tear	Partial	Grade I	13 16.25
		Grade II	3 3.75
		Rim Rent	4 5.00
	Full Thickness	4 5.00	
Complete		2 2.50	
	Massive	4 5.00	
Tendinopathy		6	7.50
Impingement syndrome		3	3.75%
Subscapularis tendon		No. of cases	Percentage (%)
Tear	Partial	6	7.50
	Complete	1	1.25
	Massive	2	2.50

Tendinopathy		3	3.75
Calcific tendinitis		1	1.25
Infraspinatus tendon		No. of cases	Percentage (%)
Tear	Partial	2	2.50
	Massive	3	3.75
Tendinopathy		1	1.25
Teres minor		No. of cases	Percentage (%)
Massive tear		1	1.25

Biceps tendon		No. of cases	Percentage (%)
Tear	Partial	4	5.00
	Complete	4	5.00
Tendinosis		2	2.50

Labroligamentous lesions		No. of cases	Percentage (%)
Slap tear	Type I	2	2.50
	Type II	2	2.50
	Type IV	2	2.50
Perthes lesion		3	3.75
Labral tear		1	1.25
Bony bankart		3	3.75
Bankart lesion		1	1.25
Reverse bankart		2	2.50
Adhesive capsulitis		5	6.25
Osseous abnormalities		No. Of cases	Percentage (%)
Acromio clavicular arthritis		20	25.00
Glenohumeral joint arthritis		3	3.75
Rheumatoid arthritis		1	1.25
Hill sachs lesion		11	13.75
Ac joint injury		2	2.50

V. Discussion

This one year cross-sectional study of internal derangement of shoulder joint included total of 80 patients who were clinically suspected with internal derangement or with history of shoulder pain or trauma referred for MRI scan of shoulder from January 2014 to December 2014 at the Department of Radio diagnosis, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum.

In the present study males outnumbered females as 81.25% of the patients were males and 18.75% were females with male to female ratio of 4.33:1.

In this study the age ranged between 15 to 72 years. The commonest age group was between 50 to 59 years which comprised nearly one third of the patients (30%). The next common group was 40 to 59 years with 23.75% of the patients and 18.75% of the patients presented with age < 30 years. The mean age was 43.95 ± 13.26 years.

In this study right side was commonly affected (65%). With regard to clinical presentation, majority (95%) of the patients presented with pain followed by stiffness (66.25%), swelling (45%), restriction of movements (61.25%) and trauma (61.25%). It was also noted that, most of the patients had history of fall as the commonest cause of injury (40%).

In the present study the clinical diagnosis of rotator cuff tear or pathology was noted in more than half of the study population (59.90%) followed by shoulder instability (8.75%), frozen shoulder, and acromioclavicular arthritis (7.50% each).

In the present study MRI scan revealed abnormal findings in 73.75% of the patients while normal findings were seen in 26.25% of the patients. The common MRI findings noted for rotator cuff pathology were hyperintensity in supraspinatus (35%), hyperintensity (11.25%) in subscapularis, hyperintensity (3.75%) in infraspinatus and muscle oedema (2.5%) in teres minor, hyperintensity (6.25%) in biceptal tendon. In our study acromioclavicular joint and its synovium showed hyperintensity of acromioclavicular joint in 26.25% of the patients, thickening of synovium in 23.75% of the patients and osteophytes in 2.5%.

Joint effusion was seen among 21.25% of the patients while thickening and hyperintensity in the axillary pouch was seen in 8.75% of the patients. Labrum hyperintensities was present among 16.25% of the patient and anterosuperior quadrant was commonly effected noted (15%). The bony abnormalities such as humeral head hyperintensity, arthritic changes, dislocation and fracture were noted in 16.25%, 3.75%, 3.75% and 15.0% of the patients respectively.

In the present study there was wide variation in the MRI diagnosis and patients presented with various conditions and was categorised into rotator and non rotator cuff pathologies. Based on the MRI patterns, commonest diagnosis of the rotator cuff pathologies was supraspinatus tear which was present in 30 patients

(37.5%). Further, among them, partial supraspinatus tear was most commonly noted in 16 patients (20.00%) of which 13 (16.25%) with Grade I and 3 (3.75%) with Grade II and 4 (5.0%) with rim rent tears. In our study partial supraspinatus tears were commonly located in the intrasubstance in 8 (10.0%) followed by articular surface in 6 (7.50%) . Full thickness supraspinatus tear was noted in 4 (5.0%), Complete tear in 2 (2.50%), Massive tear in 4(5.0%).

In the present study supraspinatus, subscapularis and infraspinatus tendinosis was noted in 6 (7.50%), 3 (3.75%) and 1 (1.25%) patients respectively. Impingement syndrome was noted in 3 patients (3.75%) and subscapularis calcific tendinitis was noted in 1 (1.25%). In the present study diagnosis of partial and complete biceps tear was noted in 4 patients (5%) each and tendinosis was noted in 2(2.50%).

Although acromioclavicular osteoarthritis can be detected on X-Ray, its effect on rotator cuff cannot be appreciated by X-Ray, and hence MRI is necessary⁷. In the present study second most common diagnosis was acromioclavicular arthritis (25%). These findings were consistent with the study by Arafat MR. et al.⁸ where 36.8% of the patients had acromioclavicular arthritis while Chaudhary et al.⁷ from India reported acromioclavicular arthritis in 19.75% of the patients.

Bony pathologies can also be evaluated by MRI, although not being the modality of choice. Common bony pathologies noted in this study are Hill-Sachs lesion, AC joint injury, dislocation and fractures. In the present study Hills-Sachs lesion was noted in 13.75% of the patients. Similar rate of Hill Sachs lesion is reported by Arafat MR. et al. ⁸ and Chaudhary et al. ⁷ from India 11.11% and 7% respectively. In the present study shoulder dislocation was noted in 3 (5.5%), fractures in 12 (15.0%) with greater tuberosity being most commonly involved in 8.75% followed by glenoid in 5.0% and humeral head in 1.25%. Acromioclavicular joint separation was noted in 2 (2.50%) patients. Glenohumeral joint arthritis and rheumatoid arthritis were noted in 3 (7.50%) and 1 (1.25%) patients respectively.

Acute bursitis is also a common cause of shoulder pain. In the present study bursal fluid was noted in 32.50% and subacromial and subcorocoid bursitis were noted in 2 patients (2.5%) each. In the present study labral lesions were noted in 16 (20.0%). Superior labral anterior posterior (SLAP) tears are pathology of the superior labrum usually on the attachment of the long head of the biceps tendon. In the present study SLAP tears were noted in 6 patients (7.50%) of which Type I, type II & type IV were noted in 2 (5.0%) each. Similarly Arafat MR. et al. ⁸ reported SLAP lesions in 6.1%. Perthes lesion was noted in 3 (3.75) and 1 (1.25%) with anterior labral tear.

In this study Bankart pathologies were present in 6 patients (7.50%). Of these 3 (3.75%) were Bony Bankart, 2 (2.5%) with Reverse Bankart and 1 (1.25%) with Bankart lesion. Chaudhary H et al⁷ in their study reported cases with Bankart lesion in 8.61% and Arafat MR. et al.⁸ in 2.6%.

Adhesive capsulitis is a clinical syndrome due to thickening of synovial sheath and joint capsule in the axillary recess. In the present study diagnosis of adhesive capsulitis was noted in 5 patients (6.25%) which consistent with a study from India where Chaudhary H et al⁷ reported in 3.70% of the patients.

Overall, the present study showed that, MRI of the shoulder joint has wide approach for the diagnosis for internal derangements of shoulder joint. This makes it as a practical, well accepted and accurate non-invasive imaging technique in patients presenting with shoulder pain and is imaging modality of choice in clinically suspected cases of internal derangement of shoulder and when plain radiographs are normal or equivocal⁷. Furthermore, excellent soft tissue contrast and multiplanar planes imaging provides optimal assessment of muscle, tendons, fibrous cartilage, joint capsule, labroligamentous structures, fat, bursae and bone marrow.

VI. Conclusion

Magnetic resonance imaging of the shoulder is an excellent non invasive investigation tool of triage for shoulder pain and suspected cases with internal derangement due to excellent contrast resolution and multiple imaging planes which provide the most detailed evaluation and diagnosis of various abnormalities of shoulder joint. Commonest pathologies detected in our study were supraspinatus tear, acromioclavicular joint arthritis, labral tears and Hill sachs lesion. However many anatomical variants of labrum and magic angle phenomenon can mimic a tear on MRI. MRI is unique in its ability to evaluate the tendon pathologies as well as capsular and labroligamentous structures and osseous abnormalities. Hence it may be considered as the standard imaging tool for optimal depiction of internal derangement of shoulder pathology.

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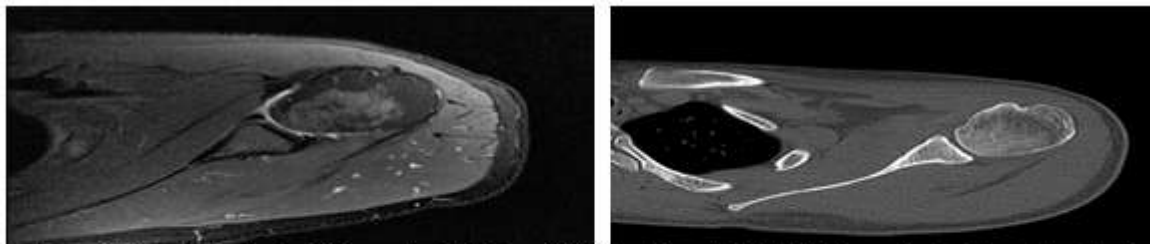


Figure 1: Bony bankart lesion: 26yrs male with history of fall from bike. Axial PD FSE image showing hyperintensity along the anteroanterior quadrant of the labrum. Corresponding axial CT image showing bony defect in the same area.



Figure 2: Supraspinatus tendinopathy: 58 yrs old male with complaints of overhead abduction restriction. Coronal PD FSE image showing thickening and prolonged relaxation of the supraspinatus tendon. Peritendinous oedema, bursal fluid noted in the subacromioclavicular bursa.

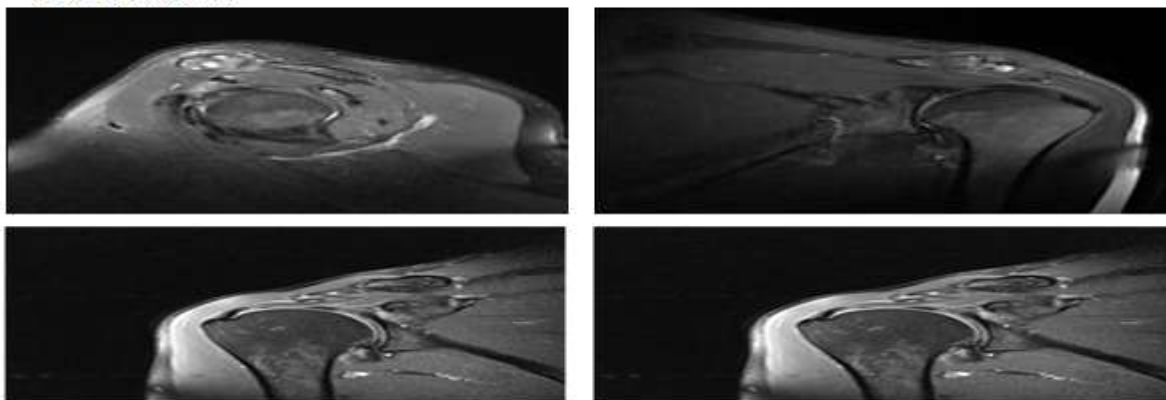


Figure 3: AC arthritis: 49 yrs male with history of stiffness of shoulder joint and painful overhead abduction movements. Coronal oblique and sagittal PD FSE images showing cystic changes and hyperintensities along the distal end of clavicle and acromion with synovial thickening.

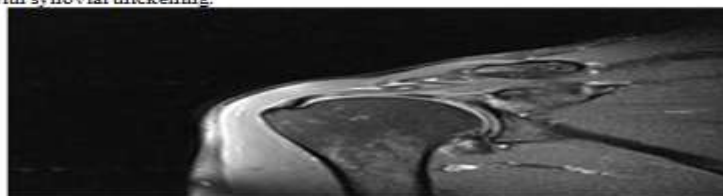


Figure 4: Adhesive capsulitis: 60 yrs old male patient with history of pain and restricted movements since 10 months. Coronal PD FSE image showing thickening >1.3 cms with hyperintensity in the axillary pouch.

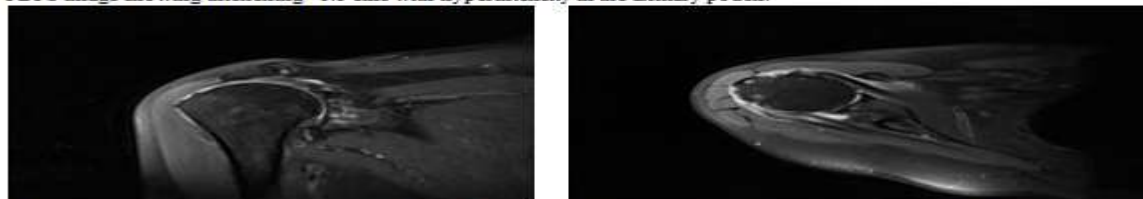


Figure 5: Glenohumeral osteoarthritis with infraspinatus tear: 64yrs female with history of pain and restricted movements since 6 months. PD FSE coronal image showing glenohumeral chondral loss, subchondral cysts and posterolateral osteophytes. Axial PD FSE weighted image showing hyperintensity along the infraspinatus tendon suggestive of tear.