

Murat Bozkurt  
Halil İbrahim Açar  
*Editors*

# Clinical Anatomy of the Shoulder

An Atlas

 Springer

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*Dedicated to our fathers ...*

Murat Bozkurt and Halil İbrahim Aar

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## Preface

The shoulder joint continues to be one of the most remarkable and challenging joints in the human body. My primary goal in editing *Clinical Anatomy of the Shoulder—An Atlas* is to create a valuable resource that includes a rich visual content for those physicians, residents, fellows, or students practicing or interested in orthopedic shoulder pathologies.

My belief is that the anatomical knowledge is crucial to maintain an appropriate approach for any orthopedic disorder. For this reason, the anatomy is intended to constitute the basis of this book. In addition to the anatomy, this book includes intensive radiology content, physical examination, and some basic requirements for shoulder arthroscopy.

I greatly appreciate the contributions of all the authors. Their work in the field of musculoskeletal system related to the shoulder has been invaluable for the understanding and treatment of shoulder pathologies.

May this book help anyone interested in the shoulder to discover more about this unique human joint with its complex functional structure and interrelations.

Ankara, Turkey

Murat Bozkurt, M.D.

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İbrahim Tekdemir, and Murat Bozkurt

The shoulder joint, commonly known as the glenohumeral joint, is very important as it is the joint with the body highest mobile capability. The ability of movement restriction of the passive structures of the joint (joint surfaces and ligaments) is very low. The articular surfaces of the bones which take part in the joint allow a wide range of movement; on one side is the shallow glenoid cavity and on the other side, the wide humeral head. The thin and loose joint capsule, again allows a wide range of movement.

How is stability provided together with this ability for wide range of movement?

As the passive structures of the joint provide limited support for stability, active structures come into operation to be able to provide both movement and support to the joint. The active structures are the muscles surrounding the joint.

The muscles which participate actively in stability and support to the weak capsular ligaments are the rotator cuff muscles. The rotator cuff is formed by the tendons of the scapulohumeral muscles which pass anterior, posterior and superior to the joint to insert on the lesser and greater tubercles of the

humerus together with the joint capsule. Thus, they support the shoulder joint anteriorly, posteriorly and superiorly. The only part of the joint capsule that has no tendonous support is the inferior part.

Another significant structure of the joint is the glenoid labrum, which increases compatibility between the small, shallow glenoid cavity and the large spheric humeral head. The glenoid labrum is a fibrocartilaginous structure attached to the edges of the glenoid cavity. The coracoacromial arch is also a very important structure for the joint. This structure is a strong osteofibrous arch formed by the acromion, coracoacromial ligament and coracoid process which supports the shoulder joint from above.

There is a substantial amount of studies in literature explaining these structures in details. The aim of the Anatomy section of this book is to present the most appropriate viewpoints related to these anatomic structures which are critical to the shoulder joint and the relationships between the structures, for both open and for arthroscopic approaches. Therefore, detailed theoretical knowledge has been avoided, and the anatomic structures have been presented with the most convenient images on adult human cadavers in a simple and comprehensible manner.

In this chapter the shoulder joint will be evaluated from various viewpoints (Fig. 1.1–1.12).

In the right shoulder region, the skin and superficial fascial structures have been removed to present a wide view of the muscles around the shoulder joint. These muscles are seen from the front (Fig. 1.1).

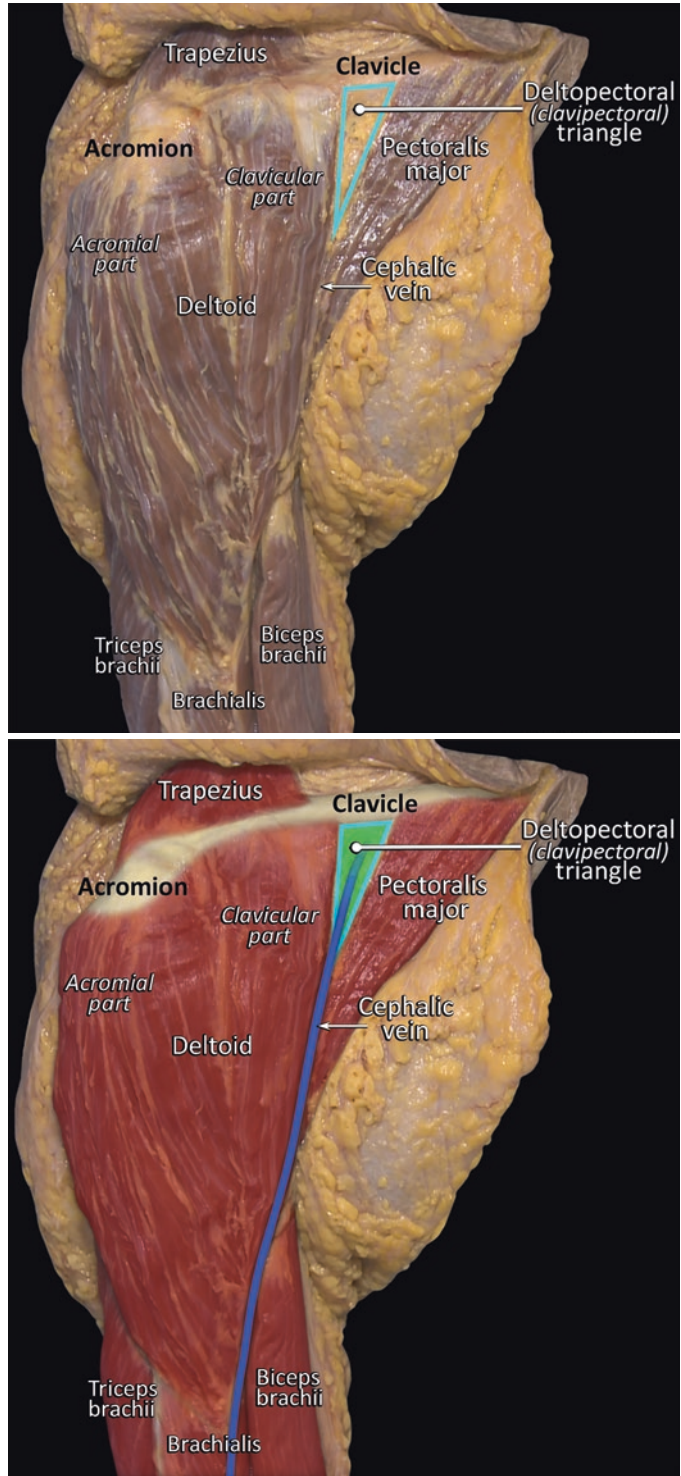
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**Fig. 1.1** Superficial muscles around the shoulder joint



The trapezius inserts on the shoulder girdle, and the parts of the deltoid which start from approximately the same region, insert on the deltoid tuberosity over the distal side on the lateral margin of the humerus. Only the clavicular head of the pectoralis major is observed on the figure (Fig. 1.1). Pectoralis major extends to the antero-lateral side of the proximal part of the humerus and inserts on the crest of the greater tubercle.

The important area here is the deltopectoral or clavipectoral triangle which lies between the clavicle, deltoid and pectoralis major. The distal part of cephalic vein was removed together with the superficial fascia. This vein passes through the triangle and extends to the axillary fossa (Fig. 1.1).

The anterior and mid sections, namely the clavicular and acromial parts of the deltoid were cut from their attachments and retracted posterior to reach the shoulder joint (Fig. 1.2).

A very important structure encountered at this level is the subdeltoid bursa. By inflating with air, the shape has become evident and the relationship with the structures surrounding the bursa is observed (Fig. 1.2). This bursa, which functions as a pillow between the deltoid and the proximal end of humerus, by usually combining with the subacromial bursa, extends as far as the level of the acromioclavicular joint (ACJ) below the acromion and coracoacromial ligament (CAL). The subdeltoid bursa extends towards the surgical neck of the humerus to as far as 4 cm to the distal from the anterolateral corner of acromion.

The coracoid process (CP), which is located below the clavicular part of the deltoid muscle, can be palpated approximately 2.5 cm below at the lateral 1/5 of clavicle. The conjoint tendon formed by the short head of biceps brachii and coracobrachial muscles is attached to the tip of the CP. With retraction of deltoid, the distal section of the pectoralis major, which inserts on the crest of the greater tubercle is visualised. The terminal part of the anterior branch of the axillary nerve, which extends below the deltoid is seen here (Fig. 1.2).

The acromion, CAL and CP form a very strong osteoligamentous girdle by supporting the shoulder joint from above. This girdle may damage the underlying structures by compressing them. The most important structure in reducing

this effect is the subacromial bursa, which shows continuity with the subdeltoid bursa.

Although not described classically; CAL, CP and the conjoint tendon should be evaluated as an important osteotendiniligamentous arch supporting the shoulder joint anterosuperiorly. While the supraspinatus inserting on greater tubercle can be compressed by acromion, subscapularis inserting on the lesser tubercle can be compressed by CP in abduction. The relationships of the structures compressing under these osteofibrous arches may partially change with rotation during abduction.

The topographical relationships and structures attaching to the coracoid process (CP) are seen. The short head of the biceps brachii and coracobrachialis form the conjoint tendon which inserts on the tip of the CP. The pectoralis minor which originates from the 3rd-5th ribs inserts over the medial edge of the CP. A little more posteriorly, a small tendon of the subclavius is also seen attaching over the medial edge of the CP. The coracoacromial ligament (CAL), which is a strong, wide structure attaches to the lateral edge of the CP. More posteriorly, two important ligaments connect the clavicle and CP and attach to the superior surface of the CP. These two ligaments are the trapezoid ligament (TL) and the conoid ligament (CL).

The infraclavicular part of the brachial plexus and the axillary vessels are seen medial to the CP (Fig. 1.3).

The entry point of anterior arthroscopic portal is immediately lateral the CP. After palpating the CP, insertion of the portal can be made through the pit just lateral to the tip of the CP without damaging the axillary neurovascular structures and the conjoint tendon attaching here.

The relationship of the subdeltoid bursa and the rotator cuff muscles is shown in the figure. Pectoralis major is seen at the anterior wall of the axillary fossa and immediately below this muscle is the pectoralis minor, and above is the subclavius (Fig. 1.3).

To better demonstrate the anterior relations of the shoulder joint, pectoralis major tendon was retracted medially by cutting its humeral insertion. The conjoint tendon was also retracted medially to reveal the subscapularis muscle and