VARIATION OF CORACOBRACHIALIS

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\textbf{ABSTRACT}

During dissection of 28 shoulders to evaluate the blood supply of the glenoid labrum a variant coracobrachialis was observed unilaterally in one cadaver. It was attached to the coracoid process and inserted into the inferior aspect of the capsule of the shoulder joint as well as the medial aspect of the superior part of the humeral shaft. As coracobrachialis is used as a flap for surgical reconstruction, for example in post-mastectomy or guidance to the location of the brachial artery and median nerve, surgeons and radiologists therefore should be aware of such variation.

\textbf{STANDARD TEXTBOOK ANATOMY}

The shape of coracobrachialis is variable: it has been reported as an elongated, rounded ridge muscle in the upper medial aspect of the anterior compartment of the arm (Standring, 2008; Moore et al., 2011). It has also been described as a thin spindle-shaped muscle (Rogers, 1992) while others have defined it as a small slender muscle (Smith et al., 1983). The textbook description of coracobrachialis describes the muscle arising from the tip of the coracoid process of the scapula via a rounded tendon (Snell, 1995, Palastanga et al., 2006; Abrahams et al., 2011) together...
with the short head of biceps brachii (Moore et al., 2011). It then runs vertically through the axilla accompanied by the short head of biceps brachii (Drake et al., 2010)

Coracobrachialis inserts via a flat tendon on a rough small linear aspect on the medial side of middle third of the humerus opposite to the deltoid tuberosity (Smith et al., 1983, Snell, 1995, Abrahams et al., 2011) between the attachment of triceps and brachialis. Additional muscle fibres may attach to the lesser tuberosity, medial epicondyle or medial intermuscular septum (Standring, 2008; Palastanga et al., 2006).

The innervation of coracobrachialis is the musculocutaneous nerve from the lateral cord of the brachial plexus (Palastanga et al; 2006). There is no agreement on the root value of the nerve in textbooks: it has been stated that C6 and C7 is the root value of musculocutaneous nerve (Palastanga et al., 2006) or C7 (Rogers, 1992) or C5 and C6 (Sinnatamby, 2006).

Coracobrachialis is active during adduction and flexion of the arm at the shoulder joint, as well as assisting in stabilization of the shoulder joint (Monkhouse, 2001; Moore et al., 2011; Faiz and Moffat, 2006). It has been emphasized that it is a weak adductor (Snell, 1995), while Sinnatamby (2006) stated that its function is not important. It may also work as a shunt muscle, with the long head of triceps and deltoid, resisting inferior shoulder dislocation (Moore et al., 2010).

Anterior to coracobrachialis is pectoralis major superiorly, the brachial vessels and medial nerve inferiorly, while posteriorly are subscapularis, latissimus dorsi, the medial head of triceps, teres major, the humerus and the anterior circumflex humeral vessels. Medially are the median and musculocutaneous nerves, as well as the 3rd part of the axillary artery with biceps brachii and brachialis laterally (Standring, 2008). Coracobrachialis can be used to find the brachial artery and median nerve, which run deep to it, and the nutrient artery of the humerus at its insertion (Moore et al., 2011).
VARIATION OF CORACOBRACHIALIS

Several studies have reported variations of coracobrachialis. In an evaluation of 13 shoulders Ogawa et al (1999) reported 11 cases with an aberrant muscle originating from the anterior aspect of the subscapularis tendon and the lesser tuberosity passing between and parallel to both heads of biceps brachii. The anterior circumflex humeral artery was anterior to the aberrant muscle in 73% and posterior in 27% of cases. In the remaining 2 cases the aberrant muscle, considered as coracobrachialis brevis, was found to arise from the coracoid process and insert into the subscapularis fascia superior to the anterior circumflex humeral vessels.

El-Naggar and Zahir (2001) observed that coracobrachialis, after arising from the coracoid process, divided into two heads with the musculocutaneous nerve between them. The first head inserted into the middle of the anteromedial aspect of the humeral shaft; the second head inserted into the tendinous origin of the medial head of triceps brachii. El-Naggar and Al-Saggaf (2004) also stated that near to the insertion of coracobrachialis was a slender tendon arising from the superficial medial aspect of coracobrachialis running inferiorly attach to the medial epicondyle forming a tendinous tunnel for the passage of the median nerve and brachial artery.

In an evaluation of 52 neonates Kopuz et al (2002) reported a 7 days old male with an accessory coracobrachialis originating from the coracoid process and capsule of the shoulder joint. It passed inferiorly parallel and medial to the short head of biceps brachii anterior to the normal coracobrachialis to insert into the antebrachial fascia and medial epicondyle of the humerus. Sugalski et al (2003) also found a bilateral coracobrachialis brevis in a 42 years old white male. It attached proximally to the coracoid process and distally to the surgical neck of the humerus: the anterior circumflex humeral vessels intervened between coracobrachialis and the short head of biceps anteriorly.
and coracobrachialis brevis posteriorly. Another study found that coracobrachialis originated from the coracoid process then divided into two heads; the muscular head inserted into the anteromedial aspect of the middle of the humeral shaft while the musculoaponeurotic head inserted into the medial intermuscular septum forming a tunnel for the passage of the brachial artery (Ray et al., 2004).

Recently, a male cadaver with an additional fusiform head of coracobrachialis arising from the base and inferior surface of the coracoid process and fusing with coracobrachialis to insert into the medial aspect of the humeral shaft was reported by Gupta et al (2012).

**CASE REPORT**

During dissection of 28 shoulders a variant of the left coracobrachialis in a 76 year old male was observed. The mean length, superior and inferior width were 54.92mm, 7.78mm, 5.59mm respectively. The textbook form of coracobrachialis was absent: there was no anatomical variation in relation to the branches of the brachial plexus, the axillary artery or the surrounding muscles.

Coracobrachialis originated from the inferior and anterior aspects of the coracoid process from a common tendinous origin with the short head of biceps brachii (figures 1, 2).

It mainly inserted into the inferior aspect of the fibrous capsule of the shoulder joint, with some fibres attaching to the medial aspect of the humeral shaft approximately 15 mm inferior to the surgical neck of the humerus (figure 2).

The muscle ran inferomedially and parallel to the short head of biceps brachii. Subscapularis was posterior, anteriorly were (from inferior to superior) the superior aspects of teres major, latissimus dorsi, pectoralis major, the anterior circumflex humeral vessels and teres minor. Medially were the brachial plexus and axillary artery, while lateral was the short head of biceps brachii (figure 1).
DISCUSSION:

Coracobrachialis variations are not common; those reported have been given different names: they have been reported with several origins, insertions and shapes. It has been referred to as an aberrant muscle (Ogawa et al., 1999), an accessory coracobrachialis (Kopuz et al., 2002), and as coracobrachialis brevis (Sugalski et al., 2003; Ogawa et al., 1999). Coracobrachialis brevis has different origins: from the subscapularis tendon and lesser tuberosity (Ogawa et al., 1999) or the coracoid process (El-Naggar and Zahir, 2001; Ogawa et al., 1999) or from both the coracoid process and fibrous capsule of the shoulder joint (Kopuz et al., 2002). In the present study coracobrachialis arose from the inferior and anterior aspects of the coracoid process with the short head of biceps undercover of pectoralis minor.

Different coracobrachialis insertions have also been observed: the anteromedial aspect of the middle third of the humerus (Drake et al., 2010; Standring, 2008; Moore et al., 2011), the medial aspect of the middle third of the humerus (El-Naggar and Zahir, 2001; Gupta et al., 2012), the intermuscular septum (Ray et al., 2004), and the anteromedial fascia and medial epicondyle of the humerus (Kopuz et al., 2002; EL-Naggar and AL-Saggaf, 2004). However in the present case coracobrachialis inserted into the inferior aspect of the fibrous capsule of the shoulder joint with some fibres attaching to the superomedial aspect of the humeral shaft.

Variable shapes of coracobrachialis has been reported: an elongated, rounded ridge (Standring, 2008; Moore et al., 2011), fusiform (Gupta et al., 2012), muscle fibres with a slender tendon (EL-Naggar and AL-Saggaf, 2004) or two heads (Ray et al., 2004). In the current study the muscle was spindle-shape with a rounded ridge.

Despite the important function of coracobrachialis in shoulder stability, and its contribution to flexion and adduction of the arm at the shoulder
joint (Monkhouse, 2001; Moore et al., 2011) some authors stated that coracobrachialis is a weak adductor and helps in flexion (Snell, 2995) while others have emphasized its function is unimportant (Sinnatamby, 2006). In the present study coracobrachialis would have an important function in shoulder stability as its contraction would counteract, anterior and inferior dislocation of the humeral head against the glenoid labrum.

Variations of coracobrachialis have functional and clinical implications. Functionally, as it is attached to the inferior aspect of the fibrous capsule of the shoulder joint, it prevents dislocation of the shoulder anteriorly and inferiorly. Clinically, during the anterior surgical approach (deltoplectoral) to the shoulder joint, surgeons should be aware of such variations to prevent confusion. Coracobrachialis can be split vertically to approach the shoulder joint taking into consideration the anterior circumflex humeral vessels which lies anterior. This study adds an unusual case study to the literature highlighting the complex variations of coracobrachialis indicating that further studies are needed.
Figure 1: Relations of coracobrachialis
Figure 2: Coracobrachialis
Bibliography


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