

Role of Ultrasonography in the Evaluation of Stiff Shoulder

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Abstract: ***Introduction:** Stiffness is one of the most common complaint of patients with shoulder pathology. Rotator cuff tendons in patients with stiff shoulder are evaluated sonographically and the results are tabulated. Study aimed at sonographic evaluation of rotator cuff tendons in patients with stiff shoulder. **Material and Methods:** This was an observational cross sectional descriptive study of 50 patients with shoulder stiffness undergoing ultrasonography of shoulder. All 50 patients with complains of shoulder pain and stiffness were examined by Ultrasonography with high frequency (3 - 14MHz) linear probe. **Results:** We found that USG is very effective initial line of investigation for evaluation of all patients with painful and stiff shoulder. Stiff shoulder is more common in adhesive capsulitis, rotator cuff tears present with painful shoulder and restricted movements (Partial stiffness). Diabetes mellitus, Hypertension, Trauma and smoking history are commonly found risk factors. Incidence of rotator cuff pathologies increases with increasing age.*

Keyword: Stiff Shoulder, Ultrasonography, Rotator cuff pathology, Adhesive capsulitis, Rotator cuff tear

1. Introduction

The glenohumeral joint is structurally a ball - and - socket joint and functionally it is considered a diarthrodial multiaxial joint.¹

Restricted movements and stiffness is one of the most common complaint of patients with shoulder pathology.

Stiff shoulder is characterized by restriction of active and passive movements of shoulder joint.²

Shoulder stiffness is commonly seen in clinical practice but greatly varies in severity & etiology.³

Pain and stiffness of the shoulder can adversely affect daily living activities and impair the quality of life.

Rotator cuff tear is often accompanied by shoulder stiffness because of the various reasons.^{4,5} Pain from the rotator cuff lesions are followed by joint disuse, secondary muscular weakness can lead to shoulder stiffness.⁶

Repair of the torn rotator cuff can exacerbate stiffness because it is a joint - tightening procedure.⁷

Members of Upper extremity committee of international society of arthroscopy, Knee Surgery & Orthopedic Sports Medicine recently introduced a consensus on the definition of this pathology.⁸ According to them, the term “stiff shoulder” is used in all patients with restricted ROM, and etiology is divided into primary or secondary causes.

“Frozen shoulder” should be used exclusively as a term to describe the primary that is idiopathic stiff shoulder that occurs, regardless of trauma or specific shoulder diseases. Secondary stiff shoulder is used to describe shoulder

stiffness with causes like trauma, surgery and other shoulder disease.⁹

Shoulder movements can be restricted by limited scapulothoracic motion (Movements between the shoulder blade and the chest wall). Scapulothoracic range of motion can be limited by factors such as sternoclavicular arthritis, acromioclavicular arthritis.¹¹

The benefits of US include great resolution, dynamic assessment capabilities, and superior diagnostic accuracy, rapid turnaround time, ease of accessibility, low price, and availability on a broad scale, portable, quick, and significantly more cost - effective imaging modality, noninvasive procedure and has no risk of radiation exposure. Therefore, it can be done with ease in patients having contraindications for MRI.

2. Aims and Objectives

- 1) Primary aim is to identify underlying pathology in stiff shoulder.
- 2) Study of various etiopathologies of underlying cause.
- 3) To study the various ultrasonographic features/ characteristics of various pathologies causing stiff shoulder.

3. Materials and Methods

This was an observational cross sectional descriptive study of the “Role of Ultrasonography In The Evaluation Of Stiff Shoulder” conducted in the department of Radio - diagnosis from December 2020 to September 2022. The study was approved by the Ethics Committees of the institution.

Patients included in our study were referred for shoulder pain and stiffness.

The procedure was explained to the patients and written informed consent was taken from each patient prior to conducting the scan.

Detail clinical examination findings were noted.

All 50 patients included in the study underwent ultrasound examination of affected shoulder.

Detailed analysis of the clinical and ultrasonography findings as follows:

Inclusion Criteria:

Patients with restricted movements of shoulder and who gave consent for undergoing ultrasound examination were included in the study.

Exclusion Criteria:

Patients with recent trauma (Up to 15 days) were excluded from the study.

All patients who did not consent to be part of study.

All 50 patients with complains of shoulder pain and stiffness were examined by Ultrasonography with high frequency (3 - 14MHz) linear probe on Samsung HS 50 Machine.

4. Observation and Results

Out of the total 50 patients we found:

Table 1: Ultrasonographic Findings

Pathologies	No. of patients	Movement Restricted			
		Abduction	External Rotation	Internal Rotation	Adduction
Rotator Cuff Tear	36	33	23	13	5
Adhesive Capsulitis	15	15	15	5	4
Impingement	13	13	7	3	-

Table 2: Adhesive Capsulitis as Cause of stiff shoulder

Findings in Adhesive Capsulitis	No. of Pt.	Movement Restricted			
		Abduction	External Rotation	Internal Rotation	Adduction
LHBT Effusion/ tendinitis	29	29	24	9	6
CHL Thickening	15	15	14	5	4
Increased Echogenicity in RI	15	15	14	5	4

Table 3: Additional Features observed

Pathology	No. of Pt. s
SASD Bursitis	26
GH Arthritic changes	13
AC Jt. Arthritis	5
LH of Bicep Tendon Effusion/ tendinitis	29

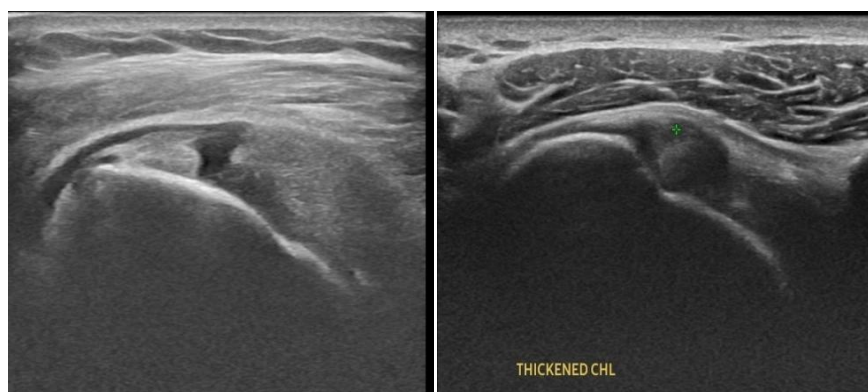


Image 1: Ultrasound image showing full thickness tear of supraspinatus tendon. **Image 2:** Thickened coracohumeral ligament.

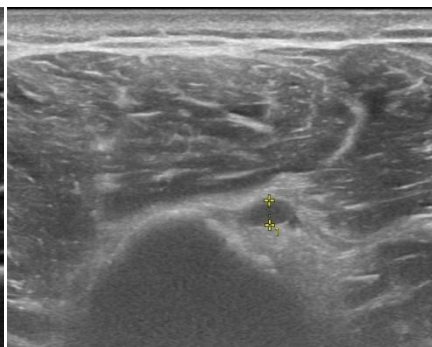
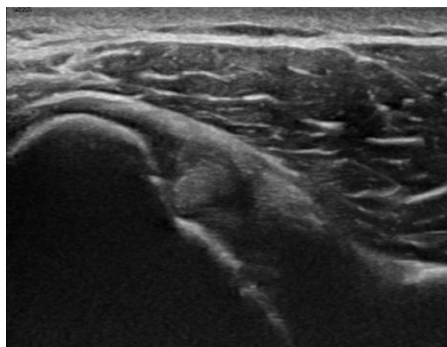


Image 3: Ultrasound image showing raised echogenicity in rotator interval. **Image 4:** Ultrasound image showing long head of bicep brachii tendon effusion

5. Discussion

The present study was undertaken to find out different causes and shoulder pathologies in patients with stiff & painful shoulder by ultrasonography.

Age distribution of the patients: Most common age group of patients presenting with pain and stiffness of shoulder were in the range of 40 to 50 years constituting 22 (44%) followed by >50 years constituting 19 (38%), suggest the rotator cuff pathologies are commonly affect after the age of 40 years. This is similar to the observation in the study by, Do - Young Kim et. al¹²

Sex distribution of patients: Out of the total 50 patients 29 (50%) were female and 21 (42%) were male patients suggest there is female preponderance.

Distribution according to side affected: Unilateral shoulder involvement is observed in 46 (98%) of the patients and Bilateral shoulder involvement is seen in 4 (9%) of the patients.

Right side (Dominant side) affected in 27 (54%) patients and left side affected in 19 (38%) of patients. These findings show correlation with the study Sayampanathan AA et. al¹³

Distribution according to symptoms: In our study Pain and restriction of movement was seen in all 50 (100%) patients.

Abduction was restricted in majority of the patients followed by external rotation. Internal rotation and adduction are least affected movements in present study.

Distribution according to history: Out of 50 patients history of Diabetes mellitus present in 26 (52%) of patients, trauma history (>15 days) present in 19 (38%) of patients, Hypertension seen in 18 (36%) of patients, Shoulder Operative history present in 6 (12%) of patients and Thyroid disease present in 9 (18%) patients. Majority of the patients are Diabetic and have history of trauma, AyushGiri et. al¹⁴ states that Comorbidities such as diabetes, hypertension, and hyperlipidemia may be associated with rotator cuff disease, likely because of mechanisms related to vascular insufficiency.

USG Findings:

In our study rotator cuff tear found in majority (36) of the patients complaining of shoulder pain and stiffness.

Abduction and external rotation were most commonly affected movement.

In our study, majority of the patients with rotator cuff tears are above 40 years of age, 16 patient with history of DM & 16 with trauma history, 15 were smokers. All (8) patients of age less than 40 years had history of trauma.

Mat T et. al¹⁵ study showed that Age is the most common factor for rotator cuff disease.

Tauro JC. Et. al⁴ study showed that Rotator cuff tear is often accompanied by shoulder stiffness due to various reasons.

Kim YS et. al⁶ stated in his study, Pain from the rotator cuff lesion followed by joint disuse and secondary muscular weakness can lead to shoulder stiffness.

In our study Among the rotator cuff tears supraspinatus tendon is most commonly affected. followed by infraspinatus and subscapularis tendon. It is similar as in the study Sandeep Bendale et. al¹⁶

In our study Infraspinatus and subscapularis tendon pathologies seen in equal number of patients as a part of spectrum. No isolated tear of infraspinatus and subscapularis tendon found.

In our study No teres minor tendon tear found in present study, however atrophy of the teres minor muscle along with the tendon seen in 4 patients. Gilles et al¹⁷

In our study Coracohumeral ligament thickening and increased echogenicity in rotator interval seen in 15 (30%) out of 50 patients with stiff shoulder.

Out of 15 patients 12 patients were diabetic, 10 were hypertensive, 5 patients had thyroid disorder, 5 patients had history of trauma and operative history was present in 4 patients.

All 15 patients having coracohumeral ligament thickening and increased echogenicity in rotator interval also had effusion in long head of bicep tendon.

Homsi, Carlos & Bordalo Rodrigues et. al.¹⁸ Study shown that a thickened CHL is suggestive of adhesive capsulitis.

S. M. Stella et. al.¹⁹ cross - sectional study of patients with adhesive capsulitis showed effusion within the LHBT sheath was detected and thickening of the CHL & SGHL.

Carina Cohen et. al.²⁰ Stated in his study that an individual with thyroopathy has 2.69 more chance of developing frozen shoulder.

In our study, long head of biceps tendon effusion/tendinitis is seen in total 29 (58%) patients out of 50 patients. Out of 29 patients 15 patients had other findings suggestive of adhesive capsulitis and remaining 14 patients had pathologies like rotator cuff tendon tears. So, long head of bicep tendon sheath effusion is frequently associated with adhesive capsulitis and rotator cuff tears.

In Park, MD, Hyo - Jin Lee et. al.²¹ study showed, Patients with adhesive capsulitis have effusion within the BLHT sheath most frequently.

In our study, shoulder impingement syndrome were seen in 13 (26%) out of 50 patients.

When the shoulder elevates, the rotator cuff and surrounding soft - tissue structures impinge in the space beneath the coracoacromial arch.

Neer in 1983²² stated that 95% of rotator cuff tears occur as a result of chronic impingement beneath this arch.

In 1988 seegar et al.²³described the hook - shaped acromion (Type III) is most common cause of impingement. It has the highest correlation with rotator cuff pathology, particularly rotator cuff tears.

In our study, subacromial subdeltoid bursitis seen in 26 patients.

All patients with impingement have associated finding of subacromial subdeltoid bursitis.

20 patients with rotator cuff tear and tendinitis predominantly involving supraspinatus tendon also, have finding of subacromial subdeltoid bursitis.

M. S. Hollister et. al.²⁴ stated in his study, the sonographic finding of fluid in the subacromial/ subdeltoid bursa, especially when combined with a joint effusion, is highly specific and has a high positive predictive value for associated rotator cuff tears.

In our study, glenohumeral joint and acromioclavicular joint arthritis was seen in 13 and 5 patients respectively.

Any pathologies causing rotator cuff derangements can give rise to bursitis and arthritis of adjacent joints as a sequaleae. Michael Thomas et. al.²⁵ degenerative shoulder osteoarthritis causes significant pain & functional limitation of joint movement and disability.

Travis J Menge et. al.²⁶ osteoarthritis of the acromioclavicular joint is a frequent cause of shoulder pain and can result in significant debilitation.

In our study, tendinitis and glenohumeral joint effusion were seen as common additional finding and rotator cuff tendon and muscle atrophy seen in 5 patients. M. S. Hollister et. al.²⁴

In our study, it is observed, that multiple overlapping rotator cuff pathologies were seen associated with shoulder pain and stiffness.

6. Conclusion

- 1) USG is very effective initial line of investigation for evaluation of all patients with painful and stiff shoulder and can be used as primary method of evaluation for a variety of rotator cuff disorders as well as non rotator cuff diseases.
- 2) Most common pathology found in this study is rotator cuff tendon tear followed by adhesive capsulitis, among the rotator cuff tendon tear supraspinatus tendon is most commonly affected in this study. Imaging findings in adhesive capsulitis are thickening of coracoacromial ligament, increased echogenicity in rotator interval and long head of bicep tendon effusion.
- 3) Stiff shoulder is more common in adhesive capsulitis, rotator cuff tears present with painful shoulder and restricted movements (Partial stiffness).
- 4) Diabetes mellitus, Hypertension, Trauma history are commonly found risk factors.
- 5) Multiple overlapping pathologies were seen associated with shoulder pain and stiffness.
- 6) Increase in incidence of rotator cuff pathologies with increasing age.
- 7) Due to ease of accessibility, low price, quick examination and noninvasiveness USG is better accepted by patients.

References

- [1] McCausland C, Sawyer E, Eovaldi BJ, Varacallo M. StatPearls. StatPearls Publishing; Treasure Island (FL): Aug 8, 2022. Anatomy, Shoulder and Upper Limb, Shoulder Muscles.
- [2] Pogorzelski, J., Imhoff, A. B., Degenhardt, H. et al. Primäre (idiopathische) Schultersteife. Unfallchirurg 122, 917–924 (2019).
- [3] Joseph C. Tauro, MelyssaPaulson, ShoulderStiffness, Arthroscopy: The Journal of Arthroscopic & Related Surgery, Volume 24, Issue 8, 2008, Pages 949 - 955, ISSN 0749 - 8063.
- [4] Tauro JC. Stiffness and rotator cuff tears: incidence, arthroscopic findings, and treatment results. Arthroscopy 2006; 22: 581 - 6.
- [5] Cho NS, Rhee YG. Functional outcome of arthroscopic repair with concomitant manipulation in rotator cuff tears with stiff shoulder. Am J Sports Med 2008; 36: 1323
- [6] Kim YS, Lee HJ, Park I, Im JH, Park KS, Lee SB. Are delayed operations effective for patients with rotator cuff tears and concomitant stiffness. An analysis of immediate versus delayed surgery on outcomes. Arthroscopy 2015; 31: 197 - 204.

- [7] Weber SC, Abrams JS, Nottage WM. Complications associated with arthroscopic shoulder surgery. *Arthroscopy* 2002; 18 Suppl 1: 88 - 95.
- [8] Itoi E, Arce G, Bain GI, et al. Shoulder stiffness: current concepts and concerns. *Arthroscopy* 2016; 32: 1402 - 14.
- [9] Park, Hyung - Seok et al. "Rotator cuff tear with joint stiffness: a review of current treatment and rehabilitation." *Clinics in shoulder and elbow* vol.23, 2 109 - 117.25 May.2020,
- [10] Tauro JC, Paulson M. Shoulder stiffness. *Arthroscopy*.2008 Aug; 24 (8): 949 - 55. doi: 10.1016/j. arthro.2008.03.014. Epub 2008 May 19. PMID: 18657745.
- [11] orthop. washington. edu/patient - care/articles/shoulder/evaluation - of - the - stiff - shoulder.
- [12] *Clin Shoulder Elb*.2020 Sep; 23 (3): 125–130. Published online 2020 Sep 1. doi: 10.5397/cise.2020.00178 PMID: PMC7714287 PMID: 33330246
- [13] Sayampanathan AA, Andrew TH. Systematic review on risk factors of rotator cuff tears. *J Orthop Surg (Hong Kong)*.2017Jan; 25 (1): 2309499016684318. doi: 10.1177/2309499016684318. PMID: 28211286.
- [14] AyushGiri, Deirdre O'Hanlon, Nitin B. Jain, Risk factors for rotator cuff disease: A systematic review and meta - analysis of diabetes, hypertension, and hyperlipidemia, *Annals of Physical and Rehabilitation Medicine*, Volume66, Issue1, 2023, 101631, ISSN18770657.
- [15] May T, Garmel GM. Rotator Cuff Injury. [Updated 2022 Jun 27]. In: *StatPearls Treasure Island (FL): StatPearls Publishing; 2022 Jan.*
- [16] Sandeep Bendale, Shashank Vedpathak. Sonographic evaluation of rotator cuff pathologies causing restricted movements of shoulder. *International Journal of Contemporary Medicine Surgery and Radiology*.2019; 4 (3): C276 - C280.
- [17] Gilles W, AzizB, SalvatoreC, AndrewH. N, Robinson. The 'dropping' and 'hornblower's' signs in evaluation of rotator cuff tears: *The Journal of Bone and Joint Surgery* 1998; 80 - B (4): 624 - 628.
- [18] Ultrasound in adhesive capsulitis of the shoulder: Is assessment of the coracohumeral ligament a valuable diagnostic tool?. *Skeletal radiology*.35.673 - 8.10.1007/s00256 - 006 - 0136 - y.
- [19] Stella, S. M., Gualtierotti, R., Ciampi, B. *et al.* Ultrasound Features of Adhesive Capsulitis. *RheumatolTher*9, 481–495 (2022).
- [20] Cohen C, Tortato S, Silva OBS, Leal MF, Ejnisman B, Faloppa F. Association between Frozen Shoulder and Thyroid Diseases: Strengthening the Evidences. *Rev Bras Ortop (Sao Paulo)*.2020 Aug; 55 (4): 483 - 489. Epub 2020 Apr 6. PMID: 32904783; PMID: PMC7458737.
- [21] In Park, MD, Hyo - Jin Lee, MD*Clin Orthop Surg*.2015 Sep; 7 (3): 351–358. Published online 2015 Aug 13. doi: 10.4055/cios.2015.7.3.351 PMID: PMC4553284 PMID: 26330958
- [22] Neer CS III. Anterior acromioplasty for the chronic impingement syndrome of the shoulder: a preliminary report. *J Bone Joint Surg Am* 1972; 54A: 41 - 50.
- [23] Seeger LL, Gold RH, Bassett LW, Ellman H. Shoulder impingement syndrome: MR findings in 53 shoulder. *AJR* 1988; 50: 343 - 347.
- [24] Hollister MS, Mack LA, Patten RM, Winter TC 3rd, Matsen FA 3rd, Veith RR. Association of sonographically detected subacromial/subdeltoid bursal effusion and intraarticular fluid with rotator cuff tear. *AJR Am J Roentgenol*.1995 Sep; 165 (3): 605 - 8.
- [25] Thomas M, Bidwai A, Rangan A, Rees JL, Brownson P, Tennent D, Connor C, Kulkarni R. Glenohumeral osteoarthritis. *Shoulder Elbow*.2016 Jul; 8 (3): 203 - 14.26. Menge TJ, Boykin RE, Bushnell BD, Byram IR. Acromioclavicular osteoarthritis: a common cause of shoulder pain. *South Med J*.2014 May; 107 (5): 324 - 9