

INCIDENCE OF THIRD HEAD OF BICEPS BRACHII IN INDIAN POPULATION

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ABSTRACT

Background: The biceps brachii is one of the muscles of the anterior compartment of the upper arm. It is characteristically described as a two-headed muscle that originates proximally by a long head and a short head. The present study was carried out to find the occurrence of a third head of biceps brachii among a sample Indian population.

Materials and Methods: The arms of 35 adult cadavers were dissected and observed for variations in the origin and insertion of biceps brachii muscle bilaterally.

Results: Among the 70 arms studied, three had 3-headed biceps brachii, 2 on the left and 1 on the right side. All the third heads were of humeral origin, which inserted into the radial tuberosity by a common tendon with the long and short heads.

Conclusion: Knowledge of the existence of the third head of biceps brachii may enhance pre-operative evaluation, facilitate surgical intervention within the arm and improve postoperative outcomes.

KEY WORDS: Biceps brachii, Scapula, Humerus, Radial tuberosity, Coracobrachialis.

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Access this Article online

Quick Response code



DOI: 10.16965/ijar.2015.265

Web site: International Journal of Anatomy and Research
ISSN 2321-4287
www.ijmhr.org/ijar.htm

Received: 11 Sep 2015

Accepted: 02 Oct 2015

Peer Review: 11 Sep 2015

Published (O): 31 Oct 2015

Revised: None

Published (P): 31 Dec 2015

INTRODUCTION

The biceps brachii is one of the muscles of the anterior compartment of the arm. It derives its name from its two proximally attached heads. The long head originates from the supraglenoid tubercle of the scapula and the short head

originates from the coracoid apex of the scapula. Distally, these two heads join to form a common belly above the elbow joint and insert together into the radial tuberosity through a common tendon, which has a broad medial expansion, the bicipital aponeurosis that

descends across the brachial artery to fuse with deep fascia over the origins of the flexor muscles of the forearm. It is a strong supinator and also a flexor at the elbow and is innervated by musculocutaneous nerve (C5, 6). In 10% of cases, a third head of biceps brachii arises from the supero-medial part of the brachialis and is attached to the bicipital aponeurosis and medial side of the tendon of insertion [1]. The knowledge of these variations is not only of academic interest but also of a great clinical significance for anaesthetists, surgeons and orthopaedic surgeons during selective motor nerve blocks and surgical interventions within the arm as well as to the clinicians and neurologists while treating nerve impairments. Therefore, this study was carried out with the aim to report the incidence of the third head of biceps brachii in a sample Indian population and to compare it with other racial groups from previous studies.

MATERIALS AND METHODS

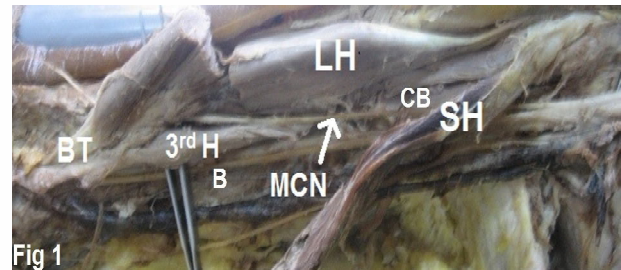
70 upper limbs of 35 human adult cadavers (30 males and 5 females) were studied in the Department of Anatomy, JNIMS, Imphal for the incidence, origin, insertion and innervation of the third head of biceps brachii. A vertical incision was made on the anterior aspect of the arm from the level of acromion to a point about 5 cm below the elbow joint. Then, two transverse incisions were made perpendicular to the upper and lower ends of this vertical incision. Skin, superficial and deep fasciae were removed to expose the biceps brachii muscle. The origin, insertion, presence of extra-head, pattern of innervation of each biceps muscle were carefully observed, recorded and photographed.

RESULTS

In the present study, the incidence of the third head of biceps brachii muscle was 4.3% (i.e. 3 out of the total 70 upper limbs studied). The variation was present unilaterally on the right side of one male cadaver (Fig 1) and the left side of two male cadavers (Fig 2 & Fig 3). Thus, 3 out of 30(10%) male cadavers had this variation. Whereas, none of the female cadavers had this variation (0%). 67% of the variant were, therefore, observed on the left side and 33% on

the right side. The third head of the biceps brachii in all three cases was arising from the anteromedial aspect of the humeral shaft in between the attachments of coracobrachialis and brachialis muscles (Fig 1, Fig 2 & Fig 3).

Fig. 1: Photograph of right arm showing the presence of the 3rd head of biceps brachii (medial view).



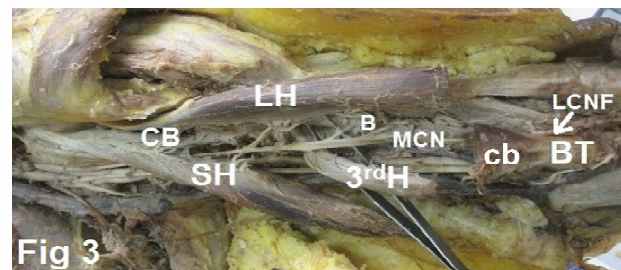
The 3rd head of biceps brachii(3rd H) originates from the anteromedial aspect of humerus in between the attachments of coracobrachialis(CB) and brachialis(B) and inserts into the common bicipital tendon (BT) formed by short(SH) and long (LH) heads of biceps brachii. Musculocutaneous nerve (MCN) is seen piercing coracobrachialis(CB).

Fig. 2: Photograph of left arm showing the presence of the 3rd head of biceps brachii (lateral view).



The 3rd head of biceps brachii(3rd H) originates from the anteromedial aspect of humerus in between the attachments of coracobrachialis(CB) and brachialis(B) and inserts into the common bicipital tendon (BT) formed by short(SH) and long (LH) heads of biceps brachii.

Fig. 3: Photograph of left arm showing the presence of the 3rd head of biceps brachii (medial view).



The 3rd head of biceps brachii(3rd H) originates from the anteromedial aspect of humerus in between the attachments of coracobrachialis(C) and brachialis(B) and forms a common belly(cb) with short(SH) and long (LH) heads of biceps brachii, which in turn, forms the common bicipital tendon (BT). Musculocutaneous nerve (MCN) is seen piercing coracobrachialis(C) and continuing as lateral cutaneous nerve of forearm (LCNF) after supplying the arm muscles including the variant 3rd head of biceps brachii.

In two cases, the third head merged with the common tendon of the other two heads which was inserted into the radial tuberosity (Fig 1 & Fig 2) while in the third case, it descended and merged with the common belly of the other two heads and formed a common tendon which was inserted into the radial tuberosity (Fig 3). All the extra heads of the biceps muscle were innervated by musculocutaneous nerve.

DISCUSSION

Testut has described the biceps brachii muscle as one of the muscles with most frequent anatomical variations [2]. The incidence of the extra heads of biceps muscle varies among the ethnic groups [3] and the appearance of these variants might be attributed to evolutionary or racial trends [4]. The incidence of the 3-headed biceps brachii is 37.5% in Colombians[3], 20.5% in South Africans blacks and 8.3% among South African whites[5], 18% in Japanese[6], 15% in Turkish[7], 8% in Chinese, 10% in white Europeans and 12% in black African[8], 21.5% in Americans[9], 7.0% in South Arabians[10]. Rai et al [11] observed that the occurrence of a third head of the biceps brachii muscle is relatively rare in the Indian population and reported an incidence of 7.1% and the present study supports this observation. However, only 4.3% incidence seen in the present study is much lower than that was reported before among the Indians and moreover, it is the lowest incidence when compared with the other racial groups.

The origin of additional head is variable. It may present as a group of accessory fascicles arising from the coracoid process, the pectoralis major tendon, head of the humerus, articular capsule of the humerus or from the shaft of the humerus itself [12]. This last variation is also known as the humeral head of the biceps brachii muscle and is a thin flattened fascicle that lies below the biceps muscle arising from the shaft of humerus, between brachialis and coracobrachialis muscles, or between the brachialis muscle and the radial groove. Sometimes, it arises from anterior surface of the brachialis muscle [3]. In the present study, the humeral head of the biceps brachii was seen in all the 3 cases of the 3-headed biceps brachii which is in agreement with the previous studies [11, 13-15] that reported that, in Indian population, the third head of the

biceps muscle was commonly taking origin from the anteromedial surface of humerus. Similar finding was also found in Turkish fetuses [7] and in South Arabian population [10].

There are varying reports regarding the side of occurrence of the third head of biceps brachii. Many studies reported that the incidence of the third head of the biceps muscle was more often seen in the right arms [3, 7, 11]. The predominance of right side of the supernumerary head of the biceps muscle might be due to the functional adaptation in the people who do more physical exercise [3]. However, in the present study, 67% of the variants were seen on the left side which is in agreement with some other studies that revealed that the occurrence of the third head of biceps muscle was more on left arms [10, 13, 14]. Further, bilateral cases of an extra head were also observed in many studies [3, 5, 9, 15]. Since there are contrasting findings regarding the side of occurrence of the third head of biceps brachii in various studies, it may be concluded that there may not be any correlation between this anomaly and the functional adaptation of the people. However, from the functional point of view, in addition to allowing elbow flexion independent of shoulder joint position, the third head of biceps brachii may enhance the strength of elbow flexion [16] and it might also enhance the supination as well as flexion of the forearm [3].

Asvat et al [5] observed that despite the relatively small female sample size in their study, a male/female comparison shows that the third head of biceps brachii is a predominantly male condition. In agreement with this observation, in the present study also, despite a small female sample size, the 3rd head of biceps brachii was exclusively observed in males with 10% incidence among the male cadavers.

Rare variations regarding the insertion of biceps have been reported [17]. A racial or a developmental factor might be the actual cause of the incidence difference of the insertion of the extra-head [10]. In most of the reported cases, it inserts into either the tendon or the aponeurosis of biceps brachii. Insertion into both may cause clinical entrapment syndrome [18, 19]. In the present study also, in 2 out of three cases, it was inserted into the tendon. However,

few studies [6, 10] reported that the highest incidence site of the extra-head insertion was into the common belly of the biceps, similar finding was observed in only one out of three cases of our study.

Similar to previous report [10, 13, 14], the present study observed that, the third head of biceps brachii was innervated by a branch from musculocutaneous nerve.

Probable causes of the third head of biceps brachii: The occurrence of the extra head of biceps brachii has been explained from different views. Embryological observations by Testut [2] described this variation of the third head of biceps brachii as a portion of the brachialis muscle supplied by the musculocutaneous nerve, in which its distal insertion has been translocated from the ulna to the radius. However, Nayak et al [20] opined that the presence of the extra heads of the biceps muscle might be caused by the presence of the circulatory factors during the time of formation of brachial plexus. From the evolutionary point of view, the presence of the third head of the biceps muscle in humans might represent the remnant of long head of the coracobrachialis of some other primates [21].

Clinical significances: No clinical manifestations were recorded in most of the limbs having a supernumerary head of the biceps muscle; therefore the supernumerary head of this muscle might be misinterpreted as being soft tissue tumour. However, in certain cases, the presence of such extra-head of biceps could produce a compression of median nerve or brachial artery in the arm [11, 22]. Moreover, because of the association of the third head with unusual bone displacement subsequent to fracture, such variation has relevance in surgical procedures [16]. On the other hand, biceps brachii has a very important role in plastic surgeries and an additional head has added value in flap surgeries [18]. Further, the knowledge regarding the presence of additional head and nerve supply is important for surgeons performing arm surgeries and clinicians for selective motor nerve blocks and to treat the nerve impairments [11].

CONCLUSION

The present study confirms the previous reports

that 3-headed biceps brachii is relatively rare in Indians and that it is predominantly a male condition but it refutes the observation that it is more common on the dominant right arm and rather, it may be concluded that there may not be any correlation between this anomaly and the functional adaptation of the people. Knowledge of the existence of the third head of biceps brachii will enhance pre-operative evaluation, facilitate surgical intervention within the arm and improve postoperative outcomes and will also facilitate the management of nerve impairments.

Conflicts of Interests: None

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How to cite this article:

Subhalakshmi Wahengbam, Renuca Karam, Kalpana Thounaojam, Elizabeth Remei. INCIDENCE OF THIRD HEAD OF BICEPS BRACHII IN INDIAN POPULATION. *Int J Anat Res* 2015;3(4):1466-1470.

DOI: 10.16965/ijar.2015.265