Biceps Sheath Fluid as an Ultrasonographic Marker of Asymptomatic Rotator Cuff Tears

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INTRODUCTION: Recruiting healthy controls in large cohort studies enables the detection of subclinical changes and the characterization of risk factors for rotator cuff tears. Because periarticular pathology in the shoulder can lead to changes such as accumulation of fluid in the biceps sheath, subacromial bursa, and/or acromioclavicular joint, or calcifications around the shoulder, these findings may contribute to early identification of at-risk populations and to better understanding of the natural history of rotator cuff pathology.[1-4] Although these findings are often considered markers of symptomatic pathology, they can also appear in asymptomatic individuals as secondary changes associated with tendon degeneration and joint fluid communication. This study investigated the factors associated with asymptomatic rotator cuff tears in adults, focusing on demographic variables and ultrasound findings including biceps sheath fluid, bursal effusion, acromioclavicular joint effusion, and calcification. It was hypothesized that biceps sheath fluid, bursal effusion, acromioclavicular joint effusion, and calcification are associated with the presence of asymptomatic rotator cuff tear.

METHODS: A total of 57 subjects (mean age, 61.2 ± 10.2 years; mean BMI, 27.1 ± 5.0 kg/m²; 45.6% male) with no symptoms of bilateral shoulder pathology were prospectively enrolled. "No symptoms" was defined as the absence of pain, functional limitation, history of prior shoulder injury, or clinical consultation for shoulder-related complaints. Ultrasound examination was performed on one randomly selected shoulder to avoid intra-subject dependency and maintain statistical independence for multivariable analyses. Shoulders were categorized into an asymptomatic group with a rotator cuff tear or a group with intact rotator cuff. Factors were compared between asymptomatic vs intact groups using the chi-square test for binary variables and the Mann-Whitney U test for continuous variables. Multivariate logistic regression analysis with a backward stepwise approach was performed on variables with $P < 0.1$ in univariate analysis. Statistical significance was set at $P < 0.05$. The factors analyzed included sex, age, body mass index, smoking history, presence of biceps sheath fluid, bursal effusion, acromioclavicular joint effusion, and calcification, all of which have previously been reported to be associated with rotator cuff tears.[1-8] Biceps sheath fluid, bursal effusion, and acromioclavicular joint effusion were defined as the presence of fluid with a thickness of 2 mm or greater on ultrasonography.

RESULTS: Asymptomatic partial or full-thickness tears of at least one rotator cuff tendon (including subscapularis, supraspinatus, and infraspinatus) were detected in 18 shoulders (31.6%). No significant difference in age between the asymptomatic group and the intact group was found (64.6 ± 10.9 years vs. 59.7 ± 9.6 years, $P = 0.063$) (Table 1). Sex, body mass index, and smoking history were not significantly associated with the presence of rotator cuff tears. For ultrasound findings, biceps sheath fluid was significantly associated with the presence of rotator cuff tears ($P = 0.004$), whereas the presence of bursal effusion, acromioclavicular joint effusion, and/or calcification was not ($P = 0.168$, $P = 1.00$, $P = 0.051$, respectively) under univariate analysis. Multivariate analysis revealed that biceps sheath fluid remained significantly associated with the presence of a rotator cuff tear ($P = 0.015$).

DISCUSSION: Biceps sheath fluid has been previously reported as a predictor of a rotator cuff tear, and thought to be influenced by joint fluid, which is linked to the biceps sheath.[1] Our study corroborates these findings, showing that biceps sheath fluid is significantly associated with asymptomatic rotator cuff tears. While asymptomatic tears are often detected incidentally, they can progress to symptomatic tears over time, leading to reduced function, strength, and range of motion.[9] As such, the presence of biceps sheath fluid in ultrasound imaging could serve as an important screening tool for identifying asymptomatic rotator cuff tears that may eventually require intervention. However, several limitations must be considered. This cross-sectional study prevents the assessment of the long-term progression of asymptomatic tears, the eventual development of symptoms, or the biceps sheath fluid as a predictive factor. Additionally, the relatively small sample size and lack of longitudinal follow-up limit the generalizability of our findings. Future studies with larger cohorts and longitudinal designs would be valuable to confirm these results and better understand the clinical implications of biceps sheath fluid in asymptomatic rotator cuff tears.

SIGNIFICANCE/CLINICAL RELEVANCE: Biceps sheath fluid, as detected by ultrasound, was found to have a significantly higher prevalence in individuals with asymptomatic rotator cuff tears compared to individuals with intact rotator cuff tendons. Although ultrasound diagnosis of rotator cuff tears can sometimes be challenging, the presence of biceps sheath fluid can be consistently identified and may serve as a useful adjunct parameter for screening of asymptomatic rotator cuff tears.

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ACKNOWLEGMENTS: This study was funded by National Institutes of Health (grant 5R01AR069503).

Table 1. Comparison of demographic data and ultrasonographic findings between asymptomatic group and intact group.

Variable	Asymptomatic group (n=18)	Intact group (n=39)	*P* Value
Age, years	64.6 ± 10.9	59.7 ± 9.6	0.063
Males	8 (44.4%)	18 (46.2%)	1.000
Body mass index	26.2 ± 4.2	27.5 ± 5.3	0.487
Smoking history	5 (27.8%)	3 (7.7%)	0.105
Biceps sheath fluid	7 (38.9%)	2 (5.1%)	**0.004**
Bursal effusion	3 (16.7%)	1 (2.6%)	0.168
Acromioclavicular joint effusion	11 (61.1%)	23 (59.0%)	1.000
Calcification	9 (50.0%)	8 (20.5%)	0.051

Data are reported as mean ± standard deviation or number (percent), the statistical significance is shown in bold.

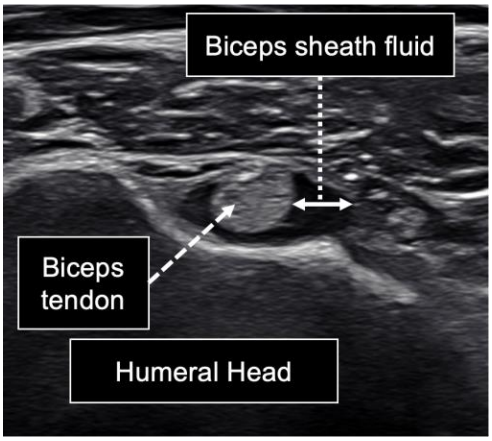

Figure 1. Ultrasonographic measurement of biceps sheath fluid thickness. Biceps sheath fluid was defined as a fluid thickness of 2 mm or greater, measured at the largest part on the axial image of the biceps tendon.