

Variations in Extra heads of biceps brachii muscle: A cadaveric study -

*Mr. Veeramalla Lingaswamy, ** Dr. Surekha D Jadhav; ***Dr. B. R. Zambare; **** Dr. S. E. Pawar
*****D Suseelamma, *****Mithil Potuganti

*Assistant professor , **Associate Professor,
Professor and HOD, *Professor , *****Assistant
Professor

Address for Correspondence : Department of
Anatomy, Padamashri Dr. Vithalrao Vikhe Patil
Medical College, Ahmednagar, Maharashtra, India

Abstract : Biceps brachii muscle is the most variable muscle in the upper limb. The commonest variation is third head of biceps brachii, uncommon anomaly of the biceps having three or more heads. Knowledge of the extra heads of biceps brachii muscle may become significant in pre operative diagnosis.

Materials & Methods : This study was carried out on a total of 80 upper limbs of 40 embalmed cadavers during routine gross anatomy dissection in the Department of Anatomy at PDVVPF'S Medical College Ahmednagar. Both arms of preserved cadavers (n=80) were dissected carefully for three years, to see the site of origin, insertion and nerve supply of extra heads of Biceps brachii. **Results :** In our study we found extra heads of biceps brachii muscle in 17 upper limbs out of 80. Three heads of biceps brachii was found in 14(17%) (right-6; left-8), four headed in 2 (2.5%) unilateral (right-2), Pentaheaded1 (1.25%) upper limb (left-1). **Conclusion :** Knowledge of the extra heads of biceps brachii showing variations in its origin, becomes significant in preoperative and during surgery of the upper limbs. They may cause compression of neurovascular structures.

Key words : Biceps brachii, variations, neurovascular bundle, Extra heads.

Introduction : Biceps brachii muscle is described typically as originating as the long head originates from the supraglenoid tubercle of the scapula, and short head originates from the coracoid process of the scapula. The two heads then fuse to form a common tendon which is inserted into the radial tuberosity. The aponeurotic expansion which continues into the ante brachial fascia^[1,2].

The prime action of the muscle mainly contributes to flexion and supination of the forearm.

The musculocutaneous nerve innervates the biceps

brachii muscle^[3,4] Occurrence of the extra heads of biceps brachii is not rare and it has been mentioned in the literature. Biceps brachii has been stated as one of the muscles showing frequent anatomical variations^[5,6].

The extra head of biceps brachii muscle originated from the tendon of pectoralis minor or pectoralis major, the insertion of deltoid or coracobrachialis muscle, the greater tuberosity or the capsule of shoulder joint^[7]. The extra head of biceps brachii muscle is a common occurrence in mammals, previous studies in human beings the extra heads of biceps seen in Chinese (8%), Europeans (10%), Africans (12%), Japanese (18%) and Indians (2%)^[8,9]. The most frequent variations of Biceps brachii was in three heads, but five and even seven heads have been described^[3,10].

Extra heads may act as an additional strength to the biceps brachii muscle^[11]. Extra head may cause unusual bone displacement subsequent to fracture and such variations may have relevance in surgical procedure^[12]. Extra heads of biceps muscle may lead compression of neurovascular bundle and confuse to the surgeons^[13]. The presence of this extra heads of biceps brachii muscle may be important for research and clinical purpose, considering the clinical importance of extra heads of biceps brachii we studied.

Materials and Methods :

This present study was conducted in the department of anatomy of PDVVPF'S medical college Ahmednagar. Both arms preserved in 10% formalin of 40 cadavers (n=80) were dissected and we observed the number, origin, insertion and nerve supply of extra heads of biceps brachii.

Results:

In our study we found extra heads of Biceps Brachii (BB) muscle in 17 upper limbs out of 80. (Table no.1). In majority of cases, the third head of BB was arising from anteromedial surface of the humeral shaft in close relation to the insertion of coracobrachialis muscle. We observed two cases of third head arising from bicipital groove lateral to distal part of insertion of pectoralis major and deltoid muscle. (rt -2; lt -1) and from brachialis muscle in 4 cases (rt-2; lt -2). In one case we observed that extra head was inserted into the interosseous membrane and in three cases on bicipital aponeurosis.

In quadricipital BB muscle we observed that in one

case third head originated from antero lateral surface of humeral shaft near the insertion of deltoid muscles, while the fourth head of BB muscle was arising from bicipital groove which merged with long head of BB.

Another case we observed that the third head was arising from capsule of the shoulder joint and fourth head arising from the anteromedial side of the brachialis muscle origin. All these tendons were merged with common tendon of BB muscle. In one case third head was from capsule of shoulder joint, fourth head arise from bicipital groove just lateral to insertion of pectoralis major muscle, and fifth head from insertion of deltoid muscle. All extra heads were innervated by musculocutaneous nerve

Table-1 showing the origin of extra heads of biceps brachii muscle.

Extra heads of biceps brachii	Bilateral (no of heads)		Unilateral (no of heads)		Total	Percentage (%)
	Right	Left	Right	Left		
Tricipital	2	2	4	6	14	17.5%
Quadricipital	-	-	2	-	02	2.5%
Pentacipital	-	-	-	01	01	1.25%
Total extra heads of Bicepsbrachii					17	21.25%

Discussion:

In human body the BB muscle is the most variable muscle. It shows variations in its morphology and number of head, Extensive study have been carried out by many researches on this muscle^[1].

According to Grays^[3] anatomy the incidence of third head of BB muscle is 10%.

Khalendpour (1985)^[14] BB muscle also shows the racial variation. In white race the incidence of the extra heads are rare, high in the yellow race and intermediate in blacks. Racial difference is presence of extra heads i.e. in Chinese-8%,Europeans-10%, Africans black-12%,Japanese -18%, South Africans blacks- 20%, as compared with Africans white- 8.3%.^[9,13] The extra heads of biceps are classified according to their locations as superomedial, inferomedial and infero lateral heads^[1]. Testut (1883)^[6] described acromial, labial and supernumerary heads of biceps brachii muscle . Very

few authors observed series of biceps muscle shows variations in its origin in Indian population, and most of studies presented case reports. In our study 80 upper limbs observed and reported (17.5%) three headed variations in biceps brachii.

In the present study, we observed biceps brachii mainly arising from anteromedial surface of humeral shaft near the insertion of coracobrachialis muscle (Fig-1), insertion into the posterior aspect of the common tendon of biceps brachii muscle as mentioned by other authors.

We also reported the third head arise from bicipital groove in close relation with pectoralis major insertion. In this case the fibers of third head were joining to the deep surface of the common tendon and some fibers inserted into the bicipital aponeurosis. Asvat et al (1993)^[13] reported that the third head arising from the shaft of humerus , inferior to the common with the insertion of coracobrachialis or in common with brachialis muscle. Sweiter and Carmichael (1980)^[15] reported the incidence of third head of biceps brachii is more on the right side .

Table - 2: Showing incidence of third head of biceps brachii.

Research workers	Incidence of third head of biceps brachii (Percentage)
Kaledpour (1985) ^[14]	31.2%
Asvat et al. (1993) ^[13]	20.5% (south African black)
Asvat et al. (1993) ^[13]	8.3% (South African white)
Santo Neto et al.(1998) ^[16]	9% (Blacks)
Nakatani et al.(1998) ^[17]	8%
Kopuz et al.(1999) ^[19]	15%
Ravindranath et al.(2005) ^[20]	1.8%
Soubhagya R et al. (2006) ^[21]	2%
Rai et al. (2007) ^[22]	7.1% (Indian population)
Kumar et al (2008) ^[23]	3.3%
Poudel and Bhattarai (2009) ^[24]	12.5%(Nepalese population)
Avadhani et al.(2012) ^[25]	16.66%
Ambali et al.(2012) ^[26]	12.83% (Indian population)
Present study	17.5%

Nakatani et al^[17] observed bilateral four headed in Japanese populations in 2 out of 50 upper limbs. Nayak et al^[18] and Agarwal et al (2010)^[27] reported a case report of four headed biceps brachii muscle.

In our study we observed Four headed biceps in 2 right side upper limbs unilaterally (Fig-2).

Asvat et al (1993)^[13] Nakatani et al.(1998)^[17] reported supernumerary three, four and five headed biceps brachii muscle. In present study fifth head has been reported arising near the insertion of deltoid muscle (Fig-3).

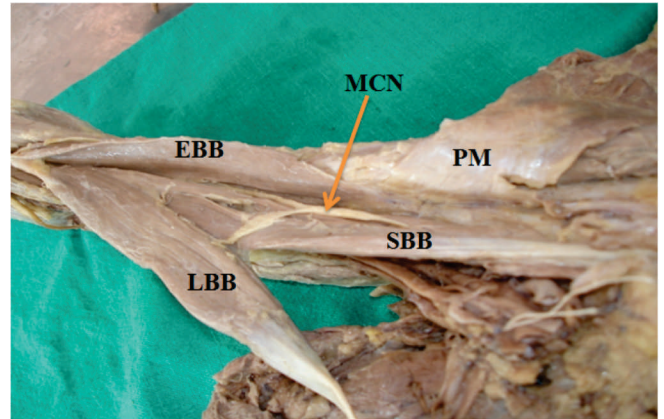
Testut^[6] reported the third head of biceps brachii as a portion of brachialis muscle supplied by musculocutaneous nerve. All extra heads were innervated by musculocutaneous nerve.

Vazquez et al(2003)^[28] reported Musculocutaneous nerve passing between supernumerary heads or supernumerary heads pierced by musculocutaneous nerve and this nerve is associated with its interconnection with median nerve. Intramuscular course compression of nerve in between heads of biceps may leads to paraesthesia and weakness of elbow flexion and supination due involvement of brachialis and nerve to long head of biceps. In this study, such communication was observed in 4 cases which is clinically important.

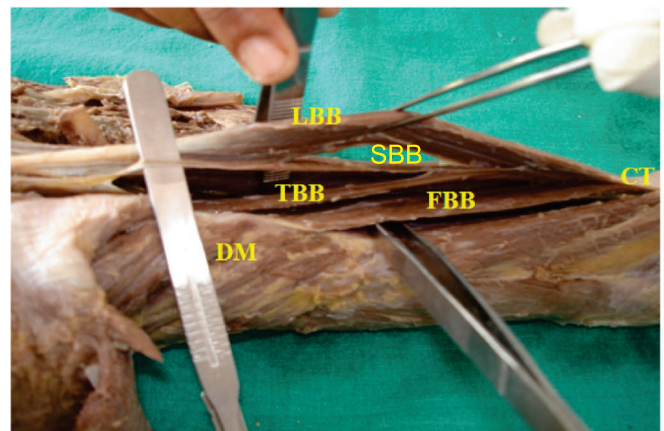
Anatomic variants that arises from persistent division between short head and long head of Biceps can be characterized with MRI knowledge of variations in the muscle is important to characterize injury to the components and to avoid pitfalls in imaging diagnosis^[29].

Conclusion : Knowledge of the extra heads of biceps brachii showing variations in its origin, becomes significant in preoperative and during surgery of the upper limbs. They may cause compression of neurovascular structures because of their close relationship to the brachial artery and median nerve. Therefore our study was attempted to highlight the extra heads of biceps brachii along with variations in its origin and is helpful for academic, surgeons, and in particular orthopedic surgeons, have to be aware of these anatomical variations of biceps brachii.

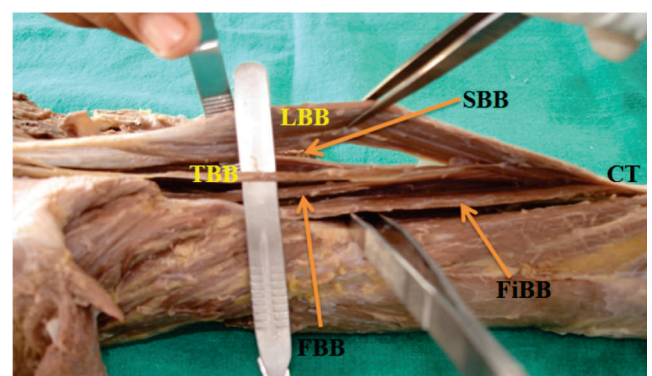
- Figure -1 Showing Extra head of biceps brachii. LBB-long head of biceps brachii, SBB-Short head of biceps brachii, EBB- extra head of biceps brachii, MCN-musculocutaneous nerve , PM-Pectoralis major muscle.



- Figure-2 Showing Four heads of biceps brachii. SBB- Short head of biceps brachii, LBB- Long head of biceps brachii, TBB- Third head of biceps brachii, FBB- Fourth head of biceps brachii, CT-Common tendon, D-Deltoid muscle.



- Figure-3 Showing Five heads of biceps brachii. LBB-Long head of biceps brachii, SBB-Short head of biceps brachii, TBB- Third head of Biceps, FBB-Fourth head of biceps , FiBB- Fifth head of biceps ,CT-Common tendon of biceps brachii.



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