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Ultrasound dimensions of the rotator cuff in young healthy adults

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Background: No studies have looked at the rotator cuff dimensions in the young healthy population using ultrasonography. Our aim is to define the ultrasound dimensions of the rotator cuff in the healthy young adult population and explore correlations with other patient characteristics.

Methods: Thirty male and 30 female healthy volunteers (aged 18-40 years), with no shoulder problems, underwent ultrasound assessment of both shoulders by a musculoskeletal radiologist. The dimensions of the rotator cuff, deltoid, and biceps were measured in a standardized manner.

Results: A total of 120 shoulders were scanned. The mean maximum width of the supraspinatus footprint was 14.9 mm in men and 13.5 mm in women ($P < .001$). The mean thickness of the supraspinatus tendon was 4.9 mm in women and 5.6 mm in men. The mean thickness of the subscapularis was 4.4 in men and 3.8 mm in women and for the infraspinatus was 4.9 mm in men and 4.4 mm in women. There was no correlation between height, weight, biceps, or deltoid thickness with any tendon measurements. Apart from supraspinatus tendon thickness, the difference between dominant and nondominant shoulders in the same sex was not significant for any other tendon dimensions.

Conclusion: This study has defined the dimensions of the rotator cuff in the young healthy adult, which has not been previously published. This is important for the documentation of normal ultrasound anatomy of the rotator cuff and also demonstrates that the asymptomatic contralateral shoulder can and should be used to estimate the expected dimensions.

Level of evidence: Anatomic Study, Imaging.

Keywords: Rotator cuff; dimensions; adults; normal; gender; ultrasound

Shoulder pain is the second most prevalent cause of musculoskeletal pain in the community, behind only low back pain.[22] It has been estimated that every year approximately 1% of all adults consult their general practitioner with new-onset shoulder pain.[18,20] Rotator cuff pathology is reported to be the most common cause for painful shoulder

This study was reviewed and approved by the University of Warwick Biomedical Research Ethics Committee.

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episodes, accounting for up to 70% of cases.[20] Accurate diagnosis of shoulder conditions is difficult because the clinical findings are often shown to have poor correlation with the actual pathology.[8,10]

Magnetic resonance (MR) arthrography is the most sensitive and specific technique for diagnosing rotator cuff tears.[7] Ultrasound is accurate and the most cost-effective method to identify full-thickness tears and, to a lesser extent, partial-thickness tears, comparable to MR imaging (MRI) in sensitivity and specificity.[7,21] According to recent systematic reviews,[7,25] ultrasound had a sensitivity of 92% to 96% and a specificity of 93% to 94.4% for diagnosing full-thickness tears. For partial-thickness tears, the sensitivity was 66% to 84% and specificity was 89% to 93.5%. One of the criteria used to diagnose a rotator cuff tear is thinning of the tendon.[5,11,24,30,31] It is based on knowing the normal dimensions of the rotator cuff and trying to visualize a decrease in tendon thickness.

Although there is an abundance of literature on the pathologic appearances and frequencies of rotator cuff pathology, a detailed literature review has revealed no previous studies looking at the cuff dimensions in a young healthy population using ultrasonography. Specifically, there is no evidence of correlation with sex, hand dominance, weight, height, and other ultrasound measurements. Defining the normal parameters for the rotator cuff will help clinicians make a comparison between normal and pathologic conditions.

The aim of this study is to define the dimensions of the supraspinatus tendon and other rotator cuff muscles in a healthy young adult population and compare them with the contralateral shoulder. Correlations with sex, height, weight, dominance of hand, and other muscle dimensions will also be established.

Materials and methods

Inclusion and exclusion criteria

All healthy adults aged between 18 and 40 years, who had no significant medical conditions and had no shoulder problems, were considered eligible to participate in the study. Anyone with significant comorbidities or who had undergone previous shoulder surgery was excluded. Volunteers who had or had experienced pain in their shoulder or who were limited in their daily activities due to shoulder problems in the preceding 4 weeks were also considered ineligible to participate in the study.

Recruitment

The first 60 volunteers (30 men and 30 women) from among the staff and students of our institution who met the eligibility criteria formed the study population. Each volunteer included in the study underwent an ultrasound assessment of both shoulders in a private consultation room by a musculoskeletal radiologist (S.B.R.).

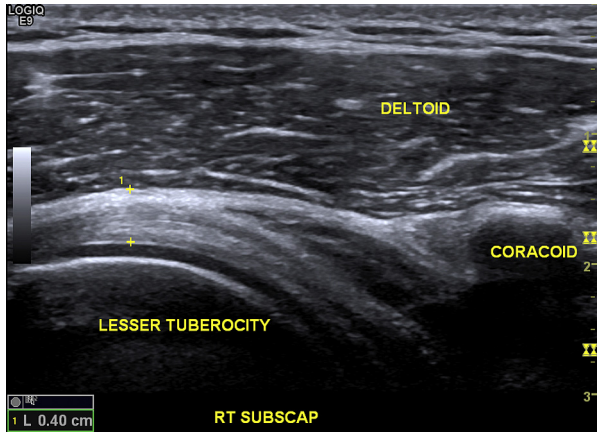

Figure 1 Thickness of the subscapularis tendon on ultrasound imaging.

Data collection

Demographic details, including age, height, weight, hand dominance, sports activities, comorbidities, and smoking and drinking habits were collected for each individual.

One experienced consultant musculoskeletal radiologist (S.B.R.) who routinely performs ultrasound assessment of shoulders did all of the measurements. Both shoulders were scanned in each individual sequentially. A GE Logiq E9 (GE Healthcare, Chalfont St. Giles, UK) ultrasound scanner with a 10- to 15-MHz linear array transducer was used for all assessments. The scan was performed with the individual sitting on a couch and facing the examiner.

The following structures were visualized in sequence, and measurements were taken as described for each structure. To minimize bias, all measurements were taken with reference to bony landmarks.

1. Tendon of long head of biceps
2. Subscapularis
3. Supraspinatus
4. Subacromial bursa
5. Infraspinatus
6. Deltoid

The biceps tendon was identified first, and its maximal thickness was measured in the transverse view at the highest point of the groove with the forearm resting supine on the lap. With the arm in external rotation, the thickness of subscapularis tendon was measured just medial to the attachment at the lesser tuberosity (Fig. 1).

The maximal mediolateral width of the supraspinatus footprint at its insertion was measured in the coronal view of the tendon, with the arm in internal rotation. Two further measurements were made to assess the thickness of supraspinatus tendon in the same view. The first was made at the medial edge of footprint and the second was at the midpoint of the footprint (Fig. 2). In addition, the thickness of supraspinatus tendon on the sagittal view was done at a fixed point 15 mm posterior to the biceps tendon (Fig. 3).

The thickness of the subacromial bursa was measured on the coronal view in the same plane as the thickness of the supraspinatus tendon. Infraspinatus tendon thickness was measured at the level of the posterior border of the acromion, and thickness of deltoid muscle was measured at the anterolateral edge of acromion.