

# A STUDY ON VARIATION IN THE INSERTION OF CORACOBRACHIALIS MUSCLE AND ITS CLINICAL IMPORTANCE

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## ABSTRACT

**Background:** The coracobrachialis muscle morphologically represents the adductor group of muscles in the arm but such function became insignificant in man during the process of evolution. It is more important morphologically than functionally & it is known for its morphological variations.

**Aims & Objective:** Variations in the structures of the human body are of importance to clinicians while performing any surgery or procedure or in the diagnosis of certain clinical conditions. Our aim is to report the occurrence of variation in insertion of coracobrachialis muscle & to observe the relationship of its abnormal slip with the median nerve & brachial artery.

**Material and Methods:** Present study was conducted on embalmed cadavers at various medical colleges in Gujarat. The coracobrachialis muscle was dissected in both the upper extremities & observed for any abnormal slip or for any variation in insertion.

**Results:** A total of 120 upper limbs of 60 cadavers were dissected. Variation at insertion was found in four cadavers as an abnormal slip to medial epicondyle of humerus & to the deep fascia on the medial aspect of arm. [6.66 % , n = 60]

**Conclusion:** Anomalous insertion of coracobrachialis muscle may lead to compression of median nerve & brachial artery. The knowledge of such variations are of importance for surgeons, orthopaedicians, neurologists, radiologists & physiotherapists while dealing with injuries or operations around elbow joint. This muscle can also be used in muscle transplants.

**Key-Words:** Brachial Artery; Coracobrachialis; Insertion; Median Nerve

## Introduction

Usually coracobrachialis muscle arises from the apex of the coracoid process, together with the tendon of the short head of the biceps, and also by muscular fibres from the proximal 10 cm of this tendon. It ends on an impression, 3-5 cm in length, midway along the medial border of the humeral shaft between the attachments of triceps and brachialis where the nutrient foramen is located. The muscle forms an inconspicuous rounded ridge on the upper medial side of the arm. The musculocutaneous nerve usually pierces the coracobrachialis muscle.<sup>[1,2]</sup>

Morphologic variations of the coracobrachialis muscle have been known for a long time and include accessory slips that attach to the lesser tubercle, medial supracondylar ridge or medial intermuscular septum.<sup>[3,4]</sup> The muscle was described as being functionally unimportant.<sup>[2]</sup> However, the muscle has recently attracted interest with its potential use for contouring the infraclavicular area<sup>[5]</sup> or covering the exposed axillary vessels specifically in postmastectomy reconstructive operations.<sup>[6]</sup> The occasional supratrochlear spur on the anteromedial aspect of the lower humerus may be continuous with a ligament of Struther which passes to the medial epicondyle and represents the remains of the third

head.<sup>[7]</sup> The median nerve or brachial artery or both may run beneath it leading to their compression.

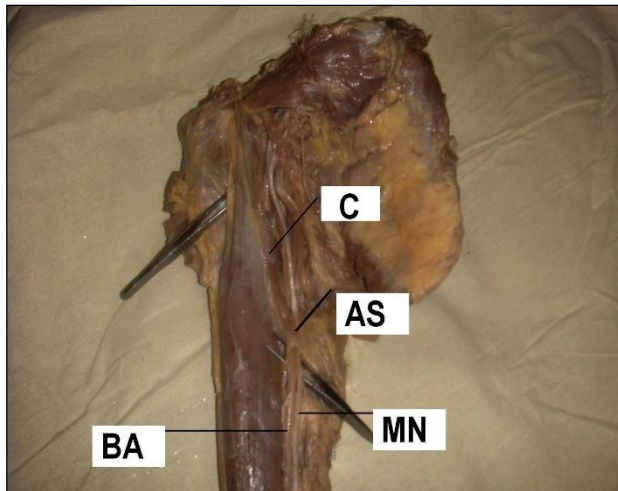
## Materials and Methods

The present study was conducted on upper limbs of 60 embalmed cadavers. They were used for dissection for first MBBS students at various medical colleges in Gujarat, West region of India. The coracobrachialis muscle in both upper limbs (right & left) was exposed after dissection according to the instructions by Cunningham's manual of practical anatomy to observe any variation in insertion or any abnormal slip from the muscle & its relation with median nerve & brachial artery.

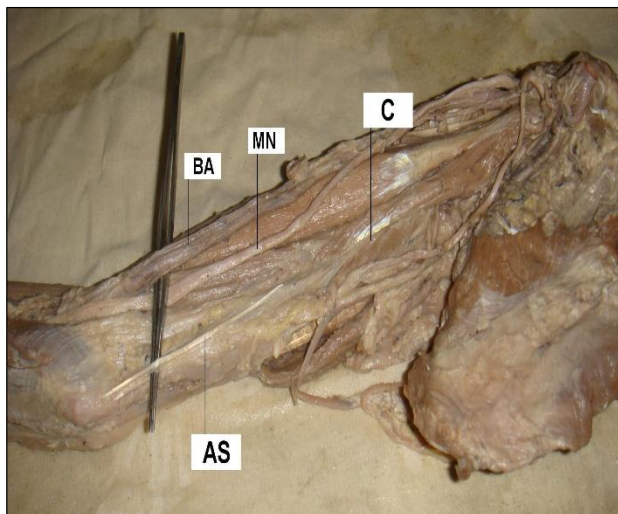
## Results

In one of the cadaver beside the usual insertion of coracobrachialis muscle into the medial border of the humerus an additional slip was found. It consists of fleshy fibres passing downward & medially in front of the median nerve & brachial artery to blend with deep fascia on the medial aspect of arm. In three cadavers we found abnormal slips extending downward & medially to the medial epicondyle of the humerus without covering the median nerve or brachial artery. The relation of the

median nerve & brachial artery were seen to be normal & the musculocutaneous nerve was arising normally from the lateral cord of brachial plexus & piercing the coracobrachialis muscle.



**Figure-1:** Fleshy fibres from coracobrachialis muscle passing over the brachial artery & median nerve. (AS-abnormal slip, BA-brachial artery, MN-median nerve, C-coracobrachialis muscle)



**Figure-2:** AS-abnormal slip from coracobrachialis, BA-brachial artery, MN-median nerve, C-coracobrachialis

## Discussion

The coracobrachialis muscle morphologically represents the adductor compartment of the arm. But its role as an adductor of the arm is insignificant in humans. In some mammals it is tricipital in origin. Upper two heads are fused which arise from the coracoid process and enclose musculocutaneous nerve between them. The lower head is usually suppressed in man. In some cases it is represented by ligament of Struther which extends from an occasional bony projection called supratrochlear spur; from the anteromedial surface of the lower part of the humerus to the medial epicondyle. In such cases the median nerve and brachial artery may pass deep to the ligament. Leading to

vascular spasm and median nerve palsy.<sup>[8]</sup> Variations of the coracobrachialis are common. The most common variation is the downward extension of its superficial part. It sometimes extends as far as medial epicondyle.<sup>[9,10]</sup>

Morphological variations in origin & insertion of muscle can be explained in terms of comparative anatomy. During the changes in locomotion pattern from reptiles to mammals, the adductor shoulder muscles became greatly reduced into the coracobrachialis muscle.<sup>[11,12]</sup> In amphibians, reptiles, and monotremes three distinct parts of the coracobrachialis muscle are described: (1) coracobrachialis brevis (profundus), which is inserted into the humerus superior to tendon of latissimus dorsi; (2) coracobrachialis medius (proprius), which is inserted into the humerus inferior to tendon of latissimus dorsi; and (3) coracobrachialis longus (superficialis) or Wood's muscle, which extends inferiorly on the shaft of humerus bridging the median nerve and brachial artery.<sup>[3,4,13,14]</sup>

The ligament of Struthers was first described as a fibrous band extending from the supracondylar (supracondyloid) process or spur on the anteromedial aspect of the humerus downwards to the medial epicondyle<sup>[7]</sup> which occurs in <2% of humans.<sup>[15,16]</sup> Supracondylar process, 2 to 20 mm in length, occasionally projects from the anteromedial surface of the shaft, proximal to the medial epicondyle. It curves distally and forwards, its apex being connected to the medial border, proximal to the epicondyle, by a fibrous band, to which part of pronator teres is attached. The foramen so formed usually encloses the median nerve and brachial artery, but sometime only nerve or perhaps nerve plus the ulnar artery in high division of the brachial artery. A groove for the artery and nerve usually exits behind the process.

It is homologue of the entepicondylar foramen of many animals and many protect the nerve and artery from compression by muscle.<sup>[1]</sup> Terry (1921) carried out manual examination of 1,000 patients and found a palpable supracondylar process in 0.7% of them.<sup>[17]</sup> At times the supracondylar process forms an arch that is homologous to the bony arch observed in the inferior part of the humerus in cats and some monkeys.<sup>[18-20]</sup> In the cat, this opening is formed completely by an arch of bone leaving and again joining the lower part of medial aspect of the shaft of the humerus.<sup>[7]</sup>

Carpal tunnel syndrome, pronator teres syndrome and anterior interosseous syndrome are three well described entrapment syndromes involving the median nerve or its branches. Compression of the median nerve and brachial

artery by accessory muscle slips leading to clinical neurovasculopathy has been reported.<sup>[21,22]</sup> On contraction, these muscles can compress the median nerve leading to its further irritation. Also, on contraction these muscles can compress both the brachial artery and brachial veins. Therefore the possibility of these muscle anomalies should be considered when in any patient, a high median palsy exists with symptoms of lower brachial artery or brachial vein compression. Also, these muscles should not be mistaken for tumors on MR imaging of the arm.<sup>[23]</sup>

Several cases of median nerve entrapment have been attributed to the presence of ligament of Struthers. The ligament of Struthers complex is well known to cause neurovascular compression syndromes.<sup>[24-27]</sup> It typically affects the median nerve and the brachial artery, or both, but several cases of ulnar nerve compression exist as well.<sup>[28]</sup> As high median nerve entrapment is uncommon, the presence of ligament of Struthers should be kept in mind as a possible cause of median nerve and brachial artery compression. It may lead to ischaemic contraction and wasting of flexor group of muscles of forearm. Smith & Fisher<sup>[25]</sup> reported a case of median nerve compression by a ligament of Struthers which originated on the humerus in the absence of any bony process. Gunther<sup>[29]</sup>, also found that the ligament can exist in the absence of a real supracondylar process, that it originates from the anteromedial humeral surface approximately 5 cm above the elbow, that it extends to the anterior part of the medial epicondyle where its fan-like insertion is clearly separate from the more superior and posterior insertion of the medial intermuscular septum.

In the present study, abnormal tendinous slips were found in three cadavers extending from coracobrachialis muscle to the medial epicondyle of humerus, and these slips did not pass over the median nerve or brachial artery. Various studies have described the compression of the median nerve and the brachial artery with anomalous muscles.<sup>[28,30-32]</sup> Paraskevas et al. Have described a variant muscle on the left side arising from the medial border of the brachialis muscle and after bridging the median nerve, the brachial artery and vein; it was fused with the medial intermuscular septum. The muscle was innervated by the musculocutaneous nerve.<sup>[33]</sup> Dharap<sup>[30]</sup> found an anomalous muscle that passed from the middle of the humerus obliquely across the front of the brachial artery and median nerve to blend with the common origin of the forearm flexor muscles, giving symptoms of high median nerve palsy together with symptoms of brachial artery compression. In our study, fleshy fibres are derived from

the coracobrachialis muscle, pass over the median nerve & brachial artery & blend with the deep fascia on the medial aspect of the arm. Nakatani et al.<sup>[22]</sup> described a rare anomaly, where the median nerve and the brachial artery passed through a tunnel formed by a third head of biceps brachii, where the nerve and artery seemed to be compressed.

This variation is important to note during the active use of coracobrachialis as a transposition flap in deformities of infraclavicular and axillary areas and in postmastectomy reconstruction<sup>[34]</sup>, during surgical intervention of the anterior compartment of the arm, such as trauma, tumour, neurovascular disease; while using coracobrachialis as a vascularized muscle for transfer for the treatment of longstanding facial paralysis.<sup>[35]</sup>

### Embryologic Explanation

The intrinsic muscles of the upper limb differentiate in situ from the limb bud mesenchyme of lateral plate mesoderm. Thereafter the muscle primordial within the different layers of the arm fuse to form a single muscle mass and some muscle primordial disappear through cell death. Failure of muscle primordial to disappear during embryologic development may be responsible for the presence of the accessory insertion of coracobrachialis muscle.<sup>[36,37]</sup>

### Conclusion

When there is suspected median nerve compression but the site is unknown, surgical exploration above the elbow is usually done retrograde, distal to proximal. The surgeon should be aware of Ligament of Struthers as well as anomalous muscles which may compress the nerve. This muscle can be used in muscle graft surgeries as it is an accessory muscle and its removal may not cause any functional problems. When the accessory coracobrachialis muscle is large, it may restrict the abduction of the arm also. It may also lead to confusions in MRI and CT scan evaluations.

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