



Radiology

MEASUREMENT OF AXILLARY RECESS CAPSULE THICKNESS IN ASYMPTOMATIC SHOULDER BY HIGH RESOLUTION ULTRASONOGRAPHY.

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ABSTRACT **Aims and Objectives:** The present study was aimed at measuring the axillary recess capsule (ARC) thickness by high resolution ultrasonography and the evaluation of various factors affecting ARC. The interrater and intrarater reliability was also assessed. **Materials and Methods:** 50 people with asymptomatic shoulder were taken up for his study. One experienced and one beginner radiologist independently measured the ARC thickness at 4 instances. High frequency linear array transducer was placed longitudinally and parallel to the shaft of humerus in the mid axillary line and the shoulder was abducted to varying extent and ARC thickness measured at 3 three different angles. i.e. 50°, 70° & 90°. The obtained values were analyzed by using intra-class correlation coefficients using the standard SPSS software. The factors affecting the ARC thickness were also assessed in addition to ICC coefficients. **Results:** The intrarater reliability coefficients calculated at three angles (50°, 70° & 90°) were 0.95, 0.96 and 0.96 on right side and 0.97, 0.95 & 0.98 on left side for the experienced radiologist, whereas the beginner radiologist attained 0.96, 0.95 & 0.97 on right side and 0.95, 0.98 & 0.96 on left side respectively. The interrater reliability was calculated and was 0.94. The mean ARC thickness in males was more than females and decreasing ARC thickness was noted with increasing abduction (angle). The mean values for males at 50°, 70° & 90° were 3.1±0.6mm, 2.79±0.51mm & 2.69±0.41mm and for females 2.5±0.58mm, 2.15±0.38mm and 2.08±0.33mm respectively with a p<0.001 for all values. The mean ARC thickness at different angles of abduction was calculated and we found out that there is an inverse relationship between the two with p<0.01. The ARC thickness correlated positively with height (r=0.45 and p<0.008) and weight (r=0.58 and p<0.005)

KEYWORDS : Axillary Recess Capsule Thickness, Intrarater And Interrater Reliability Coefficient.

INTRODUCTION :

Adhesive capsulitis (AC) is also known as periartthritis or frozen shoulder (should be avoided). It is a glenohumeral synovitis leading to inflammatory changes and subsequent thickening of the capsule with decreased range of motion. Etiology includes diabetes mellitus, trauma, lung disease, connective tissue disorders and thyroid disease. Prevalence – General population is 2%. In diabetics it is 11-30%. Females are more commonly affected than males.¹

Adhesive capsulitis was described by Neviaser et al as capsular subsynovial layer inflammation in turn leading to adherence, fibrosis and eventually contracture with decreased range of motion.² There are 3 stages in adhesive capsulitis: freezing stage, frozen stage and thawing stage. Complaints include pain, stiffness, limitation of movements or a combination of these. The limitation of the movements depends on the stage of the disease.

Plain radiography may only reveal osteoporosis of underlying humerus and scapula which is nonspecific. So the next line of investigation is fluoroscopic arthrography which may reveal - limited injectable fluid capacity of the glenohumeral joint, small dependent axillary fold, small subscapularis bursa, irregularity of the anterior capsular insertion at the anatomic neck of the humerus. Ultrasound shows - axillary recess capsule thickness³, Thickened coracohumeral ligament⁴, Echogenic material at rotator interval surrounding long tendon of biceps. Imaging workup of adhesive capsulitis - Vascularity around biceps tendon on Doppler⁵, On dynamic ultrasound we can see limitation of movement of the supraspinatus - sensitive feature. CT arthrography⁷ may reveal - decreased width of the axillary recess, thickening of the lateral wall and to a lesser extent thickening of the medial wall of the capsule at the axillary recess can serve as diagnostic signs of AC at CTA. MR arthrography shows - Subcoracoid triangle sign⁹, Coracohumeral ligament thickening. Clinico - arthrographic study can be considered as a gold standard for this condition. But the last thing we want to do in a diabetic is to do an invasive procedure which can introduce infection. So, MRI and USG can be considered as the principal line of investigation for AC. The use of ultrasound has not been completely explored. Michelin et al found that ARC thickness measurement on USG can be used as a reliable sign in patients of adhesive capsulitis. But there is no reference measurement of ARC thickness in asymptomatic individuals on USG in standard literature. Hence, the present study.

AIMS & OBJECTIVES:

The main aim of this study is to provide a reference value for ARC thickness on USG.

The objectives of the present study is to measure – Intrarater reliability, Interrater reliability, And factors affecting the ARC thickness in asymptomatic shoulders. The present study can expand the application of ARC thickness in patients of adhesive capsulitis.

MATERIALS AND METHODS:

Inclusion criteria –

Volunteers with asymptomatic shoulder.

Exclusion criteria –

Previous history of trauma to shoulder, Previous surgery to the shoulder, People with rotator cuff tears, History of cervical radiculopathies, History of inflammatory shoulder joint pathologies, Infective joint pathologies, Inadequate medical history.

Sample :

50 people with asymptomatic shoulder (30 males and 20 females) with a mean age of 35 ± 8yrs were taken up for his study. 48 people were right hand dominant and 2 of them were left dominant. Measuring ARC thickness in this sample yields a result with p value < 0.01 and with a power of 0.9. With the present sample size, the difference between the Intraclass coefficient (ICC) can be calculated i.e. between 0.85 which signifies approximate reliability and 0.95 which signifies exact reliability, by measuring ARC thickness by two radiologists (one novice and one experienced)

Ultrasound protocol:

The ultrasound machine used was Philips Clearvue 650 with a linear array transducer. (4- 12 MHZ)

Position of the patient – Supine. Position of the shoulder joint – At varying angles of abduction (50°, 70° & 90°). Elbow passively flexed at an angle of 90° with the forearm in a neutral position. Position of the probe – Longitudinally parallel to long axis of the shaft of humerus, Between coracobrachialis and axillary fold, In midaxillary line.

Measurement:

Using calipers, the ARC thickness was measured in the area of maximum concavity of the surgical neck of humerus, perpendicular to

the bone. 2 radiologists independently measured the ARC thickness at 3 angles of abduction. Each person was measured 4 times with 1 day gap. This was to blind the radiologist to their measurement and also to each other.

Table 4: Correlation between age, height and weight ARC thickness

	Age	Height	Weight
ARC thickness	-0.035	0.498	0.414

P<0.01, Pearson's correlation coefficient

Table 5: Inter and intrarater correlation coefficients

	Angles of abduction	ICC (95% confidence interval)
Intrarater reliability		
Experienced	500	0.976(0.963-0.991)
	700	0.962(0.923-0.977)
	900	0.951(0.891-0.975)
Novice	500	0.948(0.901-0.968)
	700	0.937(0.856-0.965)
	90	0.987(0.979-0.992)
Inter-rater reliability		0.953(0.934-0.973)

DISCUSSION:

The present study evaluated the use of USG for measuring ARC thickness and found that the ARC thickness varies with sex, height and weight of the patient. Age had no effect on the measurement. The reliability between a beginner and experienced had excellent correlation. It's assuring in a way as this method can be performed by relatively beginner radiologists.

Summary:

The factors affecting ARC thickness are - Sex, Weight, Height, Angle of abduction – Increased angle shows decreased ARC thickness. The intrarater and interrater correlation coefficients show excellent reliabilities for ARC measurement. Age of the patient showed no significant variation in the ARC thickness. The ARC thickness was more in men than women. KT Kim et al¹² measured the mean ARC thickness as 3.2, 2.9 and 2.6mm in males which is similar to our study with values of 3.15, 2.80 and 2.7mm. The inter-rater and intra-rater reliability coefficients were >0.950 and >0.950 which is similar to our study where both the ICCs were >0.950.

CONCLUSION :

Thus concluding that this fast and reliable investigation can be equally effective even in the hands of a beginner radiologist. As USG is reliable in determining the ARC thickness, a further study is warranted to determine the correlation between ARC thickness and periarthritis of shoulder. If any positive correlation is found between periarthritis of shoulder and ARC thickness, then USG can be used as a fast, reliable and accurate investigation for diagnosing this condition.

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