

Study of Role of Magnetic Resonance Imaging in Evaluation of Non-Traumatic Chronic Shoulder Pain in Adults

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ABSTRACT

Background: A highly helpful diagnostic technique for determining the cause of shoulder pain is magnetic resonance imaging (MRI).

Objective: To study the role of MRI in the diagnosis of chronic non-traumatic shoulder pain.

Subjects and methods: In this cross-sectional observational research, 60 patients (32 males and 28 females) presented with chronic shoulder pain and limitation of movement. All cases were recruited from the Orthopedic Surgery and Radiodiagnosis Departments at Zagazig University Hospitals. All cases were assessed by Magnetic Resonance Imaging.

Results: Fifty-three cases had rotator cuff pathologies, thirty-seven cases had acromioclavicular osteoarthritis, twenty-nine cases had bursitis, fifteen cases had biceps pathologies and nine cases had miscellaneous conditions. A study; 16 (35%) Sub coracoid, 10(16.7%) in Sub-acromial sub deltoid and (5%) Subscapular. Among the current study, 9 (15%) of cases were miscellaneous. Four cases were suffering from interosseous cystic lesions (6.7%) of all cases. Lipoma was seen in 3(5%) of cases. Ganglion cyst was seen in 2(3.3%) of cases.

Conclusion: MRI of the shoulders aided in understanding different underlying pathology of chronic shoulder pain and revealed that dependence on only clinical findings and diagnosis could delay their management as well as chronicity development.

Keywords: Magnetic resonance imaging, Non-traumatic chronic shoulder pain in adults.

INTRODUCTION

In the general population, shoulder discomfort ranks third in terms of musculoskeletal complaints, and it accounts for 5% of all musculoskeletal consultations. Recommendations to orthopedics are second only to referrals for knee pain ⁽¹⁾.

The glenohumeral articulation, rotator cuff, biceps tendon, joint capsule, and bony structures as well as the labrum, are all potential sources of shoulder pain. Imaging tests are crucial in the proper identification of individuals with traumatic shoulder pain, working in tandem with a detailed history and physical examination ⁽²⁾. Rotator cuff impingement and tears are the main causes of shoulder discomfort in patients older than 40. Magnetic resonance imaging (MRI) has assumed a more significant role as a non-invasive diagnostic for selecting patients who may benefit from surgery with the introduction of novel arthroscopic procedures for treating rotator cuff diseases ⁽³⁾.

Patients who come in for imaging often fall into one of three categories: non-specific discomfort, pain, and limited mobility while abducting the arm, or both (implying impingement). A variety of disorders, including arthropathies, tumors, and infections, can cause non-specific pain ⁽⁴⁾. Diagnostic imaging serves to direct clinical care in the evaluation of shoulder discomfort, and it can help to determine when operational therapy may be necessary. When this is the case, it can also be utilized to further design the surgical strategy, whether it be open or arthroscopic ⁽⁵⁾.

A highly helpful diagnostic technique for determining the cause of shoulder discomfort is magnetic resonance imaging (MRI) ⁽⁶⁾.

The present study aimed to study the role of MRI in the diagnosis of chronic non-traumatic shoulder pain.

SUBJECTS AND METHODS

In this cross-sectional observational research, 60 patients (32 males and 28 females) presented with chronic shoulder pain and limitation of movement. All cases were recruited from the Departments of Orthopedic Surgery and Radiodiagnosis at Zagazig University Hospitals from April 2021 to April 2022. Their ages ranged from 19 to 72 years (average mean age of 43 years).

Ethical consent:

The Zagazig University Faculty of Medicine's ethics committee gave its approval for this study IRB [Approval No. (#6722/9-9-2021)], which was carried out following the guidelines outlined in the Declaration of Helsinki. All study participants gave their informed consent.

Inclusion criteria:

- 1) Patients presented with chronic shoulder pain.
- 2) Patients older than 18 years old.

Exclusion criteria:

- 1) History of recent trauma.
- 2) Shoulder soreness that has lasted less than three months.
- 3) Patients with contraindications to MRI examination.
- 4) Patients with suspected unavailability throughout the study.
- 5) Shoulder pain due to cervical spondylosis.

All patients were subjected to the following:

Detailed personal, obstetric, and medical history including personal history, as well as medical history.

Radiological assessment:

MRI Examination:

The patient should be lying on his or her back with the head pointed in the direction of the magnet and the arm either neutral or slightly externally rotated. In the MRI unit at Zagazig University Hospital, an MR examination was conducted using a (1.5 tesla) superconducting MR magnet (Philips Achieva system). Axial T1 & Oblique coronal T1 SE (TR800, TE40) .in the later sequence cuts are taken parallel to the long axis of supra spinatous muscle, which is demonstrated in previous axial cuts. (Field of view 16-18 cm; 4mm-thick slice with 0.4mm intersection gap and 345x512 matrix;4 excitations). Axial T2 FSE(TR4000,TE120) & Oblique coronal T2 FSE(TR 3000, TE120). Oblique Coronal STIR (TR4000, TE60). Sagittal & Axial PD Fat Sat (TR3000, TE 110, FOV 16 cm, 3 mm-thick slices with 0.5-mm intersection gap).

Image analysis:

Images are acquired in three different oblique planes: coronal, axial, and sagittal. Imaging in the coronal oblique plane can be used to evaluate several structures in the shoulder, including the supraspinatus, superior labrum, acromioclavicular joint, and deltoid muscle. The axial plane is especially helpful for evaluating the long head of the bicep, subscapularis tendon, and glenohumeral cartilage as well as the anterior and posterior glenoid labrum.

The sagittal plane is useful for assessing the rotator cuff tendons and the long head of the bicep tendon.

Rotator cuff tendinopathy manifests as edema and an elevated signal on T2WIs and STIR. But the signal is not as strong as fluid. Only a segment of the tendon is involved in partial-thickness rips of the rotator cuff. When a partial rip occurs, the tendon shows a localized fluid signal rather than fully extending from the bursal to the articular surface. The signal may be weak to the fluid if granulation tissue has begun to form in a persistent partial tear. Articular-sided, bursal-sided, and intra-substance tears are different forms of partial tears.

On fluid-sensitive series, a full-thickness tear is identified by fluid signal strength that extends from the bursal to the articular surface. There may be hyperintense granulation tissue in the space between the subacromial-subdeltoid bursa and the humeral head if the injury is persistent.

Acromioclavicular arthrosis on MRI may show subchondral cysts, sclerosis, erosions, and/or marrow edema (which will have high signal intensity on T2-weighted sequences).

Statistical analysis

Version 20.0 of the IBM SPSS application was utilized. Minimum and maximum values, as well as means, standard deviations, medians, and interquartile ranges, were used to characterize numerical data. Using a 5-percent criterion, the significance of the obtained results was determined. Chi-square analysis was used. More than 20% of the cells with an estimated count of fewer than 5 required chi-square adjustment for categorical variables. Student t-test: used to compare two groups under study and determine the amounts of data with a normal distribution. P value < 0.05 was considered significant.

RESULTS

This study included 60 patients, 32(53.3%) male and 28(46.7%) female aged from 19 to 72 with a mean age of 43 years, who suffered from chronic shoulder pain and or limitation of movement, most of them with established clinical diagnosis referred from orthopedic clinics to the Radiodiagnosis Department at Zagazig University Hospitals from April 2021 to April 2022.

The patients were divided into 5 groups:

Group 1: Rotator cuff pathologies.

Group 2: Acromioclavicular joint osteoarthritis.

Group 3: Biceps tendon lesions.

Group 4: Bursitis, and **Group 5:** Miscellaneous conditions like cysts or tumors.

The age of the studied cases ranged from 19 to 72 years with a mean age of 43.13 years. The most affected group is aged (50-59). Thirty- two (53.3%) of the studied cases were males and 28 (46.7%) were females.

Thirty-eight (63.3%) of the studied cases had a lesion on the Rt side and 22 (36.7%) of the cases had a lesion on the Lt side. All cases had pain and in 29 (48.3%) of the cases, it was associated with limitation of movement. The most frequent lesions among the studied cases were rotator cuff pathologies, ACJ osteoarthritis, Bursitis, and joint effusions {53(88.3%), 37(61.7%), 29(48.3%) and 24(40%)respectively} (**Table 1**).

Table (1): MRI findings among the studied cases:

| Variable | (n=60)* | |
|---|---------|------|
| | No | % |
| Rotator Cuff pathologies | 53 | 88.3 |
| Acromioclavicular joint osteoarthritis | 37 | 61.7 |
| Bursitis | 29 | 48.3 |
| Joint effusion | 24 | 40 |
| Biceps pathologies | 15 | 25 |
| Adhesive capsulitis | 1 | 1.7 |
| Miscellanies | 9 | 15 |

The most affected rotator cuff lesions were; partial thickness tear of the supraspinatus tendon, 19 cases (31.7%) followed by supraspinatus tendinopathy, 17 cases (28.3%).

Full-thickness tear of the supraspinatus tendon and partial thickness tear of the infraspinatus tendon was the third affected lesions, 6 cases (10%) for each of them. partial thickness tear of the subscapularis tendon was the least affected rotator cuff lesion in 5 cases (8.3%).

Partial thickness tear of the supraspinatus tendon was divided as articular 9 (15%), intrasubstance 8(13.3%), and Bursal 2 (3.3%) (Table 2).

Table (2): MRI findings of Rotator Cuff pathologies among the studied cases

| Variable | (n=60)* | |
|---|---------|------|
| | No | % |
| Rotator Cuff pathologies: | | |
| Supraspinatus tendinopathy | 17 | 28.3 |
| Full-thickness tear of the supraspinatus tendon | 6 | 10 |
| Partial thickness tear of the supraspinatus tendon (Articular) | 9 | 15 |
| Partial thickness tear of the supraspinatus tendon (Intra substance) | 8 | 13.3 |
| Partial thickness tear of the supraspinatus tendon (Bursal) | 2 | 3.3 |
| Partial thickness tear of the infraspinatus tendon (Intra substance) | 6 | 10 |
| Partial thickness tear of the subscapularis tendon (Intra substance) | 5 | 8.3 |

Thirty-seven (61.7%) of the cases had acromioclavicular joint osteoarthritis and 24 (40%) of the cases had Glenohumeral joint effusion, regarding biceps pathologies; 14(23.3%) of the cases had biceps tenosynovitis and one (1.7%) of the cases had dislocation of the long head of biceps tendon.

The most commonly affected bursa was the subcoracoid bursa, 16 cases (26.7%). Other involved structures are illustrated in **Table 3**.

Table (3): MRI findings of joints, Biceps pathologies, and other lesions among the studied cases

| Variable | (n=60) | |
|--|--------|------|
| | No | % |
| Acromioclavicular joint osteoarthritis | 37 | 61.7 |
| Glenohumeral Joint effusion | 24 | 40 |
| Minimal | 15 | 25 |
| Mild | 9 | 15 |
| Biceps pathologies: | | |
| Biceps tenosynovitis | 14 | 23.3 |
| Dislocation of the long head of the biceps tendon | 1 | 1.7 |
| Bursitis: | | |
| Sub coracoid | 16 | 26.7 |
| Sub-acromial | 10 | 16.7 |
| Subscapular bursitis | 3 | 5 |
| Capsular lesions: | | |
| Adhesive capsulitis | 1 | 1.7 |
| Miscellanies: | | |
| Interosseous cystic lesion | 4 | 6.7 |
| Intramuscular lipoma | 3 | 5 |
| Small ganglion cyst below the coracoacromial ligament | 2 | 3.3 |

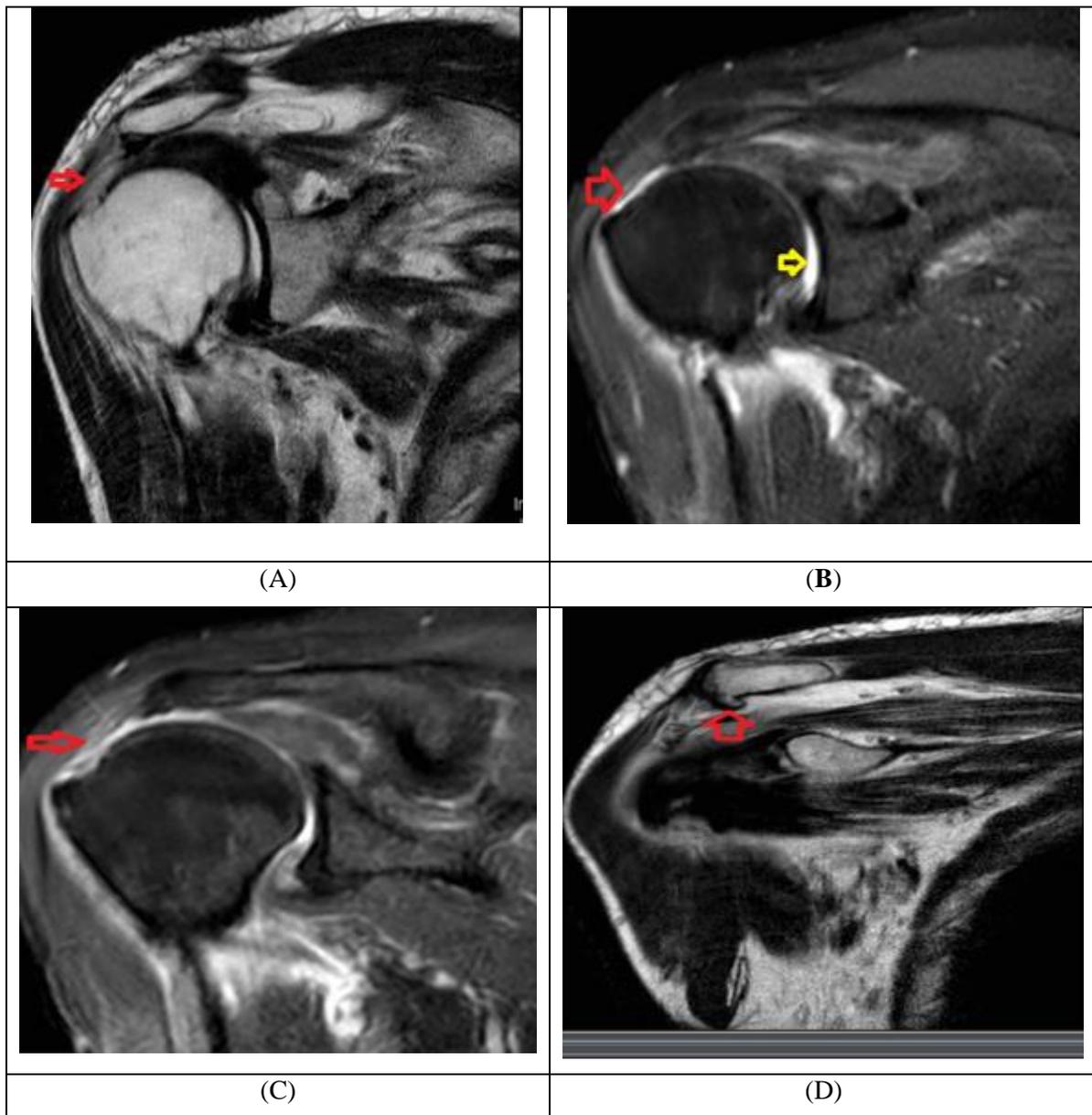


Figure (1): A female patient 72 years old age with a long history of right shoulder pain with limited movement. (A) MRI coronal oblique T2WI, (B) coronal oblique STIR: shows a gap filled with fluid high signal intensity replacing the whole thickness of supraspinatus tendon extending between articular and bursal surfaces (red arrow). associated with joint effusion (yellow arrow). (c) MRI coronal oblique STIR: shows the abnormal high signal intensity of the infraspinatus tendon. (D) MRI coronal oblique T2WI: shows acromion hooking (red arrow). **Diagnosis: Complete supraspinatus tendon tear, infraspinatus partial tear, and Type III acromion shape.**

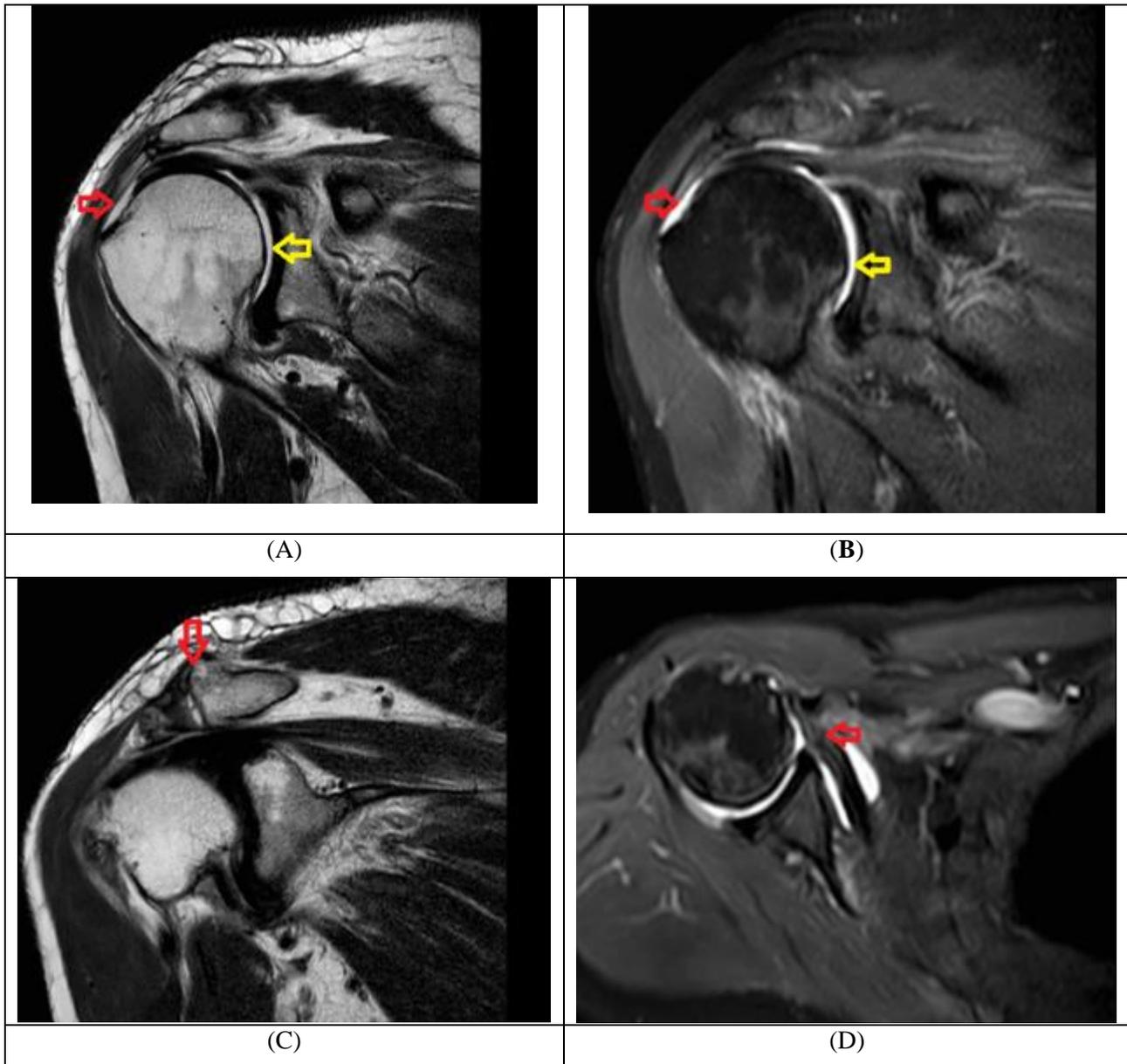


Figure (2): 65 years old male presented with right shoulder pain and limitation of movement, Fig (A)MRI coronal oblique T2WI(B)coronal oblique STIR: shows a gap filled with fluid high signal intensity replacing the whole thickness of supraspinatus tendon extending between articular and bursal surfaces (red arrow). associated with joint effusion (yellow arrow). Fig(C) MRI coronal oblique T2WI: shows mild hypertrophic acromioclavicular osteoarthritic changes (red arrow). Fig(D)MRI axial proton density fat sat: shows abnormal high signal intensity at the subscapularis tendon.

Diagnosis Complete supraspinatus tendon tear, Acromio-clavicular osteoarthritis, subscapular partial tear, and joint effusion.

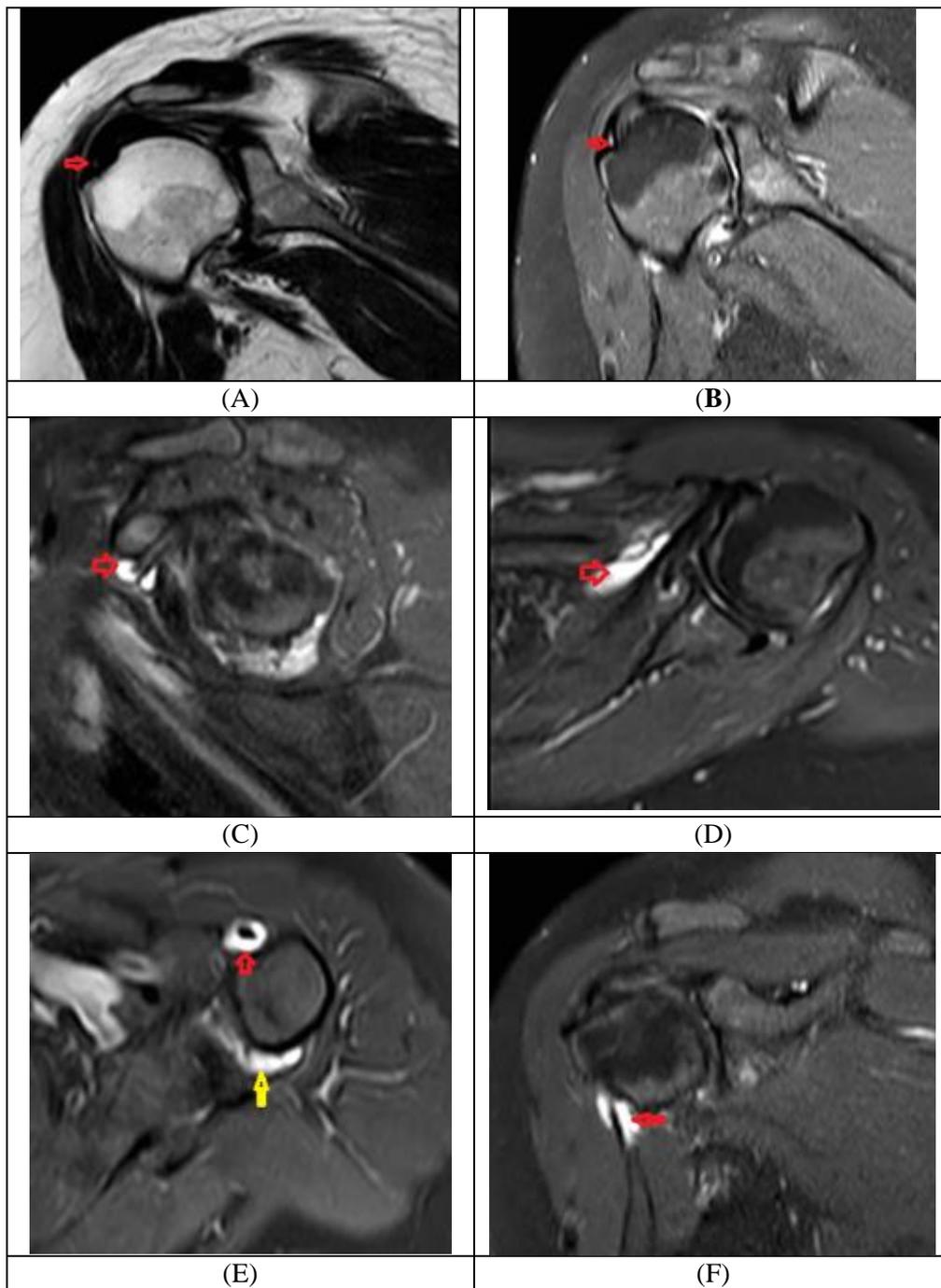


Figure (3): A female patient 45 years old with a history of right shoulder pain. (A)MRI coronal oblique T2WI (B)coronal oblique STIR: show an abnormally high signal of supraspinatus tendon within the tendon substance(red arrow). (C)MRI sagittal proton density Fat sat (D)MRI axial proton density fat sat: show a high signal of fluid collection at subcoracoid bursa. (E)MRI axial proton density (F) MRI coronal oblique STIR: show abnormal high signal excess fluid collection surrounding the biceps tendon (red arrow)associated with joint effusion (yellow arrow). **Diagnosis: Partial intra-substance supraspinatus tendon tear, ACJ osteoarthritis, biceps tenosynovitis, and subcoracoid bursitis.**

DISCUSSION

Magnetic resonance imaging (MRI) has surpassed other preoperative imaging methods for evaluating rotator cuff disorders because of its superior intrinsic soft tissue contrast and resolution ⁽⁷⁾.

Additional benefits of MRI include good multi-planer delineation even in the absence of contrast, the lack of radiation hazards and the ability to obtain detailed information about rotator cuff defects, the rotator cuff's physiologic and mechanical status is affected by the state of the surrounding structures, the amount of muscle, the size of the muscle's cross-sectional area, and the amount of fat. Its primary drawbacks are high cost, claustrophobia, the high level of technical expertise required, and several restrictions that preclude its use in patients who have surgical clips and permanent pacemakers ⁽⁸⁾.

The current study included 60 patients with complaints of chronic shoulder pain. Patients' ages varied widely, from 19 to 72, with a mean of 43; 32 men (53.3% of the total) and 28 women (67.7%) made up the majority (46.7 percent). This agrees with the **Rafiq et al.** ⁽¹⁾ study that was performed on 36 patients and revealed a higher male incidence of 55.5%.

There was a significant difference between the two sides, although the right side was more dominant (63.3% to 36.7%) (36.7 percent). This is in agreement with **Mahbuba et al.** ⁽⁹⁾ who revealed 55% of cases on the RT side. In **Kaur et al.** ⁽¹⁰⁾ study, Patients reported right-side discomfort in 70% of cases and left-side pain in 30% of cases which was comparable to research by **Onyambu et al.** ⁽¹¹⁾ it found that 104 (86.7%) of the 120 patients had more lesions on their right shoulder than their left, which had just 16 (13.3%).

In this study, the commonest cause of referral to the radiological investigation was rotator cuff pathologies 53 (88.3%) followed by Acromioclavicular joint osteoarthritis 37(61.7%). Bursitis was found in 29(48.3%) followed by biceps pathologies in 15 (25%). Miscellaneous conditions like cysts or tumors were found in 9(15%), and adhesive capsulitis 1(1.7%), respectively.

This was to some extent similar to a study by **Chudasama et al.** ⁽¹²⁾ in which it was shown that rotator cuff injuries accounted for the bulk of instances of persistent shoulder pain, arthritis of the acromioclavicular joint, biceps pathology, instability of the glenohumeral joint, arthritis of the glenohumeral joint, and lastly additional problems such tumors or cysts. Inflammation of the acromioclavicular (AC) joints (50 percent) Pathologies of the Biceps (30 percent) Arthritis of the Glenohumeral Joint (5%) Caused by Infection, Inflammation, or Degeneration; Other (Pathological Fractures Caused by Tumors, Metastases, etc); (9 percent).

In this recent study of the rotator cuff pathologies group the majority of cases were Partial thickness tears of supraspinatus tendon 19 (31.7%) arranged as 15%

articular, 13.3% intrasubstance and 3.3% bursal, then tendinosis of the same muscle 17 (28.3%). Full-thickness tears of supraspinatus were found in 6 (10%), and partial-thickness tears in infraspinatus 6 (10%). The least diagnosed pathology was partial thickness tear of subscapularis 5 (8.3%). This is in agreement with **Resnick and Niwayama** ⁽¹³⁾ who stated that Among rotator cuff tears, those that are just partially torn are estimated to be twice as common as those that are torn throughout and **Chudasama et al.** ⁽¹²⁾ who studied 126 patients suspected to have rotator cuff tears, 72 patients revealed partial tears (58 %) and 9 patients revealed complete (full-thickness) tears (7%).

Regarding rotator cuff pathology, supraspinatus was the most commonly involved tendon followed by infraspinatus and subscapularis. This is concordant with other studies done by **Vijayan et al.** ⁽¹⁴⁾ and **Singh et al.** ⁽¹⁵⁾. Among all cases that had tears, partial tears of the rotator cuff were the most common tendon abnormality found in 31.7 % of our cases. This is in agreement with **Vijayan et al.** ⁽¹⁴⁾.

In our study among 19 patients diagnosed by MRI as partial thickness tear, the commonest type was the articular surface type (9 cases), followed by the intrasubstance type (8 cases) followed by the bursal surface type (2 cases). This is in alignment with **Netam et al.** ⁽¹⁶⁾ who stated that articular surface partial-thickness tears are the commonest type 10 (19.6%) out of 51. This also is in agreement with the study of **Hassan et al.** ⁽¹⁷⁾ which encountered that articular partial thickness tear was the most found lesion 8(20%) and among 11 out of 40 patients, only 3 patients were diagnosed as bursal partial thickness tear.

In our study, the high signal intensity of the affected tendon is the whole mark in the diagnosis of either partial or full thickness tear which was seen at all pulse sequences used in this study especially fat-suppressed or STIR images this is in agree with **de Jesus et al.** ⁽³⁾ who stated that fat suppression or STIR techniques improve the detection of both complete and partial rotator cuff tears.

In our study supraspinatus tendon was the commonest tendon affected in all cases of rotator cuff tendinosis. This is going with **Fritz** ⁽¹⁸⁾ who stated that the supraspinatus tendon is the most commonest tendon to be affected with tendinopathy among rotator cuff tendons. Acromioclavicular joint (ACJ) osteoarthritis was the second cause of pain after rotator cuff pathology in this study 37(61.7%). This finding is alignment with **Refaat et al.** ⁽¹⁹⁾ in which 21 out of 30 (70%) had ACJ osteoarthritis as the most observed non-rotator cuff-related pathology.

In the present study 1(1.7) of cases had adhesive capsulitis. This is in agreement with **Khanduri et al.** ⁽²⁰⁾ who found 2(2.4%) out of 85 patients had adhesive capsulitis.

In our study diagnosis of tenosynovitis by MRI was based on the presence of a large amount of fluid around the biceps tendon that is disproportionate to the

amount of joint effusion which is in agreement with **Zanetti and Hodler** ⁽²¹⁾ who stated that large quantities of fluid within the biceps tendon sheath could be seen in several abnormalities as biceps tenosynovitis and **Forster and Khan** ⁽²²⁾ who stated that the volume of fluid around tendon should not greatly exceed that within the joint otherwise abnormality should be suspected such as tenosynovitis.

In the current study, 14(23.3%) of cases had (biceps tenosynovitis) & 1(1.7%) of cases had dislocation of the long head of the biceps tendon.

This agreed to some extent with the published study of **El-Shewi et al.** ⁽²³⁾ which found 16(32%) out of 50 patients had biceps tenosynovitis.

In our study of the bursitis group, a total of 29 (48.3%) of the cases had Bursitis (35% Sub coracoid, 16.7% in sub-acromial sub deltoid, and 5% Subscapular). This is going with **Ghazy et al.** ⁽²⁴⁾ who stated that 12 (40%) out of 30 cases showed bursitis

In our study of the miscellaneous group, miscellaneous like cysts and tumors were encountered in 9 (15%) of cases. Cases with Interosseous cystic lesions were 4(6.7%) of all cases. Lipoma was seen in 3(5%) of cases. Ganglion cyst was seen in 2(3.3%) of cases. This is consistent with research by **Schlecht et al.** ⁽²⁵⁾, which shows that MRI may identify soft tissue lesions and shoulder malignancies.

CONCLUSION

MRI of the shoulders aided in understanding different underlying pathology of chronic shoulder pain and revealed that dependence on only clinical findings and diagnosis could delay their management as well as chronicity development.

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