Arthroscopic Localization of the Coracohumeral Ligament

[1]Kevin J. McHale, MD
[1]Min Jung Park, MD, MMSc
[2]Grant Garcia, MD
[1]John D. Kelly IV, MD

[1]Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, PA

[2]Department of Orthopaedic Surgery, Hospital for Special Surgery, New York, NY

Introduction

The rotator interval (RI) is the triangular region of shoulder capsule between the supraspinatus and subscapularis tendons that contains both the coracohumeral (CHL) and superior glenohumeral ligaments (SGHL). Lesions of these ligaments, particularly the CHL, have been shown to play a major role in the development of glenohumeral joint instability.[1] As a result, RI closures are often incorporated into soft tissue repairs for shoulder instability.[1-6] Several modern arthroscopic techniques for rotator interval closure are performed in the superior-inferior direction.[2-6] However, these techniques have failed to reproduce the positive results of open medial-lateral CHL imbrication.[7] Anatomic studies have shown that the CHL traverses the rotator interval from medial to lateral, suggesting that gainful shortening of this ligament to augment shoulder stability is only attained when tissues are imbricated in this direction.[8-11] The purpose of this cadaveric study is to identify the relationship of the CHL to arthroscopically-visible anatomic reference points in order to facilitate an improved arthroscopic medial-lateral rotator interval closure. This change in technique should result in a true shortening of the CHL that may potentially reproduce the favorable results of open medial-lateral CHL imbrications without the morbidity of an open procedure.

Materials and Methods

Two fresh-frozen human donor cadavers were obtained for this study. Gross dissection was performed using a supine deltopectoral approach to identify the coracohumeral ligament. Three 18-gauge spinal needles were placed into the glenohumeral joint through the lesser tuberosity limb of the CHL in 2 mm increments. The shoulders were then placed in lateral decubitus position with 45 degrees of abduction and 20 degrees of forward flexion. A routine posterior arthroscopic portal was used to visualize the intra-articular CHL course as marked by the spinal needles. Photographs were taken to identify the course of the CHL as seen arthroscopically and in gross dissection. As shown in Figures 1 and 2, these photographs were then used to determine the angular relationships of the CHL relative to the subscapularis tendon (SSc), the glenoid articular surface, and the tendon of the long head of the biceps (LHB).

Results

Four shoulder specimens from two donor cadavers were included for analysis. One gross dissection image was obtained from each of the four shoulders, from which the angular relationships between the CHL and subscapularis tendon were calculated. One arthroscopic image was also obtained from each of the four shoulders, from which angular relationships between the CHL and glenoid surface were calculated. Arthroscopic images from two of the four shoulders were used to determine the angular relationship between the CHL and LHB tendon. The CHL was found to subtend a mean angle of 29 degrees (range 16-39 degrees, n=4), 59 degrees (range 38-77 degrees, n=4), and 29 degrees (range 11-47 degrees, n=2) with the subscapularis tendon, glenoid surface, and LHB tendon, respectively. Table 1 displays the angular relationships found between these anatomic structures for each of the cadaveric specimens.

Discussion

Several studies have discussed the use of arthroscopic rotator interval closures as a means of treating shoulder instability.[2-6] Despite the variety of surgical techniques described in these studies, arthroscopic rotator interval closures have failed to reproduce the results of open CHL imbrication.[1,7] These reports have raised concerns regarding the efficacy of arthroscopic rotator interval closure. However, the recently reported arthroscopic RI closure techniques all share an inherent limitation in that each of the described techniques were performed in the superior-inferior direction in contrast to the open medial-lateral rotator interval closure described by Harryman *et al*.[1] The CHL has been shown to cross the rotator interval from medial to lateral in multiple anatomic studies,[8-11] suggesting that shortening this ligament to augment shoulder stability is only attained when the RI is imbricated in this direction. Since superior-inferior techniques do not effectively shorten the course of the CHL, it is unlikely that any variation of this technique will reproduce the positive results of open medial-lateral RI imbrication.

Corresponding author:
John D. Kelly IV, MD
Clinical Associate Professor
Department of Orthopaedic Surgery
University of Pennsylvania
34th Street and Civic Center Boulevard
Philadelphia, PA 19104
john.kelly@uphs.upenn.edu

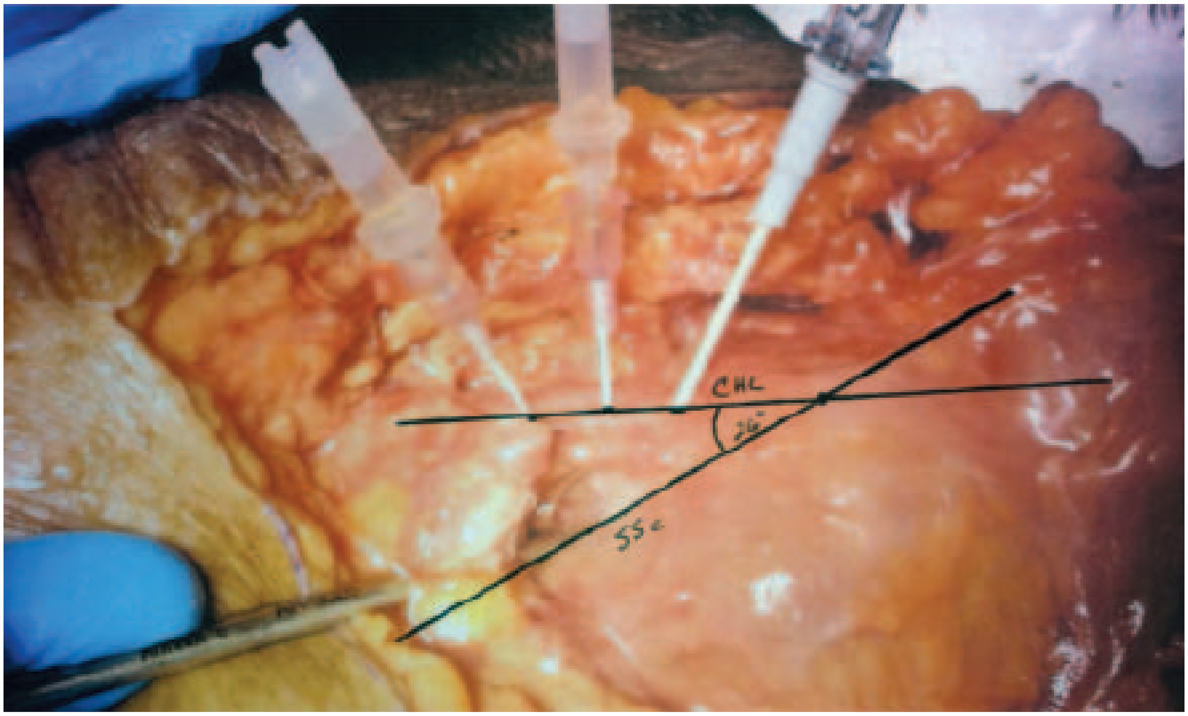

Figure 1. Determination of angular relationship between CHL and subscapularis by gross dissection.

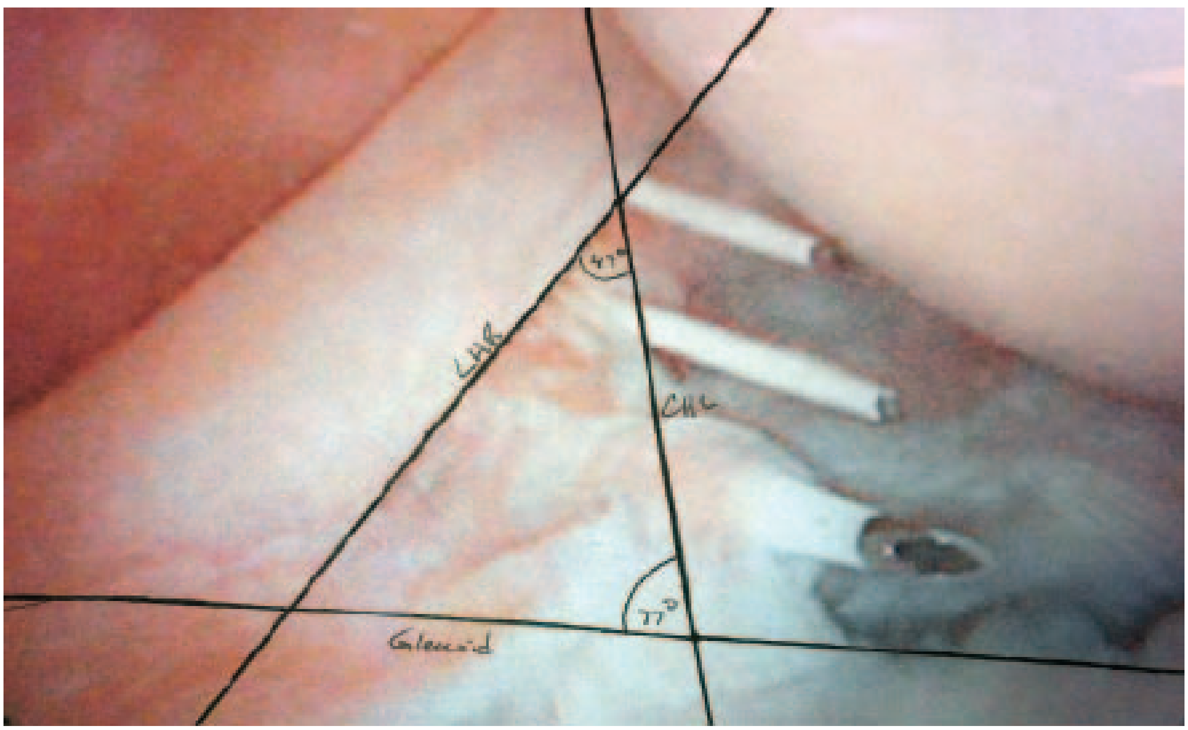

Figure 2. Determination of angular relationships between CHL, glenoid surface, and LHB tendon by arthroscopic imaging.

This study aims to provide orthopaedic surgeons with a reliable method for arthroscopic identification of the course of the CHL. Our results indicate that a surgeon can approximate the course of the CHL arthroscopically by using the angular relationships between the CHL and subscapularis (29 degrees), glenoid surface (59 degrees), and LHB tendon (29 degrees). Arthroscopic determination of the true course of the CHL facilitates arthroscopic medial-lateral RI closure as an alternative to more commonly-performed arthroscopic superior-inferior RI closure. This may allow for true shortening of the CHL and reproduction of the favorable results of open medial-lateral CHL imbrication without the morbidity of an open procedure. Future clinical studies will need to be performed to confirm the clinical efficacy of performing arthroscopic medial-lateral RI closure as a component of the surgical management of recurrent shoulder instability.

Before interpreting the results of this study, it is necessary to identify some inherent limitations. Most notably, this

Table 1. Angular relationships of coracohumeral ligament (CHL) to subscapularis (SSc), glenoid (Glen), and long head of biceps (LHB) tendon

Specimen	Image	Angle	Result	Image	Angle	Result	Image	Angle	Result
C1L	Gross	CHL/SSc	16°	Arthroscopic	CHL/Glen	38°	Arthroscopic	CHL/LHB	NR
C1R	Gross	CHL/SSc	39°	Arthroscopic	CHL/Glen	53°	Arthroscopic	CHL/LHB	NR
C2L	Gross	CHL/SSc	26°	Arthroscopic	CHL/Glen	68°	Arthroscopic	CHL/LHB	11°
C2R	Gross	CHL/SSc	35°	Arthroscopic	CHL/Glen	77°	Arthroscopic	CHL/LHB	47°
Mean Angle			**29**°			**59**°			**29**°

study includes the analysis of only four cadaveric specimens. Anatomic variability noted in this study has identified the need to obtain a greater number of cadaveric specimens to determine a more accurate measurement of the relationships between the CHL and the above anatomic structures. In addition, the utilization of thawed fresh-frozen cadaveric specimens may result in some degree of inaccuracy due to the difference in appearance of soft tissues of cadaveric shoulders when compared to the shoulders of living patients. Measurements obtained in this study could also be subject to human error during the interpretation of the angular relationships between anatomic structures depicted in photographs of the dissection.

Conclusion

While the relationships of the CHL to the subscapularis tendon, glenoid surface, and LHB tendon show moderate degrees of anatomic variability, these structures provide anatomic reference points to assist in arthroscopic localization of the CHL, and subsequently may facilitate the execution of arthroscopic medial-lateral rotator interval closure.

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