



THICKENING OF THE AXILLARY RECESS ON ULTRASONOGRAPHIC MEASUREMENT IN ASYMPTOMATIC SHOULDER

Radio-Diagnosis

Dr. Poonma Ram*	Senior Resident, Department of Radiodiagnosis, Govt. Medical College and Associated Group of Hospitals, Barmer, Rajasthan, India. *Corresponding Author
Dr. R. N. Gehlot	Sr. Professor and Head, Department of Radiodiagnosis, Dr. S. N. Medical College, Jodhpur, Rajasthan, India.
Dr. Ghanshyam Gahlot	Senior Demonstrator, Department of Biochemistry, Govt. Medical College and Associated Group of Hospitals, Barmer, Rajasthan, India.

ABSTRACT

Purpose: The purpose of this study was to measure the axillary recess (AR) thickness in an asymptomatic shoulder by using ultrasonography (US) and to analyze the factors affecting it.

Methods: We recruited One hundred patients (50 volunteers healthy in which 30 males and 20 females and 50 with various shoulder pathology) and age >20 yrs. Two physiatrists (novice and experienced rater) measured the AR thickness independently in an upright sitting position with elbow flexed and forearms in neutral position with transducer was placed longitudinally on the mid-axillary line. Two physiatrists measured the AR thickness of the unaffected shoulder independently. All patients were examined in an upright sitting position with 90° shoulder abduction. The ultrasonographic transducer was placed longitudinally on the mid-axillary line and along the long axis of the humeral shaft. The factors affecting the AR thickness values were analyzed, and intra-class correlation coefficients were used for assessing the reproducibility of each measurement.

Results: The intrarater reliability values for the two physiatrists were 0.98 and 0.96, respectively. The inter-rater reliability of the mean AR thickness measurements was 0.91. Mean AR thickness in asymptomatic shoulders 2.00 ± 0.36 mm and in males was significantly greater (2.21 ± 0.33 mm) than that in females (1.69 ± 0.04 mm) ($P < 0.05$). In our study adhesive capsulitis with DM mean ART 4.36 ± 0.00 mm which is greater than without DM (3.86 ± 0.22 mm). No difference between the dominant and the non-dominant sides shoulders and between the left and the right sides for sex in ART measurement. Mean AR thickness correlated positively with anthropometric variables, height ($r = 0.136$) and the weight ($r = 0.140$).

Conclusion: US measurements of the AR thickness in asymptomatic shoulders demonstrated excellent intrarater and inter-rater reliabilities. The mean AR thickness in males was significantly greater than females. In symptomatic there is significant difference in AR thickness between novice and experience rater. Adhesive capsulitis with DM have ART is greater than without DM. No difference in ART in left and the right side for sex and dominant and the nondominant sides shoulders.

KEYWORDS

Shoulder; Axilla; Ultrasonography

INTRODUCTION

Frozen shoulder (FS) is a common cause of shoulder pain. In addition to pain, it is characterized by a reduction in the range of motion of the shoulder [1]. The diagnosis of FS is usually based on history taking, physical examination, and plain radiography. Although the exact pathogenesis of FS is still unclear, temporal evolution from inflammation, to fibrosis of the rotator interval (RI), anterior joint capsule, and axillary recess (AR) seems to be the main pathologic process [2]. Magnetic resonance imaging (MRI) has revealed various changes in patients with FS, such as thickening, signal changes, or enhancement of the RI, including the coracohumeral ligament, long biceps tendon, superior glenohumeral ligament, and AR [3-9]. The reliability of AR thickness measurements using MRI is high [10]. Few studies that assessed the diagnostic value of ultrasonography (US) in FS have been published, but the region of interest was the RI, and the results were controversial [11,12]. Recently, US examinations of glenohumeral synovitis of the aspect of the AR or posterior capsule have been included in the revised diagnostic criteria for polymyalgia rheumatica [13]. However, glenohumeral synovitis is usually investigated from the posterior capsule rather than AR [14-18]. There have been few reports of US examination of AR in normal subjects or patients with FS.

The objective of the current study was to test the inter and intra-rater reliability of the US measurements of AR thickness in healthy volunteers, and to analyze the factors affecting the AR thickness. The results of the current study will expand the area of clinical applications of AR measurements in the diagnosis of FS.

METHODOLOGY

Patients- One hundred subjects (50 volunteers healthy in which 30 males and 20 females and 50 with various shoulder pathology in which 40 males and 10 females) with unilateral or bilateral shoulder pain and may be right or left or mixed dominant (age >20 yrs). Right shoulders dominant (34) in which 20 males and 14 females. Left shoulders dominant (7) in which 4 males and 3 females. Mixed dominant (9) in which 6 males and 3 females. Patients with frozen shoulder (AC), partial or full-thickness rotator cuff tendon tear or calcific tendinitis arthritis, osteoarthritis, neurological disorders of the upper limbs were

also enrolled in the study.

Excluded patients:

Previous history of shoulder or cervical spine surgery. US Measurement and Procedure.

The ART was measured using US in the upright sitting position with shoulder abduction angles (90°), elbow flexed and forearms were neutral with transducer was placed longitudinally on the mid-axillary line. The ART measured perpendicularly in the thickest AR portion in the middle of the humeral surgical neck concavity by two physiatrists (novice and experienced rater).

Statistical Analysis

Statistical analysis was performed using SPSS (software package for management and statically analysis) ver. 24.0 (IBM Co., Armonk, NY, USA) with the significance level set at $p < 0.05$. An independent "t" test was used for assessing the ART difference between males and females, right and left sided shoulders, dominant and non dominant for both sex. Pearson's correlation coefficient used for ART between anthropometric variation.

RESULTS

Study was done in the department of radiodiagnosis, Dr. S. N. M.C. and Associated Group of Hospitals, Jodhpur, Rajasthan, India. In our study mean ART correlated positively with anthropometric variables, height ($r = 0.136$) and the weight ($r = 0.140$) BMI in healthy subjects and did not correlate with age. Mean ART on US in asymptomatic shoulders 2.00 ± 0.36 mm. The mean ART (2.21 ± 0.33 mm) in males greater than in females (1.69 ± 0.04 mm).

Adhesive capsulitis with DM mean ART 4.36 ± 0.00 which is greater than without DM mean ART 3.86 ± 0.22 . No difference between the dominant and the nondominant sides shoulders for ART measurements (p value > 0.05) and the left and the right sides for sex. (In male right side 2.18 ± 0.32 mm and on left side 2.23 ± 0.36 mm and in female right side 1.70 ± 0.06 mm and in left side 1.68 ± 0.04 mm.). In symptomatic shoulders there is significant difference in AR thickness measurement between novice and experience rater.

Observation Table

Table: 1 Correlation between frozen shoulder and diabetes in case group

Type of disease	Case group (N=13)
	Mean ART
Adhesive capsulitis without DM	3.86±0.22 4 PATIENTS
Adhesive capsulitis with DM	9 PATIENTS 4.36±0.00

Table: 2 AR thickness in gender in asymptomatic shoulder (control group)

AR thickness	Male	Female	Total (50)
AR Thickness (mm)	2.21±0.33	1.69±0.04	2.00±0.36

AR, Axillary Recess

P<0.01, significant difference between male and female by independent t test

Table: 3 Correlation between the AR thickness in Asymptomatic shoulder with anthropometric parameters [control group]

Parameters	Age	BMI	Height	Weight
R value (Correlation coefficient)	-0.275	0.168	0.136	0.140

AR, Axillary Recess; BMI, Body Mass Index.

P<0.01, Pearson's correlation coefficient.



Fig 1 Representing image showing USG Measurement of the ART in symptomatic patient (~3.76 mm).

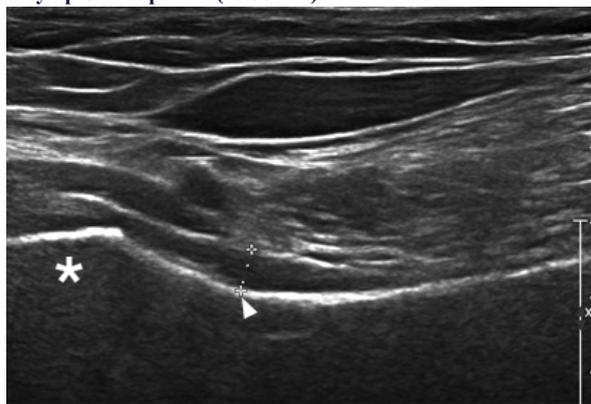
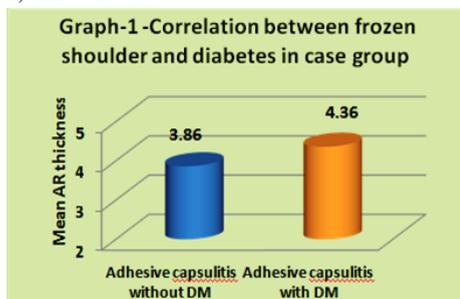


Fig 2 A representative longitudinal sonogram shows the measurement of the axillary recess thickness. The thickness (crosshairs) was measured perpendicularly in the thickest portion of axillary recess at the humeral surgical neck (arrowhead). Asterisk, humeral head.



DISCUSSION

We measured the mean AR thickness on US and found excellent

intrarater and inter-rater reliabilities of the US measurement of AR thickness; we also found significant differences in the AR thickness by comparing US measurements among subjects of different sex, height, and weight. This is the first report to present such findings.

US are most useful tools in the diagnosis of shoulder diseases and superior in comparison with MRI include better visualization of the rotator cuff & cost effective, widely available, faster examination and dynamic assessment. MRI cannot be performed bilaterally. US can measure AR thickness up to 0.1 mm & no need contrast. AR thickness on US in asymptomatic was 2.00±0.36 mm. Emig et al.(8) reported that the mean ART was 2.9 mm (range, 2.0 to 3.8 mm) in a normal shoulder by method of Manton .Previous studies proposed the usefulness of AR thickness measurement using MRI for the diagnosis of FS 8,11. Manton et al.(11) reported that capsular and synovial thickness and joint volume were inconclusive as MR arthrography.US possesses advantages over MRI as AR is folded and redundant in the neutral position so can be overestimated and stretched with a lateral elevation of an arm (best method).12 Other MRI studies measured each portion of the humeral and glenoid aspects of the AR11,13. AR thickness is not recommended as a good diagnostic indicator for FS.11 Out of 50 patient, 13 patients clinically diagnosis as FS. The AR thickness measured as the total thickness of the glenoid and humeral capsules.8,13 Jung et al. measured the thickness of the glenoid and humeral capsules separately.19 Eleven(11) patients have recurrent shoulder dislocation and 21 patients have diffuse shoulder pain and 5 patients have rotator cuff tears in which 4 patients have difficult in abduction (<300) with restrictive movements and have fluid collection in joint cavity, so, proper AR thickness measurement not possible. Out of 13 (adhesive capsulitis) patients 4 patients have diabetes and 9 patients without diabetes. In our study adhesive capsulitis with DM (4 patients) mean ART 4.36±0.00 which is greater than without DM (9 patients) mean ART 3.86±0.22.

In asymptomatic shoulders (50) 34 volunteers have right shoulder dominant (M=20,F=14) and 9 have mixed dominant (M=6,F=3), 7 with left dominant (M=6,F=3). In our study there is no difference between the dominant and the non-dominant sides shoulders for ART measurements (p value >.05). These study are similar to Gi-Young Park, Jin Hoon Lee, Dae Gil Kwon- (7). In our study there is no difference (p value >0.05) between the left and the right sides in males and females for sex ART measurement. (In male right side 2.18± 0.32 mm and on left side 2.23±0.36 mm and in female right side 1.70±0.06 mm and in left side 1.68± 0.04 mm.)These our study are similar to Gi-Young Park, Jin Hoon Lee, Dae Gil Kwon(7).

In symptomatic shoulders there is significant difference in AR thickness measurement between novice and experience rater, but in asymptomatic shoulder there is no significant difference between novice and experienced rater. The mean AR thickness was significantly greater in men than in women. The mean AR thickness (2.21± 0.33 mm) in males was significantly greater than that in females (1.69±0.04 mm) (P<0.05.). The US measurement of the AR thickness correlated positively with the height and weight in all subjects. These study are similar to Gi-Young Park, Jin Hoon Lee, Dae Gil Kwon(7) and Kyoung Tae, Dong Gyu Lee, So young, Du Hwan Kim et al.12.

Limitations

On US ART could not measure in the neutral position of the shoulder, unrestricted movements, unable to sit, fluid collection due to tears or chronic pathology.

CONCLUSION

Adhesive capsulitis with DM mean ART is greater than without DM. ART in males was significantly greater than that in females (P<0.05) and correlated positively with anthropometric variables in healthy subjects .In symptomatic shoulders there is significant difference in AR thickness measurement between novice and experience rater, but in asymptomatic shoulder there is no significant difference between novice and experienced rater. No difference (p value >0.05) between the left and the right side for gender and for dominantity.

Clinical application-USG evaluation of shoulder is an excellent non-invasive investigation for various shoulders pathology and ART measurement by USG give best correlation and helpful in planning of treatment and follow up.

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Conflict Of Interest: None declared

Ethical Approval: The study was approved by the Institutional Ethics Committee.

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