

### ADHESIVE CAPSULITIS OF THE SHOULDER – PLAIN MRI FINDINGS: A CASE SERIES AND REVIEW OF THE LITERATURE

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#### Abstract

**Background:** Adhesive capsulitis of shoulder, also known as frozen shoulder and periarthritis is a common musculoskeletal problem causing reduction in range of mobility and may be associated with pain leading to significant morbidity. Adhesive capsulitis should accurately be diagnosed for it to be effectively treated. The diagnosis is usually established on the basis of clinical diagnostic criteria. Since the classical clinical features may not be seen in all cases of adhesive capsulitis, radiology plays an important role in its diagnosis. The aim of the study is to evaluate the radiological spectrum in this disease on plain MRI studies of shoulder joint. **Materials and Methods:** A clinical and radiological evaluation of 5 cases of adhesive capsulitis was conducted within a period of 1 year. Cases were diagnosed based on clinical criterias on initial presentation or on follow up, after other causes of shoulder pain are ruled out. **Result:** All the five patients were between the age of 41-65 years. 3 patients were male and two were female. All the 5 patients had history of restriction of movements and 4 patients had pain. On MR imaging, all the 5 patients showed atleast two of features attributable to the changes expected in adhesive capsulitis. **Conclusion:** In addition to clinical features, MRI imaging plays a very important role in identifying the abnormalities of adhesive capsulitis especially in cases with atypical clinical features.

## INTRODUCTION

The shoulder joint has the greatest range of movement of any joint in the body. A reduction in range of mobility of shoulder joint leads to significant morbidity. Adhesive capsulitis (Frozen shoulder) of the shoulder is a common condition which presents with restriction of range of shoulder movements with or without shoulder pain.<sup>[1,2,3]</sup> The incidence of Adhesive capsulitis is about 2-5% in general population.<sup>[4,5]</sup> Even though adhesive capsulitis is primarily a clinical diagnosis, MRI plays an important role. We are presenting various imaging spectrum of adhesive capsulitis in a series of patients with adhesive capsulitis.

## MATERIALS AND METHODS

MRI findings were reviewed in 5 patients with MRI findings suggestive of adhesive capsulitis. These 5 cases presented with unexplained shoulder pain and/or reduced range of motion with plain MRI findings suggestive of adhesive capsulitis. Cases with varied spectrum of MRI findings were selected and presented here. Plain shoulder MRI studies of the cases were done using 1.5 Tesla MRI machine Siemens Magnetom Sempra with standard shoulder

protocol. All patients correlated retrospectively with orthopedic department and confirmed to be adhesive capsulitis as per clinical criteria.

## CASE REPORT

### Case 1

51-year-old man who presented with shoulder pain restriction of range of shoulder motion. Magnetic resonance (MR) images showed joint capsule edema in inferior glenohumeral ligament (IGHL) at axillary recess, extracapsular edema adjacent to IGHL, thickening of coraco-humeral ligament and thickening & hyperintensity in anterior joint capsule.

### Case 2

60-year-old diabetic woman with adhesive capsulitis characterized by severe pain and limitation of range of motion on external rotation and abduction. MR images showed complete obliteration of subcoracoid fat triangle, abnormal soft tissue in rotator interval and abnormal soft tissue around intraarticular portion of biceps tendon.

### Case 3

61 year male presented with stiffness of shoulder with decreased range of movements.

MR study showed mild thickening and focal hyperintensity in glenoid portion of IGHL, abnormal soft tissue partially encasing biceps tendon near biceps anchor, abnormal soft tissue and abnormal hyperintensity at the subcoracoid fat triangle causing partial obliteration of the subcoracoid fat triangle.

**Case 4**

41 female patient with mild shoulder pain with limitations of joint range of motion.

MR images shows abnormally thickened IGHL at axillary pouch, which appears contracted and poorly distended, abnormal soft tissue signal adjacent to intrarticular biceps tendon partially encasing it and abnormal soft tissue within rotator interval.

**Case 5**

65-year-old diabetic man with shoulder pain with decreased range of movement.

MR images showed abnormal hyperintensity (edema) & thickening involving the glenoid and humeral portion of IGHL with surrounding soft tissue edema, soft tissue thickening in rotator interval causing partial obliteration of subcoracoid triangle fat, biceps tendon completely encased by abnormal soft tissue and mild thickening of the anterior joint capsule.

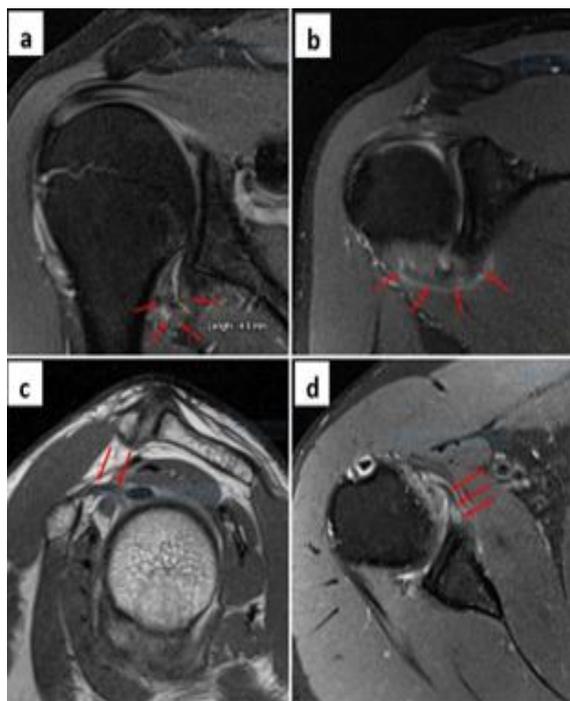


Figure 1: a, Oblique coronal proton density fat-suppressed (PDFS) MR image shows joint capsule edema in inferior glenohumeral ligament (IGHL) at axillary recess (red arrows). b, Oblique coronal proton density fat-suppressed (PDFS) MR image shows extracapsular edema (red arrows) adjacent to IGHL. c, Oblique sagittal proton density(PD) MR image shows thickening of coraco-humeral ligament (red arrows). d, Axial proton density fat-suppressed (PDFS) MR image shows thickening and hyperintensity in anterior joint capsule (red arrows).

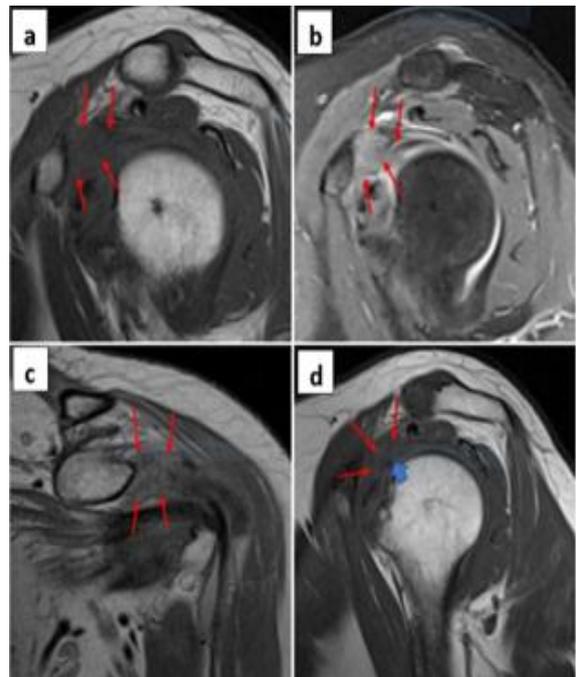


Figure 2: a & b, Sagittal PD and PDFS show the complete obliteration of subcoracoid fat triangle-normal fat surrounding the coracohumeral ligament has disappeared and the coracohumeral ligament could not be measured (red arrows). c, The coronal PD image demonstrates abnormal soft tissue in rotator interval (red arrows). d, soft tissue (red arrows) encasing biceps tendon (blue thick arrow).

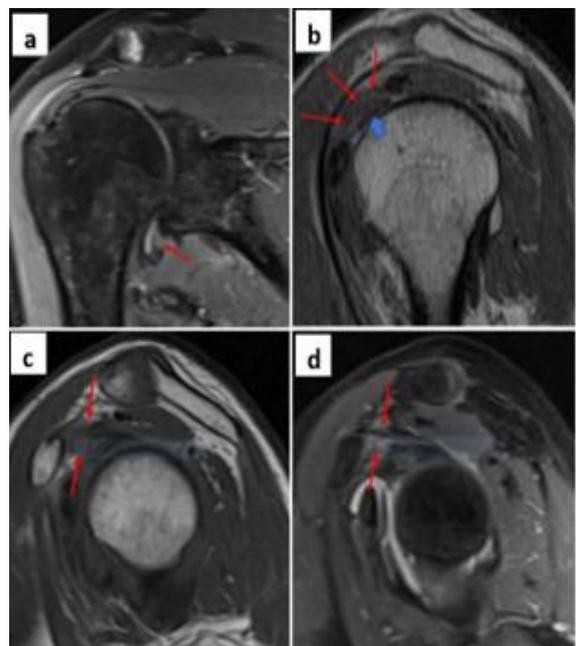
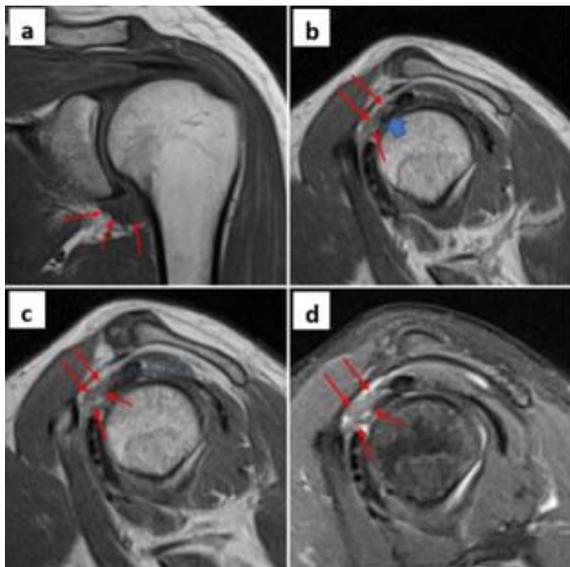
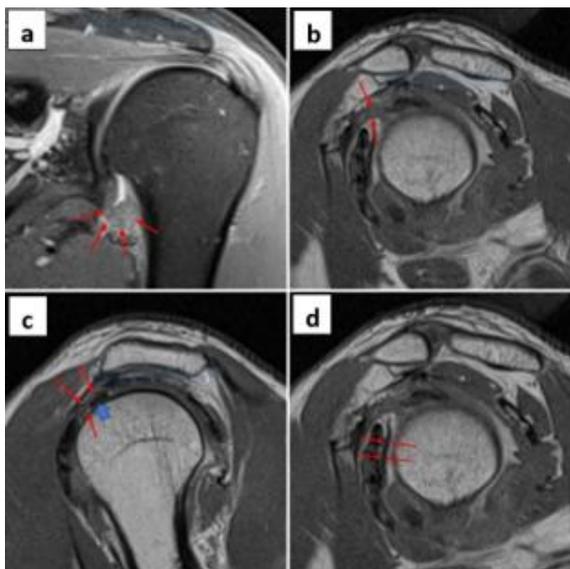


Figure 3: a, Mild thickening and focal hyperintensity in glenoid portion of IGHL (red arrows) b, abnormal soft tissue (red arrows) partially encasing biceps tendon near biceps anchor (blue thick arrow), c & d, Sagittal PD & PDFS images at the subcoracoid fat triangle showing abnormal soft tissue and abnormal hyperintensity respectively, causing partial obliteration of the subcoracoid fat triangle (red arrows).



**Figure 4. a, Coronal oblique T1 weighted MR images shows abnormally thickened IGHL at axillary pouch, which appears contracted and poorly distended (red arrows). b, abnormal soft tissue signal (red arrows) adjacent to intarticular biceps tendon (blue thick arrow) partially encasing it. c&d, Sagittal PD & PDFS images at the level of coracoid process shows abnormal soft tissue within rotator interval (red arrows).**



**Figure 5: a, Sagittal PDFS images showed abnormal hyperintensity (edema) & thickening involving the glenoid and humeral portion IGHL (red arrows) with surrounding soft tissue edema. b, Soft tissue thickening in rotator interval causing partial obliteration of subcoracoid triangle fat (red arrows) c, Sagittal PD imaging showing biceps tendon is completely encased by abnormal soft tissue. d, Sagittal PD imaging showing mild thickening of the anterior joint capsule (red arrows).**

## DISCUSSION

Adhesive capsulitis is most common in women between the age 40–60 years, but can occur in patients of any age or sex.<sup>[3]</sup> The etiology of adhesive capsulitis is poorly understood, usually idiopathic

and occurs due to excessive scar tissue formation or adhesions in joint capsule and perarticular tissues.<sup>[3,4]</sup> It may be associated with trauma, diabetes, hypothyroidism, hypoadrenalism, parkinson's disease, cardiac & pulmonary pathologies, stroke, shoulder surgery and even surgical procedures involving areas other than shoulder with diabetes having the strongest association.<sup>[6,7,8,9,10]</sup>

Clinically adhesive capsulitis presents as shoulder pain and shoulder stiffness for one month or more and in the absence of other abnormalities such as rotator cuff injuries and calcific tendinitis. Bilateral simultaneously adhesive capsulitis may occur rarely.<sup>[10]</sup>

Spontaneous resolution is the rule in adhesive capsulitis, but it can take months to years (average duration 12–30 months) before restricted joint mobility returns to normal.<sup>[11]</sup> Some other studies reported that upto 50% of patients with adhesive capsulitis suffer long-term restricted joint mobility lasting upto 10 years.<sup>[1,10]</sup>

Reeves divided the clinical presentation of frozen shoulder into three stages in 1975. In the first stage, which is called the 'freezing or painful stage', the patients experience insidious onset of diffuse shoulder pain mainly in the night and at rest which lasts for about 3 months. As the symptoms progress, pain worsens with restriction of both active and passive range of motion. In the second phase, which is called the 'frozen stage' patients experience dull aching pain with extreme restriction of range of motion, external shoulder rotation being the most limited movement. The frozen stage lasts anywhere between 4 to 12 months. In the third stage, which is termed the 'thawing stage' improvement of shoulder motion and the reduction of pain occurs. This stage lasts anywhere from 12 to 42 months and is defined by a gradual return of shoulder mobility.<sup>[10,12,13]</sup>

The diagnosis of adhesive capsulitis remains primarily clinical.<sup>[1,10,14]</sup> Clinical assessment has a high sensitivity and high specificity for the diagnosis of shoulder adhesive capsulitis when signs and symptoms are typical.<sup>[3,15,16,17,18,19,20]</sup> Imaging plays an important role in the identification of adhesive capsulitis when clinical features are atypical or early stages of the disease and especially when an invasive treatment is being considered. Also MRI study helps to rule out other causes of shoulder pain.<sup>[9,21,22,23]</sup> MR Arthrography and contrast MRI studies have also shown some additional diagnostic utility in the diagnosis.<sup>[9,14,17,18,19]</sup> If the diagnosis of adhesive capsulitis is made correctly then this condition can be better managed.

Non surgical methods like NSAIDs, physical therapy and intraarticular steroid injection, intraarticular sodium hyaluronate injection, are helpful. Hydrodilation will be enough in most cases to shorten the duration of the joint stiffness and pain.<sup>[3,15,16]</sup> Surgical methods like manipulation under anesthesia, arthroscopic capsulotomy and open capsulotomy in severe and nonresolving cases.<sup>[3]</sup>

Signal intensity changes in joint capsule on MRI have been described in patients with adhesive capsulitis in all phases of the disease.<sup>[3,22,24]</sup> Thickening of coracohumeral ligament (>4mm) has been described as a finding highly suggestive of adhesive capsulitis with high specificity.<sup>[25,26,27]</sup> The coracohumeral ligament is considered as thickened if the thickness is more than 4 mm on sagittal plane at the level of the rotator interval.<sup>[22,28]</sup>

The inferior portion of the shoulder capsule is formed by the inferior glenohumeral ligament which has an anterior band, a posterior band and an intervening potential space called axillary pouch. Hyperintensity at the inferior glenohumeral ligament is an important imaging marker for the diagnosis of adhesive capsulitis on plain MRI with high sensitivity and high specificity. T2 hyperintensity of the inferior glenohumeral ligament has an excellent interobserver variability.<sup>[22,29,30]</sup> Thickening of inferior glenohumeral ligament >4mm at axillary pouch also has high specificity.<sup>[28,31,32]</sup>

Increased anterior capsular thickness of more than 3.5 mm showed excellent diagnostic accuracy. Anterior capsule extends from 2- to 5- o'clock anterior portion of the glenohumeral joint capsule and lies deep to the subscapularis tendon. The anterior capsule also includes middle glenohumeral ligament. Changes in joint capsule and pericapsular tissues in rotator interval are thought to be primarily responsible for restriction of external rotation in adhesive capsulitis patients.<sup>[33,34]</sup> In adhesive capsulitis, the soft tissues in rotator interval may become inflamed and scarred.<sup>[35]</sup> Complete obliteration of rotator interval fat pad has 100 % specificity for the imaging diagnosis adhesive capsulitis.<sup>[32]</sup> In a study by Lee JC et al, patients in which fibrovascular inflammatory changes in the rotator interval at arthroscopy had clinical features of adhesive capsulitis.<sup>[36]</sup> Partial or complete obliteration of the subcoracoid fat triangle (known as subcoracoid triangle sign) is more frequently seen in patients with adhesive capsulitis. Subcoracoid fat triangle is a triangular area of fat signal intensity formed by the coracoid process antero-superiorly, coracohumeral ligament superiorly and head of humerus postero-inferiorly.<sup>[24]</sup> Complete obliteration of subcoracoid fat triangle on MR imaging is highly specific for adhesive capsulitis, but not sensitive.<sup>[37,38,39,40]</sup> Abnormal soft tissue encasing the biceps anchor has also been described.<sup>[9,29]</sup>

Peri-articular hyperintensity has been described in adhesive capsulitis of shoulder, especially adjacent to inferior glenohumeral ligament.<sup>[9,22,41,42]</sup> This hyperintense layer along the outer capsular surface at the inferior glenohumeral ligament is highly specific for the diagnosis of adhesive capsulitis.<sup>[9]</sup> This sign was almost always associated with T2 hyperintense signal within the inferior glenohumeral ligament.<sup>[22]</sup>

Major limitation of our study is that the cases were not confirmed by arthroscopy or histopathology. However, the literature supports that the diagnosis of

adhesive capsulitis is primarily clinical, based on established clinical criterias.<sup>[3,22,43,44,45]</sup>

## CONCLUSION

Knowledge of these various plain MR imaging features shown in above spectrum of cases may help diagnose and confirm adhesive capsulitis of shoulder using a standard shoulder MR imaging protocol without intraarticular or IV contrast injection.

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