FIBROMUSCULAR TUNNEL BETWEEN BRACHIALIS AND BRACHIORADIALIS MUSCLE WITH NEUROVASCULAR ABNORMALITIES.

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ABSTRACT: Variations in origin and insertion of muscles are common in upper limb. They may or may not be associated with neuromuscular abnormalities. Being common does not lessen their importance from the point of view of orthopaedic surgeons, cardiovascular surgeons, plastic surgeons and physiotherapists. During routine dissection of a middle aged male cadaver while teaching medical students in Government Medical College Jammu, We found a not so common variation in the insertion pattern of Brachialis muscle on the left side which beside its usual insertion was inserted as a thick muscular slip to the origin of Brachioradialis. So, a fibromuscular tunnel was formed between insertion of Brachialis and origin of Brachioradialis. The Radial nerve along with descending branch of posterior circumflex humeral artery passed beneath this tunnel. In this cadaver the Profunda brachii artery was very small and remained undivided. It continued as posterior division or middle collateral artery. The anomaly reported above is rare and can lead to neural, vascular or neurovascular compression symptoms. Normal anatomy of arm and forearm seen on the right side.

KEY WORDS: Brachialis, Brachioradialis, Fibromuscular tunnel, Radial nerve, Profunda brachii artery, Anterior and Posterior circumflex humeral artery.

INTRODUCTION: Brachialis (anticus) is a muscle on the front of forearm which is the primary flexor of elbow joint. Variations in the origin and insertion of Brachialis are rare. Brachialis arises from distal half of anterior humerus starting on either side of insertion of deltoid and extending distally to cubital articular surface. It also arises from medial intermuscular septum and is inserted into the coronoid process of ulna.(1) The most frequent variations of Brachialis consists of its subdivision into two or more parts. Its insertion is also variable and may be attached to coronoid process of ulna, radius or below the tuberosity, fascia of forearm (brachiofascialis of Wood) or muscles of forearm arising from the medial epicondyle (2) In the present case Brachialis is inserted partly into the coronoid process and ulnar tuberosity of ulna and partly to the Brachioradialis muscle on the left side. Brachioradialis muscle (Supinator longus) is also a flexor of forearm and arises from upper two-third of lateral 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 styloid process of the radius. Marked variations are rarely seen in superficial group of extensor muscles of forearm (3). However some workers have reported accessory muscle slips (3,4) Such variations are assigned to their respective muscles by their innervation. In the present case the fibromuscular 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 (5, 6). The fibromuscular slip between the Brachialis and Brachioradialis forms a fibromuscular tunnel underneath which lies the Radial nerve along with

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descending branch of posterior circumflex humeral artery .No mention of this vascular relationship was found in available literature.

CASE REPORT: We report a case of possible entrapment of Radial nerve and descending branch of posterior circumflex humeral artery due to abnormal fibromuscular tunnel between Brachialis and Brachioradialis on the left side in a middle aged male cadaver. The Brachialis muscle was originating from the lower half of the front of humerus including both the Anteromedial and Anterolateral surfaces and the anterior border embracing the insertion of Deltoid and from the medial and lateral intermuscular septum. Medial fibres were getting inserted at the coronoid process and the ulnar tuberosity of the ulna and the rough anterior surface of the coronoid process of ulna. The lateral which was the larger bundle of fibers was passing to the Brachioradialis muscle So the Brachioradialis muscle was getting a muscular slip from the Brachialis along with its usual origin from the upper two-third of the supracondylar ridge of the humerus.(fig-1) . The insertion of Brachioradialis was normal that is on the base of styloid process of the radius. The course of the Radial nerve was different .To begin with it was lying posterior to the Brachial artery ,Then it left the Brachial artery by entering the radial groove on the back of the arm(humerus)along with the Profunda brachii vessel arising from the Brachial artery. In the radial groove the nerve ran downwards and laterally between the lateral and medial heads of Triceps brachii in contact with the humerus. At the lower end of the groove the nerve pierced the lateral intermuscular septum and passes into the anterior compartment along with the descending branch of posterior circumflex humeral artery which started accompanying the radial nerve in the middle of the radial groove thereby replacing the anterior division (radial collateral)of Profunda brachii artery which usually accompanies it .In the present case the Profunda brachii artery on the left side was very small in calibre and remained undivided It continued as the posterior division or middle collateral artery. In the spiral groove the Radial nerve supplied the lateral and medial heads of the Triceps brachii and Anconeus and also gave lower lateral cutaneous nerve of arm and posterior cutaneous nerve of fore arm. Below the radial; groove on the front of arm in the anterior compartment it passed below the thick muscular slip (continuation of brachialis and brachioradialis) through a facial tunnel along with the descending branch of posterior circumflex humeral artery across the lateral epicondyle into the cubital fossa. (Fig-2) Here it gave branches to Brachialis, Brachioradialis and Extensor Carpi radialis longus. It terminated by dividing into a superficial and deep branch at the level of lateral epicondyle. The branches thereafter had usual course and supply. No anomaly observed while dissecting the right upper limb.

DISCUSSION: Variations of insertion of brachialis are rare and very less literature is present about the same. Musculocutaneous nerve is the main nerve supply of Brachialis but its dorsolateral part is supplied by Radial nerve. The Musculocutaneous nerve is a branch of the lateral cord of brachial plexus formed from ventral rami of 5th, 6th and 7th cervical spinal nerves while Radial nerve is a branch of posterior cord formed from dorsal rami of 5th, 6th, 7th, 8thcervical and 1st thoracic spinal nerves. Brachialis muscle develops from the fusion of two muscular primordial. Most of it is formed from the ventral or flexor premuscular mass (which is supplied by the ventral rami of spinal nerves) and a part of it is formed from dorsal or extensor premuscular mass (which is supplied by the dorsal rami of spinal nerves).Some authors state that Brachialis arises only from the ventral premuscular

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mass and the branch of Radial nerve which supplies it, is derived from anterior division of Brachial plexus which uses Radial nerve only as route to Brachialis muscle by unknown mechanisms. However this view has no reliable evidence(7). The extensor premuscular mass in the forearm differentiates into three parts (8).

- 1) A radial mass which differentiates into Brachioradialis, Extensor Carpi radialis longus and Extensor Carpi radialis brevis. This group of muscles are seen on the flexor side of the forearm
- 2) A superficial part which forms Extensor digitorum communis, Extensor carpi ulnaris, and Extensor digiti minimi.
- 3) A deep part which is innervated by posterior interosseous nerve -Abductor pollicis longus and Extensor pollicis brevis on the radial side and Extensor pollicis longus and Extensor indicis on the ulnar side.

So both Brachioradialis and inferolateral part of Brachialis have a common origin. Some authors consider the 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 a fibromuscular band between the two.

We also noticed a vascular variation in the present case that the Profunda brachii artery which is normally a large branch of the Brachial artery was of a smaller calibre and it accompanied the Radial nerve initially that is while passing through the lower triangular intermuscular space (between long head of Triceps, shaft of humerus and Teres major) and the upper half of spiral groove and then continued as the middle collateral or posterior descending branch which had its usual course. Normally Profunda brachii artery gives:

1. Ascending or deltoid branch which anastomoses with descending branch of posterior circumflex humeral artery
2. Nutrient artery And then divides into
3. Anterior descending or Radial collateral artery
4. Posterior descending or Middle collateral artery

The posterior circumflex humeral artery which is a branch of the third part of axillary artery passes through the Quadrangular space or humero tricipital foramen(between Teres major, Teres minor, shaft of humerus and long head of Triceps) along with Axillary nerve. Its descending branch accompanies the Radial nerve in the lower part of the spiral groove and in the tunnel beneath the fibromuscular flap. Then it takes part in anastomosis around the elbow.

So there is variation of Profunda brachii and posterior circumflex humeral artery with mutual linkage. Such double variations with mutual linkage are rare but have been reported by some authors like Marek Konarik et al 2009 (9) who observed change in the status of Profunda brachii artery, which could even be said to be missing, and it was originating from posterior circumflex humeral artery (branch of axillary artery). They observed no abnormalities in their further distal course. The present case is different as Profunda brachii artery though small in calibre is arising as usual from the brachial artery and after passing through the lower triangular space continues as

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middle collateral artery, so its radial collateral branch is missing which is replaced by descending branch of posterior circumflex humeral artery.

The variations in the origin of Profunda brachii artery are quite rare as reported in the literature source available: Adachi "1928" (10). The variations of Axillary artery have attracted the attention of anatomists for over a century. Among these are Quain "1844" (11) Henle "1868" (12) Muller "1903" (13) Poynter "1920" (14) McCormack et al "1953" (15) etc., all of whom state that the deep, Brachial artery (Profunda brachii artery) which usually is a branch of Brachial artery may arise in common with posterior circumflex artery. The variant which we have observed is rare not been reported in the available literature.

SUMMARY: Anatomical variations always have an underlying cause as development arrest during intrauterine life."Ontogeny repeats Phylogeny" so variations are due to decreased evolution than usual (4). About 3% of all fractures in orthopedics are of humeral shaft (16) so understanding topography of muscles and neurovascular structures in this region is important. In the present case neurovascular compression can occur as radial nerve and descending branch of posterior circumflex humeral artery lie underneath a fibromuscular flap between Brachialis and Brachioradialis. Epidemiologically Carpal tunnel syndrome (Median nerve compression) and cubital tunnel syndrome (Ulnar nerve compression) are more common than Radial nerve compression in upper limb. Radial nerve compression can occur at any site along its anatomical course the most important site being the Arcade of Frohse. The anatomical causes of pathophysiology of nerve compression are anomalous muscles, fibrous bands and vascular plexuses. Meticulous knowledge of variations of upper limb may endow us with valuable help in management of trauma, constructive surgeries and repair of iatrogenic damages in upper limb.

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Fig-1 Dissected left upper limb showing (A) Brachioradialis, (B) Biceps Brachii, (c) Brachialis, (D), Fibromuscular band

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Fig-2 Dissected left upper limb showing (A) Radial nerve and descending branch of profunda Brachii artery, (B) Tendon of Biceps Brachii, (C) Brachioradialis, (D) Brachialis, and (E) Fibromuscular band between Brachialis and Brachioradialis.

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