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## Research Article

### Variations of the coracoacromial ligament and the possible rotator cuff tendinopathy

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#### Abstract

The coracoacromial ligament represents a strong triangular band, which extends between the coracoid process and the acromion. Its function is related to the formation of vault for the protection of the humeral head together with the acromion and the coracoid process. During routine dissection in the section hall of the Department of Anatomy and Histology in Medical University – Sofia we came across a very interesting variation of the coracoacromial ligament. It consists of two parts joining together to the acromion. These bands attached respectively to the apex and the base of the coracoid process. There is a fibrous connective tissue and a gap between two bands of the coracoacromial ligament. Two bands combined in a common portion joining together to the acromion. We observed the presence of a deformation of the humeral head and the osteoarthritis in the shoulder joint. The severe osteoarthritis changes were accompanied with the absence of cartilage on the humeral head in the investigated shoulder joint. In our case the question arises whether the ligament is adherent intimately to the undersurface of the overlying anterior deltoid muscle especially the deltoid fascia. It may be the main reason for the impingement syndrome during lifetime. The impingement syndrome very often is a cause for the pain in shoulder and may lead to operative treatment, which in turn leads to a period of temporary disability. It is clear that the variations of the acromion and the coracoacromial ligament are important since, in turn, they can lead to the impingement syndrome.

**Keywords:** Coracoacromial ligament, variations, shoulder joint, rotator cuff tendinopathy.

## Introduction

The coracoacromial ligament represents a strong triangular band, which extends between the coracoid process and the acromion. It is attached, by its broad base to the whole length of the lateral margin of the coracoid process. On the other hand it is attached by its apex, to the summit of the acromion just in front of the articular surface for the clavicle. Standard texts described the ligament as being a flat, triangular structure with its base on the superior lateral side of the coracoid and its apex of insertion into the tip of

the acromion anterior to the acromioclavicular joint (Williams, et al., 1989, Woodbume, 1961). The coracoacromial ligament, together with the acromion and the coracoid process, forms a vault for the protection of the humeral head. There are three different types of acromion: Type I, or flat acromion found in 17% of shoulders; Type II, or curved, in 43%; and the Type III, or hooked, in 39% of shoulders (Bigliani, and Morrison, 1986). A big bursa is situated under surface of the

Deltoides. It is in relation, above, with the clavicle and; below, with the tendon of the Supraspinatus. The lateral border of the ligament is continuous with a dense lamina that passes under the Deltoides upon the tendons of the Supraspinatus and Infraspinatus.

## Materials and Methods

### Experimental material

The material for this study was collected in the period 2000 - 2013. This work is collaboration between the Department of Anatomy and Histology, Department of Endocrine Surgery, from Sofia's Medical, State Hospital, Biala Slatina – Bulgaria, and Institute of Microbiology, Bulgarian Academy of Sciences. During routine dissection in the section hall of the Department of Anatomy and Histology we came across a very interesting variation of the coracoacromial ligament.

As a material for the present study were used upper limb from human cadaveric materials. The material was taken during a routine autopsy from the Department of Anatomy and morphology, in accordance to the ethical principles applying by the Sofia's Medical University.

### Macroscopic observations

The presented unusual anatomical variation of the coracoacromial ligament was photographed using a Nikon Colpix 95 camera with a 3.34 Megapixels. We take some pictures to describe this observation..

## Results and Discussion

The coracoacromial ligament is sometimes described as consisting of two marginal bands and a thinner intervening portion, the two bands being attached respectively to the apex and the base of the coracoid process, and joining together at the acromion. When the Pectoralis minor is inserted, as occasionally is the case, into the capsule of the shoulder-joint instead of into the coracoid process, it passes between these two bands, and the intervening portion of the ligament is then deficient. According some investigations (Pieper, et al., 1997) 59.7% of investigated coracoacromial ligaments were bipartite, 25.8 % were undivided and 14.5% consisted of three parts. It is important to mention that in neonatal there are three types of the coracoacromial ligament: quadrangular, broad band and U-shaped. The final shape of the ligament should be defined by developmental factors, rather than degenerative changes. Often the broad and U-shaped ligaments in newborn convert in

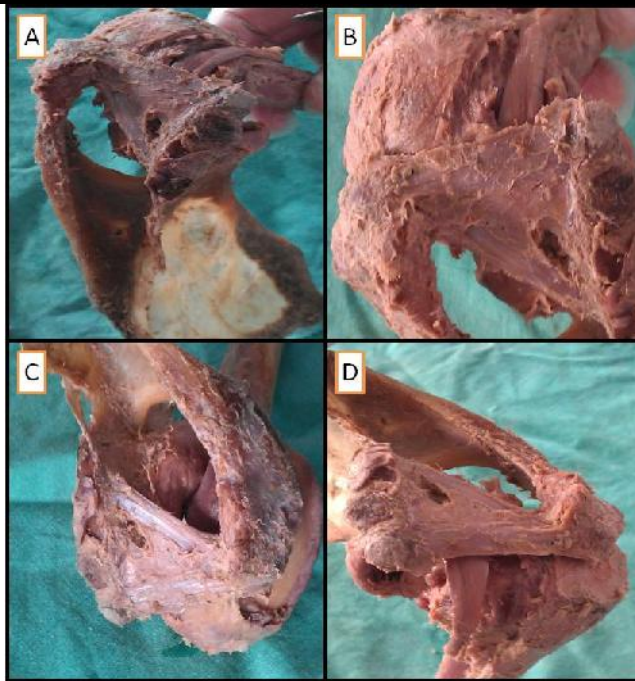
quadrangular and Y-shaped ligaments in adults (Kopuz, et al., 2002). The Y-shaped ligament is the most common type (Kesmezacar, et al., 2008).

In our case we observed a typical Y-shaped ligament (Figure 1 and Figure 2). It is clearly seen two bands of the ligament attached respectively to the apex and the base of the coracoid process and the triangular shape between them filled with the loose connective tissue (Figure 2).

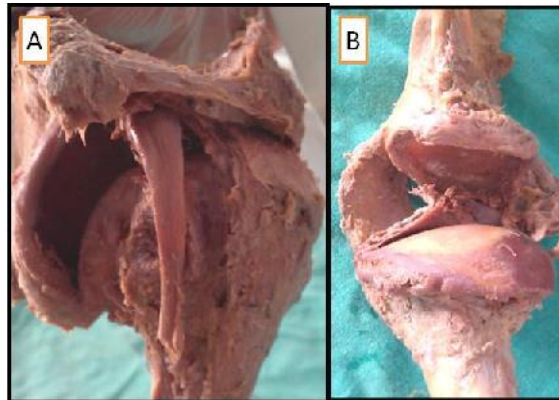
Information regarding the anatomy and morphology of the coracoacromial arch, especially the acromion, has contributed to our understanding of rotator cuff tendinopathy. Variations in the architecture of the coracoacromial arch have been shown to alter the volume of the subacromial space (Ticker, and Bigliani, 1995). Decrease in this volume by any number of factors can result in the initiation of the impingement syndrome (Figure 3). When no significant bony abnormality exists in the surrounding structures, the coracoacromial ligament has been implicated as a possible cause of impingement on the cuff tendons and various morphological variants of the ligament have so far been claimed to be either the cause or the result of impingement (Kopuz, et al., 2002). Proper decompression of the coracoacromial arch for impingement pathology or rotator cuff disease usually calls for the complete release of the coracoacromial ligament (Matsen, and Amtz, 1990, Neer, 1972). Coracoacromial ligament release and transfer is also a part of some popular procedures used to repair high-grade acromio-clavicular (A-C) dislocations (Neviaser, 1968, Weaver, and Dunn, 1972). All of these procedures are predicted on an appreciation of the ligament's anatomy. There are few contemporary studies of the detailed anatomy of this structure (Holt, and Allibone, 1994, Soslowsky, et al., 1994, Uthoff, et al., 1988).

In our case the question arises whether the ligament is adherent intimately to the undersurface of the overlying anterior deltoid muscle especially the deltoid fascia. An understanding of this relationship is crucial in avoiding complications when operating in this area (Edelson, and Luchs, 1995).

During arthroscopy at impingement syndrome in case of adherence between the ligament and the deltoid muscle the coracoacromial ligament could not be cleanly released at the back the point of adherence without release of the deltoid attachment as well. Since the ligament consists of two parts with a wide attachment to the acromion a substantial portion of the posterior band may inadvertently remain attached to bone after



**Figure 1.** A. The coracoacromial ligament consists of two parts joining together to the acromion. B. The coracoacromial ligament consists of two bands attached respectively to the apex and the base of the coracoid process. C. Two bands of the coracoacromial ligament combined in a common portion joining together to the acromion. D. There is a fibrous connective tissue and a gap between two bands of the coracoacromial ligament.



**Figure 2.** A. A lateral view to the space situated under the coracoacromial ligament. The impingement syndrome usually developed here. B. It is clearly seen the deformation of the humeral head and the osteoarthritis in the shoulder joint.



**Figure 3.** Severe osteoarthritis changes with the absence of cartilage on the humeral head in the investigated shoulder joint.

arthroscopic surgery. Even by open surgical procedure this part may not be released. It is important to mention that release of the coracoacromial ligament from the lateral acromion may threaten the integrity of the overlying deltoid muscle fascia, which is intimately related to the ligament in this area. This can result in significant iatrogenic complications (Groh, et al., 1994). Equally important to rotator cuff function are anatomic repair of torn tendons and treatment of associated conditions, such as subacromial or coracoid impingement. Awareness of neurovascular structures is also paramount to avoid iatrogenic injury (De Franco, and Cole, 2009).

## Conclusions

The impingement syndrome very often is a cause for the pain in shoulder and may lead to operative treatment, which in turn leads to a period of temporary disability. It is clear that the variations of the acromion and the coracoacromial ligament are important since, in turn, they can lead to the impingement syndrome. Prolonged impingement syndrome leads to a serious restriction of movements and eventually to osteoarthritis of the shoulder joint. Therefore, in any patient with this syndrome should not exclude the presence of variation, which is a reason for that.

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