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Role of MRI in Evaluation of Chronic Shoulder Pain

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ABSTRACT

Objectives: - The objective of this study was to evaluate the causes of chronic shoulder pain using Magnetic resonance imaging with in depth evaluation of rotator cuff pathologies and to assess the usefulness and accuracy of MR imaging in rotator cuff pathologies, their characteristics and also evaluation of associated bony injuries or bony pathologies of shoulder joint, gleno-humeral joint instability and its correlation with surrounding rotator cuff pathology.

Materials and methods:- 150 patients presenting with chronic shoulder pain and other complaints like restriction of movement or recurrent dislocation of shoulder joint were assessed with 1.5 Tesla Magnetic Resonance Imaging system using Axial T1WI, T2WI, PD fat sat; Coronal PD fat sat and STIR; Sagittal PD fat sat; Axial, coronal and sagittal-Contrast T1 Fat sat sequences.

Results: - The age distribution in our study was in range of 15 years to 70 years with maximum population within 45-54 year range.

- The majority of cases of chronic shoulder pain included rotator cuff injuries followed by biceps pathologies, acromio-clavicular arthritis, gleno-humeral instability, gleno-humeral arthritis and lastly miscellaneous conditions like tumors or cysts.
- The rotator cuff tears were more common in non-traumatic causes and supraspinatus was the most commonly involved tendon followed by subscapularis, infraspinatus and teres minor in decreasing order of frequency.
- Type I and type II acromion morphology was most commonly observed. Anterior instability was most common type of gleno-humeral instability. Anterior instability was strongly associated with Hill-Sachs and Bankart lesion.

Conclusions: - MRI is highly accurate and non-invasive modality for evaluating rotator cuff disorders like rotator cuff tendinopathy, partial tears, and complete tears because of multi-planar imaging and comprehensive display of soft tissue anatomy, unlike CT which has a limited role in the setting of soft tissue pathologies.

Key Words: Shoulder, Rotator cuff, Acromion, MRI

INTRODUCTION

- Shoulder pain is the third most common musculoskeletal complaint in the general population, and accounts for 5% of all musculoskeletal consults.
- The rotator cuff is the most commonly affected structure in the shoulder.
- The imaging modalities used for evaluating rotaor cuff pathologies include conventional radiography, USG, CT, MR, arthrography. Conventional radiography and CT has very little role. USG is very much operator dependent.
- MRI has significant advantages over computed tomography, conventional arthroscopy and radiography because of its excellent soft tissue contrast, high resolution, reduced artifacts, shorter imaging time and improved accuracy.
- MRI also has additional advantages of providing good multiplaner delineation even without contrast and absence of radiation hazards and detailed information can be obtained regarding cuff defects, adjacent structures, muscle

atrophy, size of muscle cross-sectional area and fatty degeneration which have implications for the physiologic and mechanical status of the rotator cuff.

MATERIALS AND METHODS

This prospective study was conducted at the Department of Radiodiagnosis, M. P. Shah govt. medical college and Shri Guru Gobind Singh Government Hospital, Jamnagar, Gujarat during June 2018 to January 2020. After taking informed consent, total 150 patients presenting to orthopaedic out-patient department with complaints of shoulder pain for at least for 3-6 months' duration associated with swelling, stiffness, dislocation, with or without a history of trauma to shoulder were included and assessed with 1.5 Tesla Magnetic Resonance Imaging system. All patients were of age ranging from 15 years to 70 years.

Inclusion criteria:

- Chronic causes of shoulder pain.
- Compound injuries of shoulder.
- Cases of all age groups irrespective of sex.

Exclusion criteria:

- Shoulder pain of less than 3 months' duration.
- Shoulder pain due to cervical spondylosis.
- Post treatment patient
- Cardiac pacemaker.
- Claustrophobia.
- Patients who are unwilling for imaging.

Protocol:

After enrolment of the case, detailed history with clinical examination was done. Specific shoulder tests were done wherever needed and MRI shoulder were done by 1.5 Tesla Magnetic Resonance Imaging system (Magnetom Essenza, Siemens health care, Germany).

Following different criteria was used for the pathologies.

- Normal tendon: normal in signal intensity and morphology
- Tendinopathy: increased signal intensity on proton density with fading of signal on T2-weighted image without any tendon defect.
- Partial tear: partial intra-substance tear or extending to any one of the surface with increased signal intensity on T2-weighted image.
- Complete tear: tendon defect extending to both surfaces with increased signal intensity on T2-weighted image.

OBSERVATIONS AND RESULTS

TABLE NO 1: AGE-WISE DISTRIBUTION

AGE GROUP (YRS)	NO. OF PATIENTS	PERCENTAGE
15-24	16	11%
25-34	31	21%
35-44	31	21%
45-54	40	27%
55-64	19	13%
>65	13	8 %
TOTAL	100%	

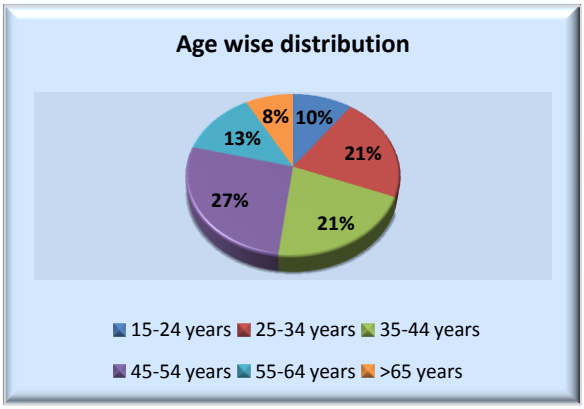


TABLE NO 2: GENDER DISTRIBUTION

GENDER	NO. OF PATIENTS	PERCENTAGE
MALE	93	62%
FEMALE	57	38%
TOTAL	150	100%

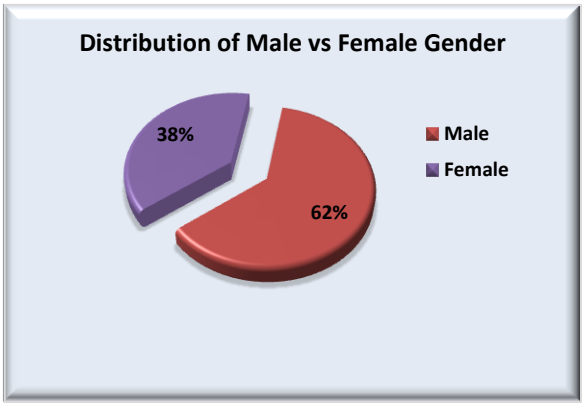


TABLE NO 3: AFFECTED SHOULDER SIDE

SIDE	NO. OF PATIENTS	PERCENTAGE
RIGHT	94	62.66%
LEFT	56	37.33%
TOTAL	150	100%

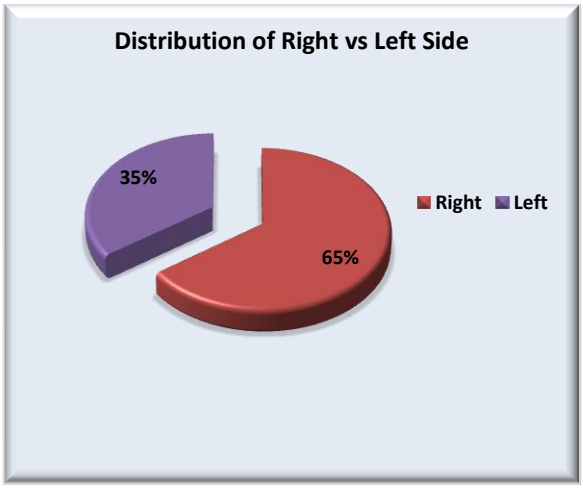


TABLE NO 4: DISTRIBUTION OF ETIOLOGIES OF CHRONIC SHOULDER PAIN

ETIOLOGIES OF CHRONIC SHOULDER PAIN	FREQUENCY OF ETIOLOGIES (MORE THAN ONE ETIOLOGY CAN BE SEEN IN ONE PATIENT)	PERCENTAGE OF ETIOLOGY AMONG THE STUDY GROUP
ROTATOR CUFF PATHOLOGIES	119	79%
ACROMIO-CLAVICULAR JOINT ARTHRITIS	75	50%
BICEPS PATHOLOGIES	48	30%
SHOULDER INSTABILITY	31	21%
GLENO-HUMERAL JOINT ARTHRITIS (INFECTIVE/INFLAMMATORY/DEGENERATIVE)	8	5%
MISCELLANEOUS (PATHOLOGICAL FRACTURES DUE TO TUMORS, METASTASES ETC)	13	9%

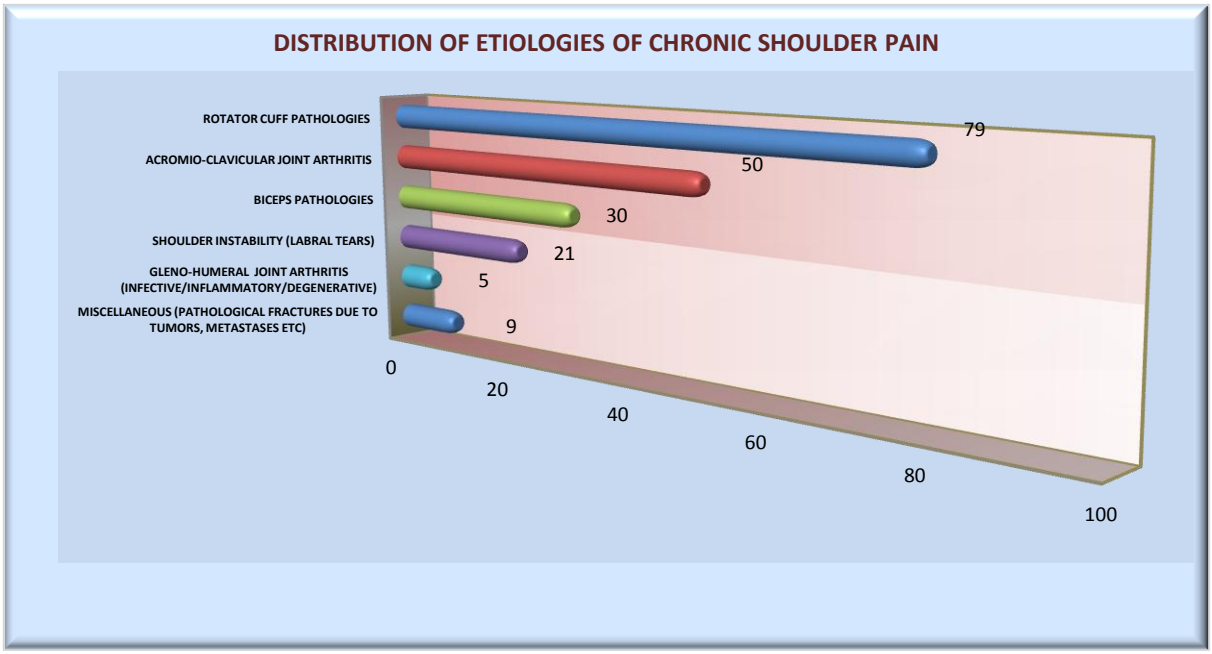


TABLE NO 5: ETIOLOGY FOR ROTATOR CUFF PATHOLOGIES

ETIOLOGY	NUMBER OF CASES	PERCENTAGE
NON-TRAUMATIC	78	65%
HISTORY OF TRAUMA/ DISLOCATION/INSTABILITY	42	35%
TOTAL	120	100%

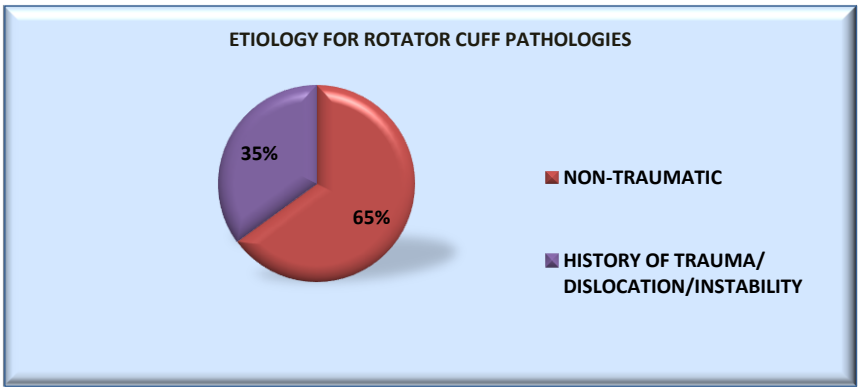


TABLE NO 6: DISTRIBUTION OF ROTATOR CUFF PATHOLOGIES [N=126]

ROTATOR CUFF TENDON	NUMBER OF CASES (MORE THAN ONE MUSCLE TENDON INVOLVEMENT CAN BE SEEN IN ONE PATIENT)	PERCENTAGE OF INVOLVMENT OF CUFF TENDON
SUPRASPINATUS	114	90%
INFRASPINATUS	18	14%
SUBSCAPULARIS	77	61%
TERES MINOR	3	2%

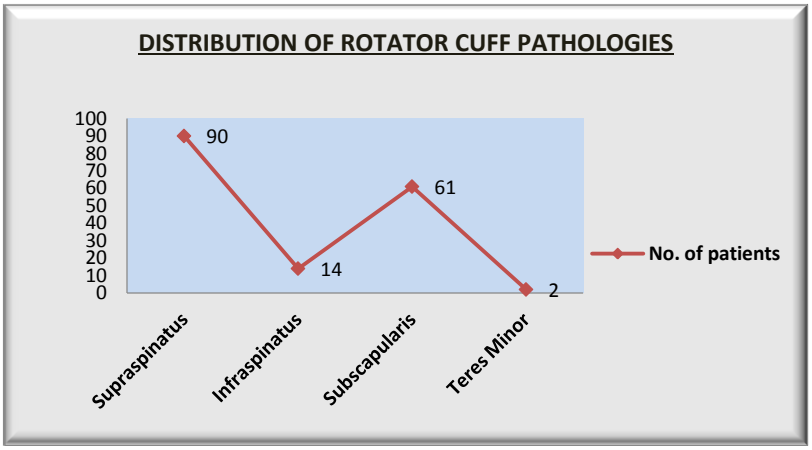


TABLE NO 7: INVOLVEMENT OF ROTATOR CUFF MUSCLES [N=126]

ROTATOR CUFF TENDON INVOLVEMENT	NUMBER OF CASES (MORE THAN ONE MUSCLE TENDON INVOLVEMENT CAN BE SEEN IN ONE PATIENT)	PERCENTAGE
PARTIAL TEAR OF SUPRASPINATUS	72	58%
PARTIAL TEAR OF SUBSCAPULARIS	64	51%
PARITAL TEAR OF INFRASPINATUS	11	9%
COMPLETE TEAR OF SUPRASPINATUS	9	7%
COMPLETE TEAR OF SUBSCAPULARIS	1	0.8%
COMPLETE TEAR OF INFRASPINATUS	1	0.8%

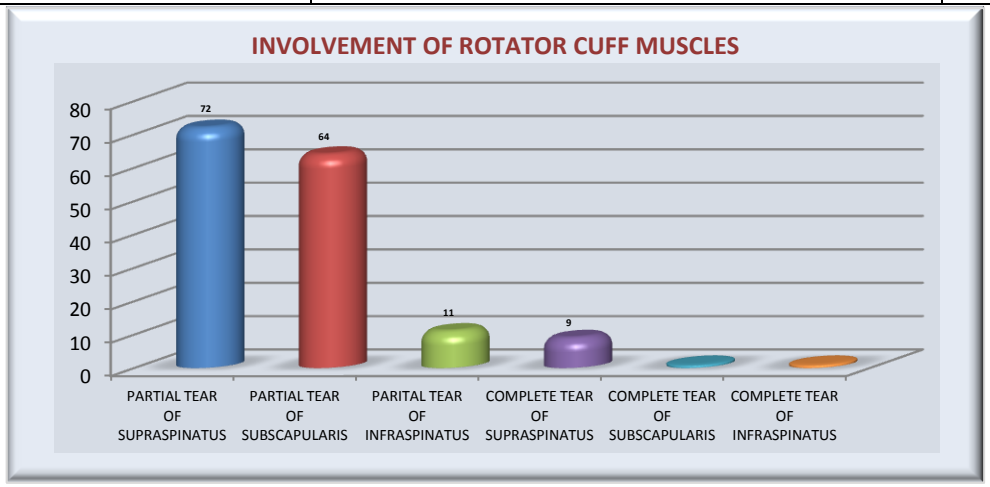
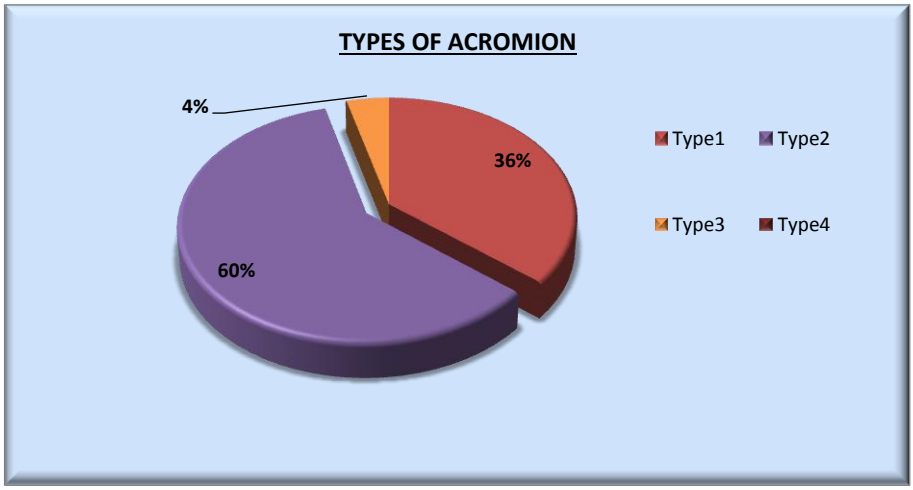


TABLE NO 8: TYPES OF ACROMION

TYPE	FREQUENCY	PERCENTAGE
TYPE 1	54	36%
TYPE 2	90	60%
TYPE 3	6	4%
TYPE 4	0	0%
TOTAL	100	100%



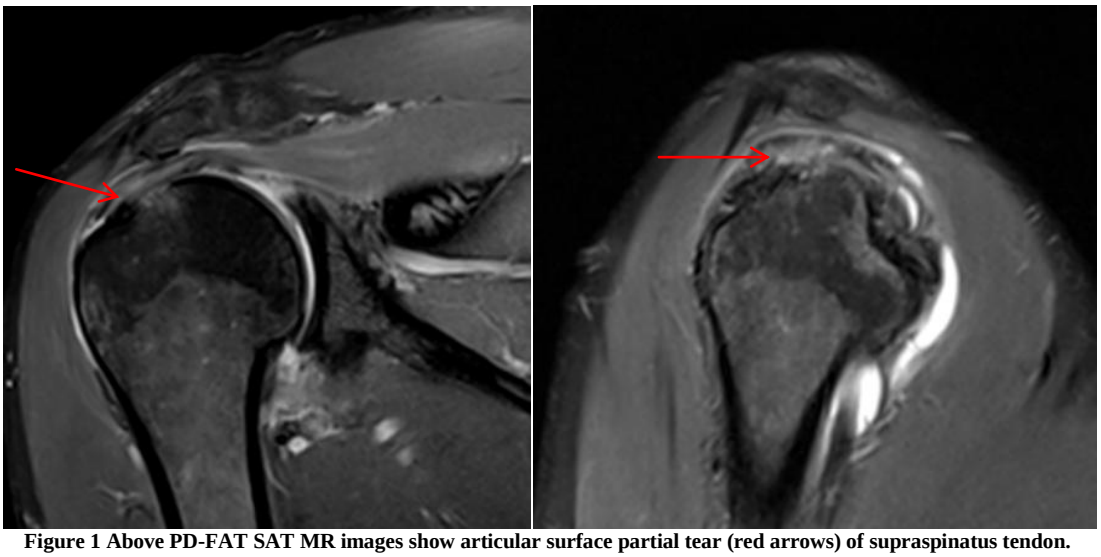


Figure 1 Above PD-FAT SAT MR images show articular surface partial tear (red arrows) of supraspinatus tendon.

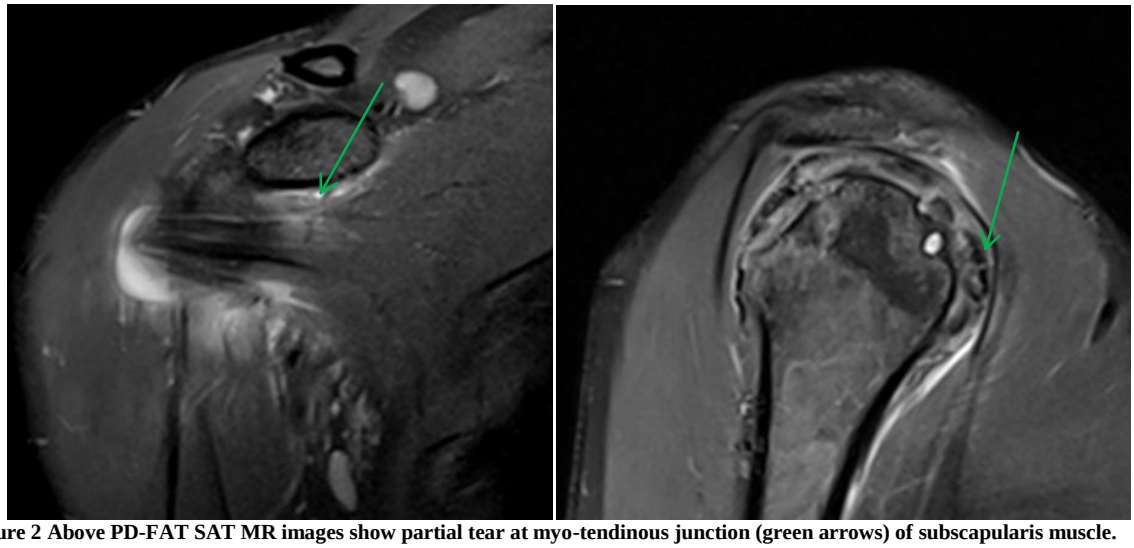


Figure 2 Above PD-FAT SAT MR images show partial tear at myo-tendinous junction (green arrows) of subscapularis muscle.

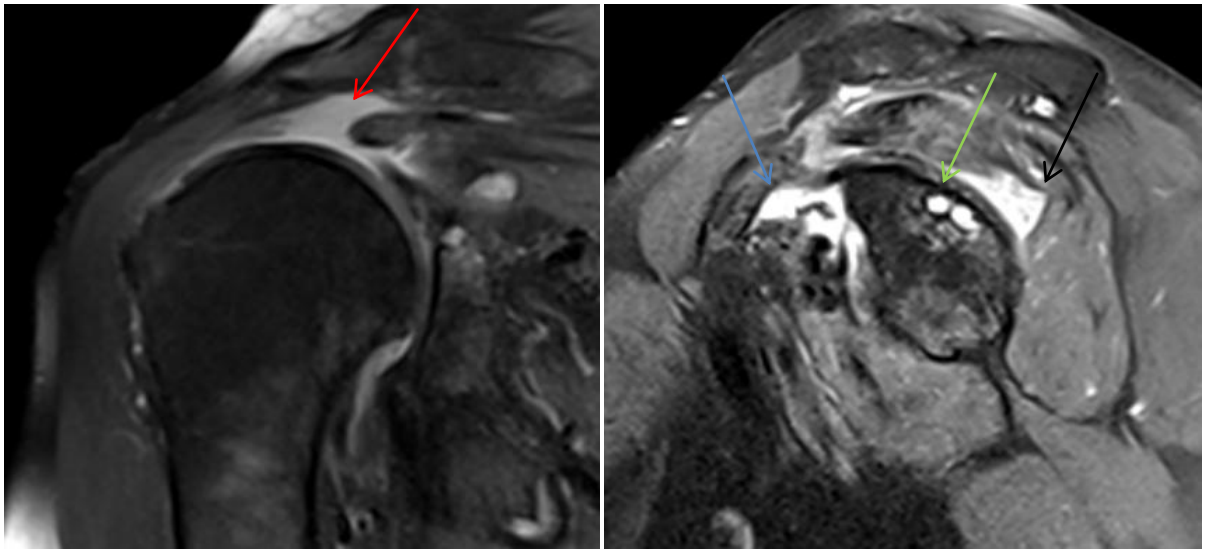


Figure 3 Above PD FAT SAT MR images show complete tear of supraspinatus at myo-tendinous junction (red arrow) and partial tear of subscapularis (blue arrow) and infraspinatus (black arrow). Subchondral cystic changes are noted involving glenoid (green arrow).

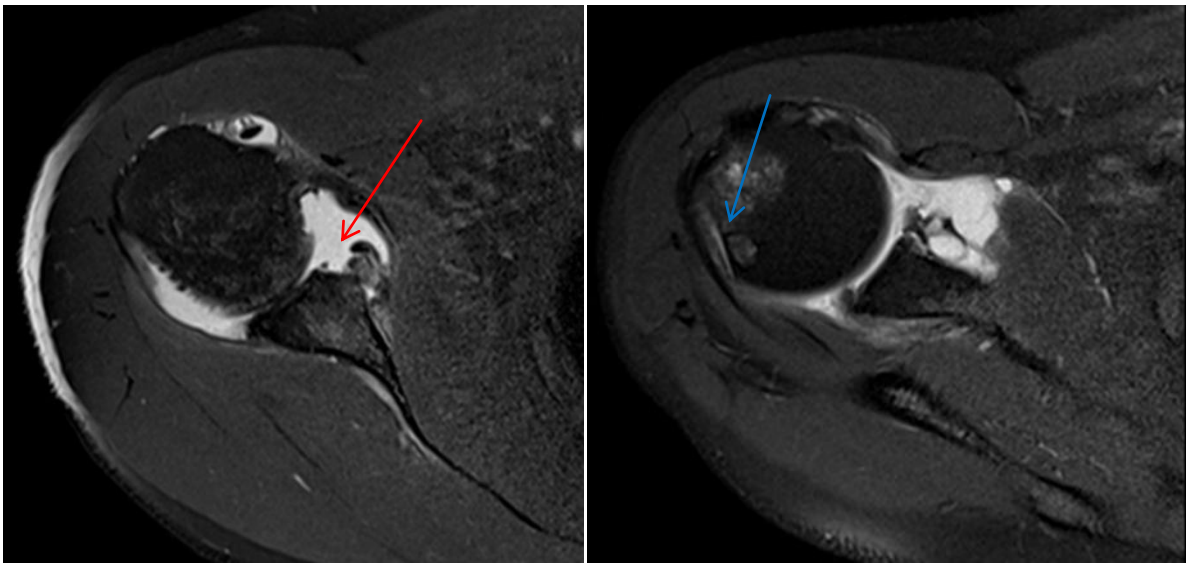


Figure 4 Above PD FAT SAT MR images show Hill-Sach's lesion (blue arrow) and bony Bankart lesion (red arrow) as described above.

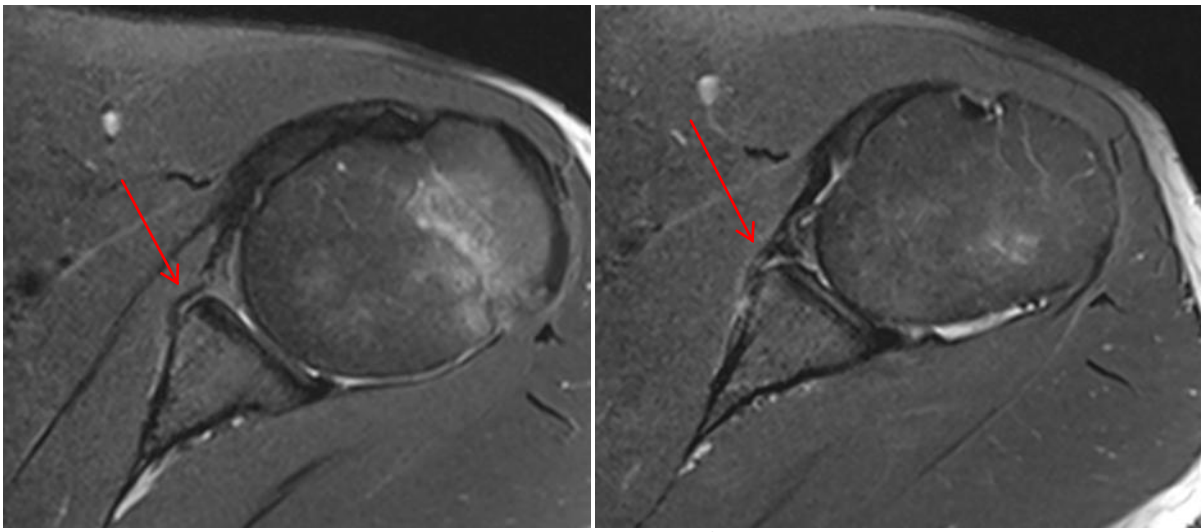


Figure 5 Above PD FAT SAT MR images show detachment of the antero'-inferior labrum (3-6 o'clock) with medially stripped but intact periosteum – Perthe's injury (red arrows)

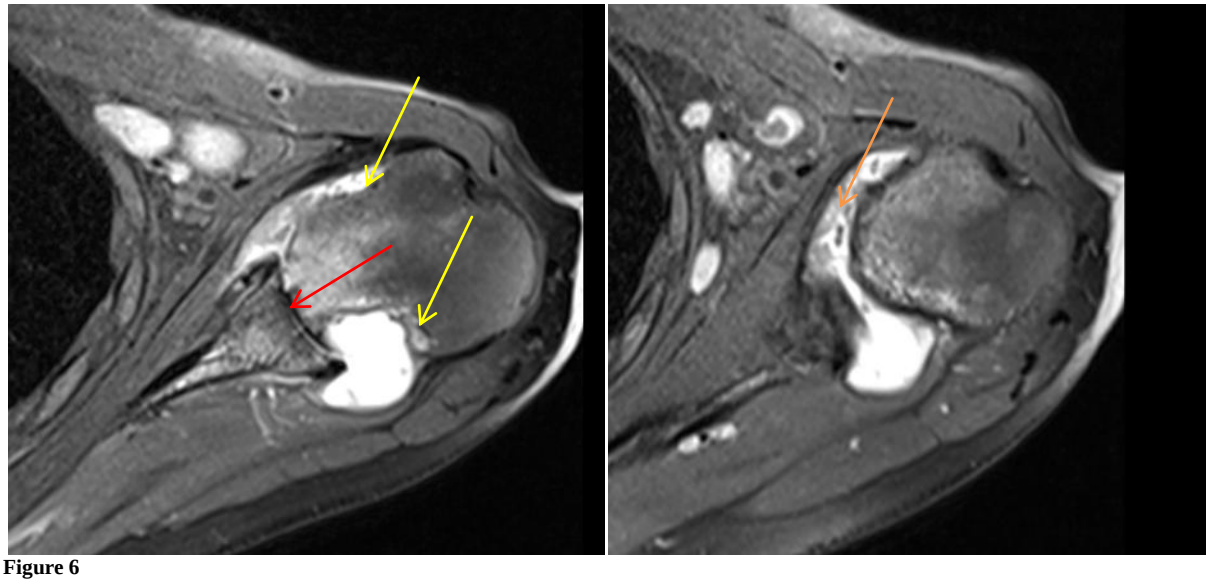


Figure 6
PD-FAT SAT MR IMAGES

Above images show significant gleno-humeral joint space narrowing (red arrows) and cartilage loss associated with synovial hypertrophy (green arrow). Large punched out erosions (yellow arrow) are noted involving humeral head predominantly at rotator cuff attachment sites. Synovial hypertrophy with mild joint effusion and rice bodies are noted (orange arrow).

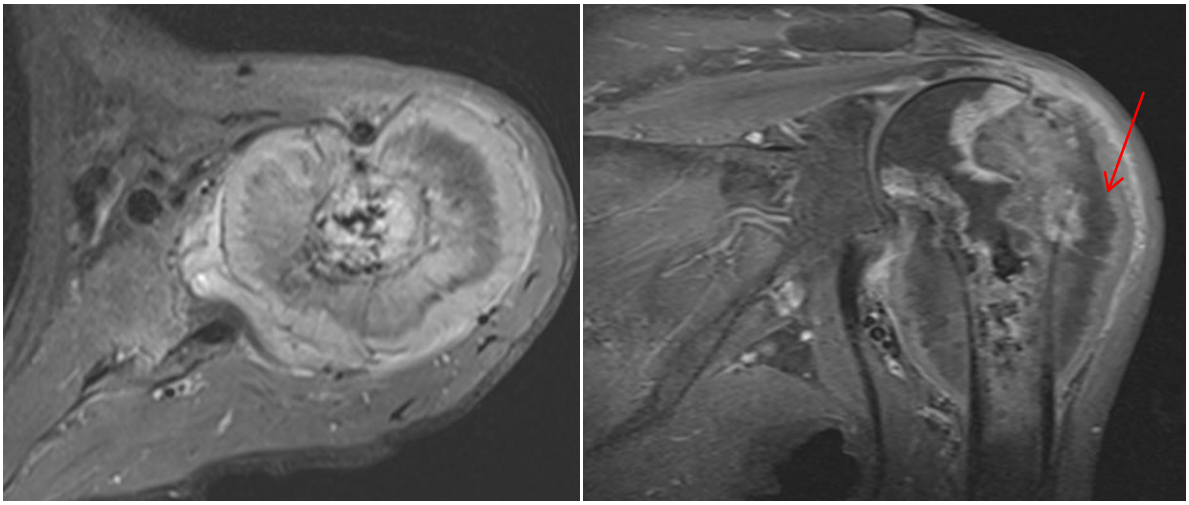
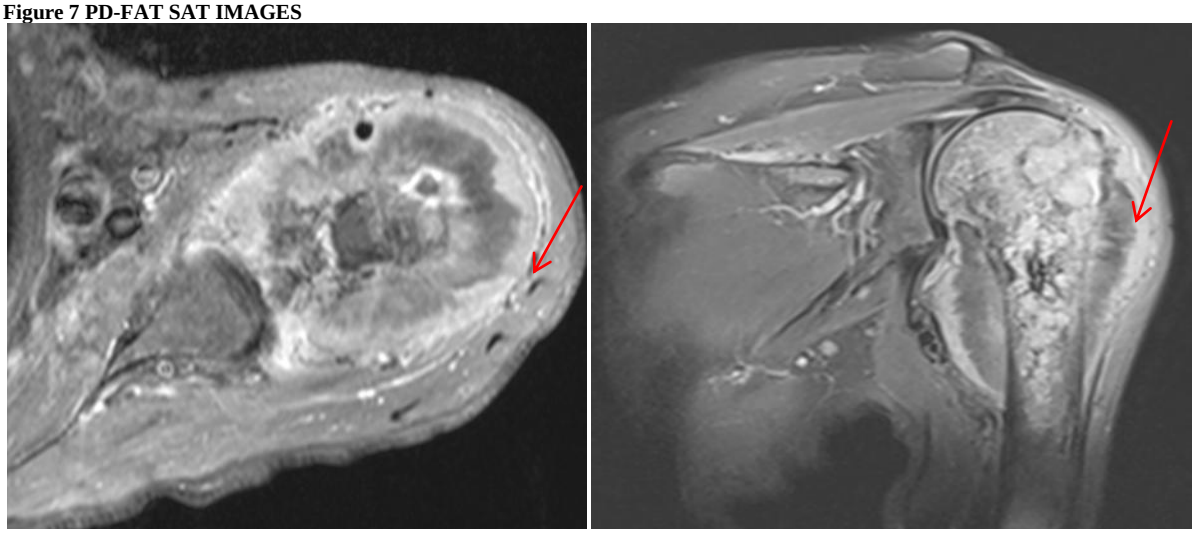


Figure 7 PD-FAT SAT IMAGES



T1 FAT SAT POST CONTRAST

Above MR images show large lesion with soft tissue component involving metaphysis extending to involve epiphyses of head, neck and proximal shaft of left humerus associated with sunburst periosteal reaction.

DISCUSSION

- The age distribution in our study was in range of 15 years to 70 years with maximum population within 45-54 year range.
- The majority of the cases in our study were male.
- Most commonly involved side was right shoulder.
- The majority of cases of chronic shoulder pain included rotator cuff injuries followed by biceps pathologies, acromio-clavicular arthritis, gleno-humeral instability, gleno-humeral arthritis and lastly miscellaneous conditions like tumors or cysts.
- The findings of rotator cuff injuries are as followed:
    - The rotator cuff tears are more common in non-traumatic causes. Trauma mostly only aggravates the prior inflammatory and degenerative tendon alterations.
    - Supraspinatus was the most commonly involved tendon followed by subscapularis, infraspinatus and Teres minor in decreasing order of frequency.
    - Among these, partial tears of the rotator cuff were the most common tendon abnormality where partial tears of supraspinatus tendon were most common.
    - Among partial tears, articular surface tears were most common.
- Acromio-clavicular joint showed abnormality showed strong association with rotator cuff injuries.
- Decreased acromio-humeral distance has been associated with rotator cuff injuries especially supraspinatus tendon injuries. As the distance reduces, chances of rotator cuff injury increase.
- Type I and type II acromion morphology was most commonly observed. Rotator cuff injuries were more commonly seen in type II and type III acromion with type III acromion showing strong association with rotator cuff injuries.
- Biceps tendon showed positive association with rotator cuff injuries.
- Anterior instability was most common type of gleno-humeral instability. Anterior instability was strongly associated with Hill-Sach's and Bankart's lesion.
    - Rotator cuff injuries were seen in the 73% cases of the shoulder instability.

CONCLUSIONS

- According to our study MRI is more sensitive than clinical tests to evaluate chronic shoulder pain because of rotator cuff disorders like rotator cuff tendinopathy, partial tears, and complete tears.
- MRI being non -invasive does not involve morbidity associated with other tests like arthroscopy.
- MRI is unique in its ability to evaluate the labral pathologies, bone marrow, cartilage and deeper intra-articular pathologies.
- Its advantages are: no ionizing radiation, multi-planar imaging and comprehensive display of soft tissue anatomy, demonstration of causes for impingement and also characterisation and staging of bone tumours.
- MR imaging used for soft tissue as well as bony changes involving shoulder region. MR is even better than CT in detecting smaller erosions and acromio-clavicular arthritis. Owing to the better soft tissue resolution of MRI, it was primarily used for detecting the rotator cuff, labral and acromio-clavicular joint pathologies.

Source of Support: None
Conflict of Interest: None

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