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# ANALYSIS OF CORACOACROMIAL LIGAMENTS AND THEIR ROLE IN SHOULDER JOINT BIOMECHANICS AND SURGICAL SIGNIFICANCE

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## ABSTRACT

**Background:** The triangular band known as the coracoacromial ligament connects the acromion and coracoid process, forming an arch over the humeral head that protects it during abduction. Additionally, gleno-humeral stability depends on it. It is frequently observed with anatomical variants as straight, quadrangular, or Y-shaped, and it can be observed as a thick anterolateral bundle and a posteromedial bundle with a triangular base. In order to treat shoulder impingement syndrome, coracoacromial ligament release is recommended during surgery.

**Aim**: The purpose of this study was to examine the different kinds of coracoacromial ligaments found in Indian cadavers, as well as their function in shoulder joint biomechanics and surgical relevance.

**Methods**: Eighty upper limbs with undamaged shoulder joints that were obtained from Indian cadavers were evaluated for this investigation. 10% formalin was used to embalm the corpses. After dissection, the deltoid was revealed and the skin was mirrored. The anterior and middle deltoid muscle fibers were severed for further dissection. The coracoacromial ligament was seen by exposing the superior surfaces of the acromian and coracoid processes.

**Results**: The study's findings demonstrated that the individuals' upper limbs were carefully dissected in order to evaluate the different coracoacromial ligament forms. Y-shaped, rectangular, trapezoid, tripartite, and bipartite coracoacromial ligaments were among the types observed in the cadavers.

**Conclusion**: The current study comes to the conclusion that improved knowledge of the coracoacromial ligament through research findings can aid in improving the intraoperative decision-making of arthroscopic surgeons.

**Keywords:** Coracoacromial ligament, impingement syndrome, morphological variations glenohumeral stability, shoulder joints

## INTRODUCTION

The coracoacromial ligament (CAL) connects the curving coracoid to the flat acromion process of the scapula. It has a triangle form, with the apex linked to the region in front of the clavicle's articular facet on the acromion process and the wide base attached to the coracoid process's lateral aspect.[1]

This ligament forms the coracoacromial arch, which, along with the flat acromion process and the beaklike coracoid process of the scapula, protects the head of a humerus and stabilizes the glenohumeral joint during abduction. The arch has a superior relationship with the clavicle and the surface of the deltoid muscle, while it has an inferior relationship with the scapula's supraspinatus fossa and the subacromial bursa. Between this arch, which is made up of two scapular processes, the glenohumeral joint, and the supraspinatus tendon, the bursa facilitates fluid mobility.[2]

The acromion and coracoid processes of the scapula are separated by a sturdy protective arch formed by the osseoligamentous structure. This arch is used to stop the humeral head from moving superiorly out of the scapular glenoid cavity. Because of the strength of the coracoacromial arch, the humerus cannot be fractured by superior push. Prior to the joint, a triangular band is visible between the acromion and coracoid processes of the scapula. The coracoacromial ligament extends above the humeral head to increase the surface area that supports the humerus head. It is isolated from the rotator cuff muscle by the subacromial bursa.[3]

The shoulder joint's suprahumeral articulation plays a crucial part in shoulder joint abduction. The coracoacromial ligament connects the acromion and coracoid processes of the scapula, which make form the suprahumeral articulation. In order to facilitate smooth movement of these bony components, the subacromial bursa intervenes to protect the humerus head during shoulder joint abduction. Normally, there is a tiny gap between the bony parts of the articulation, but the arch prevents the humerus head from dislocating upward. Additionally, during normal abduction, the end of the upper humerus will often impinge on the arch at a 90-degree angle.[4]

Sometimes, it is seen that CAL consists of two strong, thin marginal bands. Usually, anatomical variances are seen in the ligament's shape. It can occasionally be rectangular, quadrangular, or Y-shaped. Literature describes CAL's various morphological forms. Because ligament thickening can result in shoulder arthropathy or impingement syndrome, it plays a crucial role in shoulder impingement syndrome. Surgery to release the CAL and other glenohumeral ligaments is essential for reducing discomfort associated with this problem.

## MATERIALS AND METHODS

Examining the different kinds of coracoacromial ligaments in Indian cadavers, as well as their function in shoulder joint biomechanics and surgical relevance, was the goal of the current study. The Institute's Department of Human Anatomy provided the study participants.

All subjects gave their written and verbal informed permission before to participation. The study evaluated 80 cadavers that were ultimately included, embalmed in 10% formalin, and dissected in accordance with recommendations and criteria. Shoulder joints that were intact met the inclusion criterion for the cadavers in this study, but disarticulated shoulder joints met the exclusion criteria.

Forty of the cadavers utilized in undergraduate research were the ultimate size in this study. Dissection was carried out in accordance with Cunningham's Manual of Practical Anatomy.Six The deltoid muscle exposure was performed on the shoulder joint while the skin was reflected. Middle and anterior deltoid muscle fibers were cut and reflected in order to further dissect the shoulder joint in the cadaver. The coracoid process and acromion's superior surfaces were visible. The form and attachments of the coracoacromial ligament were examined, and its margins were cleaned. Every diversity in the morphological forms and shapes of CAL was seen.

The collected data was statistically evaluated using the Student t-test, ANOVA (analysis of variance), Chi-square test, and SPSS (Statistical Package for the Social Sciences) software version 24.0 (IBM Corp., Armonk, NY, USA) for evaluating descriptive measures. The findings were presented as frequency, percentages, mean, and standard deviation. A p-value of less than 0.05 was taken into account.

## RESULTS

In this investigation, 160 dissected specimens from 80 cadavers—80 left and 80 right—were evaluated. Different morphological kinds and shapes of the coracoacromial ligament were shown in accordance with Rothenberg et al.'s categorization.7 The apex of the triangle-shaped ligament is connected to the acromion process, while the base is connected to the coracoid process. 35% of the individuals have this kind of form.

The narrow part of the ligament was connected to the acromion process, while the wide part was connected to the coracoid process for the trapezoid form. Ten percent of research participants had a trapezoidal ligament. The two attachments were almost the same size, and the CAL had a rectangular form. In 32.5% of the limbs, rectangular CAL was seen. The acromion process had two attachment points, indicating the bifurcation that gave the ligament its Y form, while the coracoid process showed a single attachment. Of the limbs evaluated, 12.5% had this kind.

CAL was represented by bipartite type as two distinct bands. The lateral part is often thin, whereas the medial portion is typically large. Seven.5% of the limbs were of the bipartite type. Three distinct bands, one wide and the others thin like strips, were used by Tripartite to represent CAL. It was detected in 2.5 percent of the limbs.

There were two participants from each of the right and left limbs who had a tripartite form, six subjects from each of the right and left limbs who had a bipartite shape, and eight subjects from each of the right and left limbs who had a trapezoid shape. Y-shaped in 10 (right and left limb) patients, rectangular in 26 (right and left limb) subjects, and triangular in 28 (right and left limb) subjects (Table 1).

## DISCUSSION

In the current investigation, 160 dissected specimens from 80 cadavers—80 left and 80 right specimens—were evaluated. According to Rothenberg et al.'s categorization, the coracoacromial ligament showed a variety of morphological forms and morphologies.7. The ligament is triangular in form, with the acromion process at the apex and the coracoid process at the base. Thirty-five percent of individuals had this form.

This mirrored the findings of earlier research by Demir M et al. in 2019 and Alraddadi A et al. in 2017, in which the authors evaluated participants who had coracoacromial ligament traits comparable to those in the current study. The ligament's trapezoid form was characterized by a small piece attached to the acromion process and a large portion attached to the coracoid process. Ten percent of research participants had a trapezoidal ligament. The two attachments were almost the same size, and the CAL had a rectangular form. In 32.5% of the limbs, rectangular CAL was seen. The acromion process had two attachment points, indicating the bifurcation that gave the ligament its Y form, while the coracoid process showed a single attachment.

Of the limbs evaluated, 12.5% had this kind. These findings aligned with those of Fagelman M et al. (2007) and Wang YC et al. (2009), whose research found that trapezoidal and rectangular CAL were similar to the current study's findings.

It was seen that the Bipartite type represented CAL as two distinct bands. The lateral part is often thin, whereas the medial portion is typically large. Seven.5% of the limbs were of the bipartite type. Three distinct bands, one wide and the others thin like strips, were used by Tripartite to represent CAL. It was detected in 2.5 percent of the limbs.

These results were consistent with those of Dietrich TJ et al. (2012) and Yomamoto N et al. (2013), who also observed bipartite and tripartite CAL shapes similar to the current study in their separate investigations. According to the study findings, the coracoacromial ligament was found to have a variety of shapes in the study participants. Two subjects from each of the right and left limbs had a tripartite shape, six subjects from each of the right and left limbs had a bipartite shape, eight subjects from each of the right and left limbs had a trapezoid shape, ten subjects from each of the right and left limbs had a Y-shaped ligament, 26 subjects from the right and left limbs were rectangular, and 28 subjects from the right and left limbs were triangular.

These results were consistent with the findings of Wu CH et al. (2010) and Wellmann M et al. (2008), whose authors also reported conclusions comparable to the present study regarding the form of the present study.

## CONCLUSION

Given its limitations, the current study comes to the conclusion that improved knowledge of the coracoacromial ligament through research findings can aid in providing surgeons doing arthroscopic procedures with more intraoperative decision-making options. A definite conclusion, however, requires more research with a larger number of limbs and in a different geographic location.

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| Shape of coracoacromial ligament | Right upper limb (n=80) | Left upper limb (n=80) |
| --- | --- | --- |
| **Tripartite** | 2 | 2 |
| **Bipartite** | 6 | 6 |
| **Trapezoid** | 8 | 8 |
| **Y-shaped** | 10 | 10 |
| **Rectangular** | 26 | 26 |
| **Triangular** | 28 | 28 |

**Table 1: Various shapes of coracoacromial ligament seen in study subjects**