

# Variation in the Insertion of Brachialis Muscle- A Case Report

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**Abstract:** While dissecting the right upper limb of an adult male cadaver an additional slip of brachialis muscle was found. **Normal Anatomy:** The muscle has two heads. Superficial inserting into ulnar tuberosity innervated by musculocutaneous nerve, the deep head inserts into coronoid process of ulna and supplied by radial nerve. **Embryology:** Failure of muscle primordia to disappear may account for additional heads. **Case report:** An additional slip originated from lateral aspect of superficial head, descended lateral to biceps tendon as a content of cubital fossa. Present unilaterally supplied by radial nerve. The additional slip split to enclose tendon of biceps brachii. Superficial slip passed in front and deep slip behind biceps tendon. The tendon so formed inserted into shaft of radius below the tuberosity. The superficial slip sent communicating slips to flexor digitorum superficialis muscle beneath which passed ulnar artery. **Clinical significance of additional head:** Radial component is incorporated into the action of brachialis. Communicating fibres to neighbouring muscles may compress the ulnar artery causing vascular symptoms. The presence in cubital fossa is a source of pain in compression syndrome. Vascular pedicle can be utilized in surgeries like distal biceps tendon transfer and reconstruction of ligaments of elbow joint.

**Keywords:** cubital fossa, communicating fibres, ulnar artery, compression syndrome, tendon transfer

## 1. Introduction

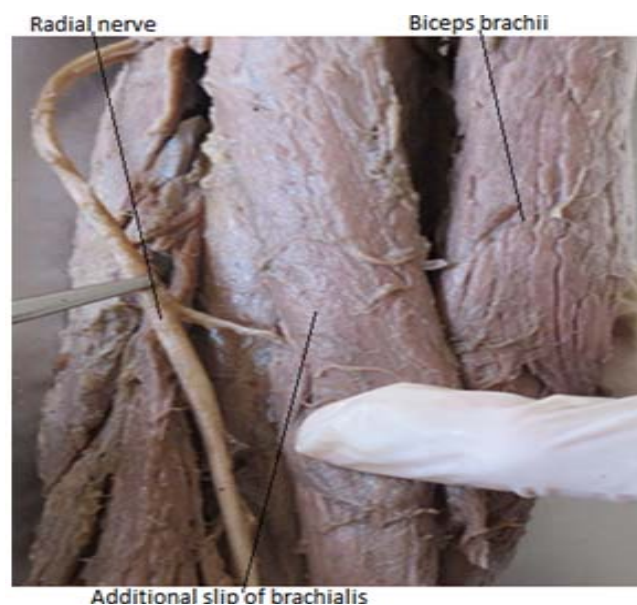
Brachialis is a muscle of anterior compartment of the arm. It arises from the lower half of the front of the humerus, starting on either side of the insertion of deltoid muscle and also from the medial intermuscular septum. Its fibres converge to a thick broad tendon which is attached to the ulnar tuberosity and to the rough impression on the anterior aspect of coronoid process of ulna.

It may be divided into two or more parts and may be fused with brachioradialis, pronator teres or biceps. In some cases it sends a tendinous slip to the radius or bicipital aponeurosis [1]. Brachialis has 2 heads, superficial and deep. The larger superficial head originate from the anterolateral aspect of the middle third of humerus and lateral intermuscular septum. Its parallel fibres run distally and terminate in a thick tendon to get inserted on to the ulnar tuberosity. The smaller deep head originate from the distal third of anterior aspect of humerus and medial intermuscular septum. Its oblique fan shaped fibres converge to insert by means of an aponeurosis onto the coronoid process of ulna. The nerve supply to superficial head is by musculocutaneous nerve and the deep head is supplied by radial nerve [2].

## 2. Case report

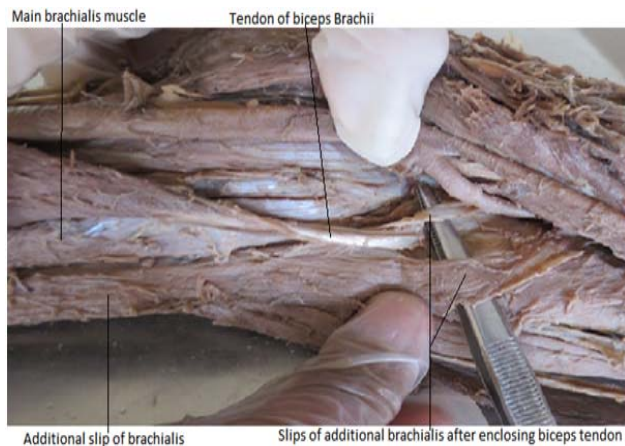
During dissection in the right upper limb of an adult male cadaver in the Department of Anatomy, Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka, an additional slip of brachialis muscle was found. It originated from the lateral aspect of the superficial head then descended downwards and medially, lateral to biceps tendon forming

one of the contents of cubital fossa. It was unilateral and innervated by radial nerve.



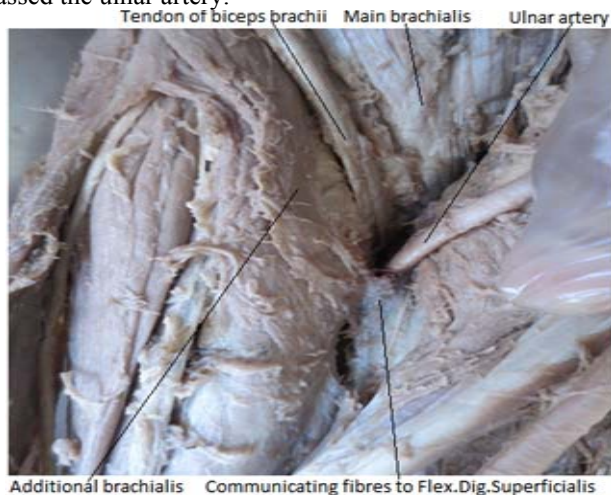
**Figure 1:** Showing additional slip of brachialis muscle innervated by radial nerve

As it descends it splits to enclose the tendon of Biceps brachii. Superficial slip passed in front and deep slip passed behind biceps tendon and they blended to form a tendon that got inserted into shaft of radius below the radial tuberosity.



**Figure 2:** Showing additional slip of brachialis muscle splitting to enclose the tendon of biceps brachii

Superficial slip gives communicating fibres to flexor digitorum superficialis muscle of forearm beneath which passed the ulnar artery.



**Figure 3:** Showing communicating fibres to flexor digitorum superficialis muscle from superficial slip beneath which passes the ulnar artery

### 3. Discussion

*Vadgaonkar et al* (2008) found an additional slip of brachialis arising from the medial aspect of the anterior surface of brachialis that descended downwards and laterally in the form of a distinct belly crossing and forming one of the content of cubital fossa beneath the bicipital aponeurosis and entered the forearm. In forearm it unites with the fibres of pronator teres muscle from radial side forming a common tendon that inserts to the middle of the lateral surface of the shaft of radius. Proximally, the tendinous fibres fused with the medial intermuscular septum forming a fibromuscular tunnel beneath which traversed the median nerve along with the brachial artery. The muscle belly was innervated by median nerve within the tunnel [3].

*Biswas et al* (2010) observed that from the distal part of brachialis muscle an accessory fleshy slip passed obliquely downwards and medially and merged with the common origin of the superficial flexors of forearm. The median nerve and brachial artery passed deep to the accessory slip which were prone for compression [4].

*Krishnamurthy A et al* (2010) reported a case of additional slip of brachialis muscle taking origin from the anteromedial surface of shaft and medial supracondylar ridge of lower end of humerus. The additional slip merged with the tendon of pronator teres before inserting on the lateral surface of the shaft of radius. Associated with the muscular variant higher division of brachial artery into radial and ulnar artery was found. The ulnar artery passed beneath the accessory brachialis muscle along with the median nerve [5].

*Muthukumar et al* (2012) found an accessory brachialis muscle that originated from the lateral intermuscular septa and blended with the main brachialis muscle. Both main and accessory muscle blended with the tendon of the biceps and got inserted into the posterior aspect of radial tuberosity with no insertion on ulna. The accessory muscle narrows the space in the cubital fossa and may compress the median nerve, brachial artery and radial artery to cause neurovascular symptoms [6].

*Sawant SP et al* (2012) observed an additional insertion of brachialis muscle on the radius bone. The origin of accessory muscle belly was from the anteromedial surface of the shaft and medial supracondylar ridge of the lower end of humerus. The accessory slip merged with the tendon of pronator teres and got inserted into the upper one third of the lateral surface of the shaft of radius. The accessory muscle belly was innervated by the musculocutaneous nerve. Median nerve and brachial artery travelled deep to the accessory muscle belly which is prone for compression syndrome. The brachialis got inserted into the radius bone and therefore can participate in pronation and supination of the forearm [7].

*Sawant SP et al* (2012) reported a case of accessory brachialis muscle taking origin from the anteromedial surface of shaft and medial supracondylar ridge of lower end of humerus and inserted into medial epicondyle of humerus. The median nerve and brachial artery pierced the muscle [8].

*Magothra R et al* (2013) reported a case in which brachialis partly inserted into the coronoid process and ulnar tuberosity and partly to the brachioradialis on the left side. Brachioradialis muscle is a flexor of forearm and arises from upper two third of supracondylar ridge of humerus and lateral intermuscular septum normally. In this case its origin receives a well-defined fibro muscular slip from brachialis. The insertion of brachioradialis is on the base of the styloid process of radius. Marked variations are rarely seen in superficial group of extensor muscle of forearm. However some workers have reported accessory muscle slips. Such variations are assigned to their various muscles by their innervation. In the present case fibro muscular sheath between insertion of brachialis and origin of brachioradialis receives a twig from radial nerve which indicates that it is a derivative of humeroradialis group of muscles. The fibromuscular slip between brachialis and brachioradialis forms a fibromuscular tunnel underneath which lies the radial nerve along with descending branch of posterior circumflex humeral artery. Medial fibres of brachialis were getting inserted at coronoid process and ulnar tuberosity of ulna and rough anterior surface of coronoid process of ulna. Lateral which was larger bundle of fibres was passing to brachioradialis muscle. So brachioradialis muscle was

getting muscular slip from brachialis along with its usual origin from upper two third of supracondylar ridge of humerus.

Brachialis muscle develops from the fusion of 2 muscular primordia. Most of it is formed from the ventral or flexor pre muscular mass (which is supplied by ventral rami of spinal nerves) and a part of it is formed from the dorsal or extensor pre muscular mass (which is supplied by dorsal rami of spinal nerves). Some author state brachialis arose only from ventral pre muscular mass and branch of radial nerve which supplies it is derived from anterior division of brachial plexus which uses radial nerve as a route to brachialis muscle by unknown mechanism. However this view has no reliable evidence. The extensor pre muscular mass in the forearm differentiates into 3 parts, of which one is a radial mass which differentiates into Brachioradialis, Extensor carpi radialis longus and Extensor carpi radialis brevis. This group of muscle is seen on the flexor side of forearm. So both brachioradialis and inferolateral part of brachialis have a common origin. Some authors consider inferolateral part of brachialis as a detached portion of brachioradialis. In the present case separation between the two muscles has not occurred which is seen as fibromuscular flap between the two, neurovascular compression can occur as radial nerve and descending branch of posterior circumflex humeral artery lie underneath the fibromuscular flap between brachialis and brachioradialis [10].

Compared with previous studies, in the present case the additional slip arose from the lateral aspect of brachialis which is similar to Muthukumar et al and Magothra et al while in rest of afore mentioned studies it arose from the medial aspect. Nerve supply in present case is by the radial nerve which is similar to Magothra et al but differed from Vadgaonkar et al where it is supplied by median nerve and in Sawant SP et al it is supplied by musculocutaneous nerve. Innervation of accessory head by the radial nerve in present case is probably due to developmental reasons. Additional slip in Vadgaonkar et al and Krishnamurthy A et al blended with pronator teres, in Biswas et al it blended with common origin of superficial flexors of forearm. In present case additional fibres blended with flexor digitorum superficialis muscle.

In present case additional slip split to enclose biceps tendon and gets inserted into shaft of radius distal to radial tuberosity. This is comparable to Muthukumar et al where the additional head got inserted into the posterior aspect of the radial tuberosity and Sawant SP et al where additional slip is inserted into upper one third of the lateral surface of the radius bone. Compression of ulnar artery by the additional slip was similar to Krishnamurthy et al.

#### 4. Embryological factors

Double nerve supply of a muscle is an indication about its composite character developmentally. In the foetal limb it consists of two portions, one occupies the flexor compartment and the other occupies the extensor compartment and consequently the two portions derive their nerve supply from two different sources [9].

In man, forelimb muscles develop from the mesenchyme of the para-axial mesoderm during 5th week of embryonic life. The precursors of the musculoskeletal lineage are derived from the myotome of the somite. Myoblasts are stimulated to migrate into the developing limb buds by several growth factors produced by cells in the proximal limb bud. These premuscle cells express adhesion molecules that are important in properly distributing them throughout the limb. The presence of an accessory slip of brachialis muscle may indicate alterations in the formation and structure of the myotome or somite, or in the distribution of the cell adhesion molecules present on the premuscle cells.

The interpretation of the nerve anomaly of the arm requires consideration of phylogeny and development of the nerves of the upper limb. The axons of spinal nerves grow distally to reach the limb bud mesenchyme. As a guidance of the developing axons is regulated by expression of chemoattractants and chemorepulsants in a highly coordinated, site-specific fashion any alterations in signal between mesenchymal cells and neuronal growth cones can lead to significant variations [4]. Failure of muscle primordia to disappear during embryologic development may account for the presence of accessory muscular bands reported in this case [5].

#### 5. Conclusion

Additional slip incorporates a radial component into the action of Brachialis. The communicating fibres to Flexor digitorum superficialis may compress the ulnar artery leading to vascular symptoms. Compression syndrome in cubital fossa could act as a source of pain. With its vascular pedicle it can be used in various surgeries like distal biceps tendon transfer and reconstruction of annular or medial collateral ligament of elbow joint.

#### 6. Acknowledgement

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