

A CADAVERIC STUDY OF ACCESSORY HEADS OF BICEPS BRACHII IN SOUTH INDIAN POPULATION

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ABSTRACT

Introduction: Muscular variations are comparatively less when compared to vascular variations. Biceps brachii is a muscle of the flexor compartment of the arm. It has two heads, short head and long head. The Biceps brachii muscle is known to show variations in the number of heads. The most common variation is presence of third head, but up to seven heads have been reported.

Aim: To study the incidence of accessory heads of biceps brachii in a South Indian population

Materials and Methods: The study was carried out on 50 upper limbs of 25 adult formalin fixed cadavers in the Department of Anatomy, M.S.Ramaiah Medical College, Bangalore. The presence of accessory heads, their origins, insertions and their innervations were recorded.

Result: Accessory heads of the biceps brachii muscle were found in 5 upper limbs. The supernumerary heads joined with the other two heads to form a common tendon which was inserted into the tuberosity of the radius and bicipital aponeurosis. In the present study the incidence of accessory heads of biceps brachii was 10 %.

Conclusion: Accessory heads of the biceps brachii muscle have been one of the causes of neurovascular compression, leading to erroneous interpretations during surgical procedures. Knowledge of these extra heads is important in treating injuries of the muscle and in tendon reconstruction surgeries.

KEY WORDS: Third head of biceps brachii, Supernumerary head, Accessory head.

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INTRODUCTION

Biceps brachii is a double headed muscle having short head and long head of anterior compartment of arm. It is the only flexor muscle of the arm which crosses the shoulder as well as the elbow joint. The long head originates from

the supraglenoid tubercle and short head originates from the coracoids process of scapula. Distally, these two heads join to form a common tendon which is inserted to the radial tuberosity, and some aponeurotic fibers form the bicipital aponeurosis which merges with deep

fascia of forearm. This muscle mainly contributes to supination and flexion of forearm. The Biceps brachii muscle is innervated by the musculocutaneous nerve and supplied by brachial and anterior circumflex humeral arteries [1].

Upper limb muscles presents with a wide range of variations in the form of accessory muscles, accessory heads of origin or ectopic site of origin. Occasionally accessory muscles develop and some are clinically significant. Biceps brachii muscle was described as one with frequent anatomical variations [2].

The morphological variations of biceps brachii muscle which has been reported includes absence of short head, two heads remain separate for the entire length of muscle, the muscle split for 3/4th of its course, doubled long head, presence of supernumerary or accessory heads [3]. Though several variations are reported the most common variation is in the number of heads of origin ranging from three to seven, usually three heads. The third head that is found most frequently arise from the interval between the insertion of coracobrachialis and origin of brachialis from the anterior surface of humerus [4]. Several authors reported gender and racial differences in the presence of 3rd head of biceps, Chinese 8%, European White 10%, African Black 12%, Japanese 18%, [5]. Incidence of supernumerary heads of biceps in Indians was 7.1% [4] with male preponderance of 8 to 12 % compared to females. The incidence was higher in the right arm [6].

The knowledge of accessory heads of biceps is of clinical importance as they may confuse the surgeon who performs procedures on the arm such as treatment of fracture of shaft of humerus and may lead to iatrogenic injuries or they may cause compression of important neurovascular structures in the upper limb. In the present study, the incidence of accessory head, its embryological and clinical significance has been highlighted.

MATERIALS AND METHODS

The present study was carried out on both formalin fixed 50 upper extremities of 25 human cadavers irrespective of age and sex in the department of Anatomy, M.S.Ramaiah Medical College during the period of 2013-2015.

Biceps brachii muscle was examined for the number of heads of origin, their attachments, and the level of fusion of muscle bellies and its innervation. Details of the additional heads and morphology of biceps brachii were studied and appropriate photographs were taken.

RESULTS

Fig. 1: Showing the Third Head of Biceps Brachii.

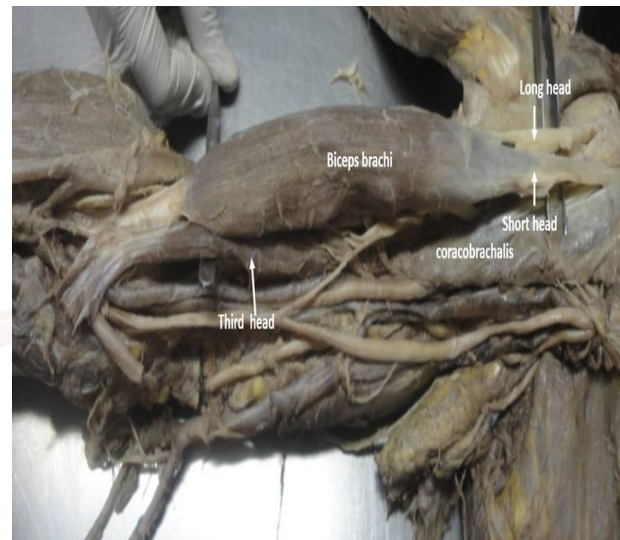
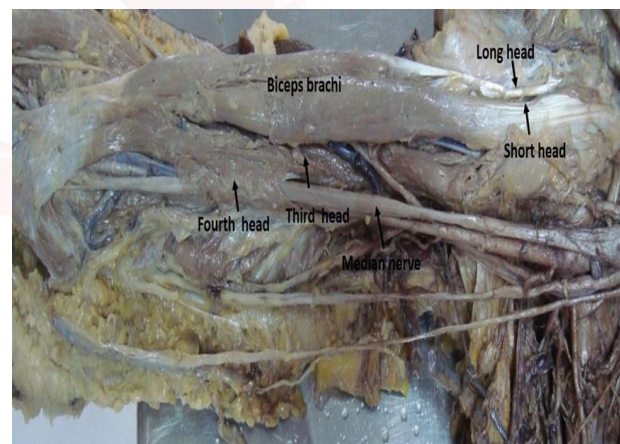


Fig. 2: Showing the four Heads of Biceps Brachii.

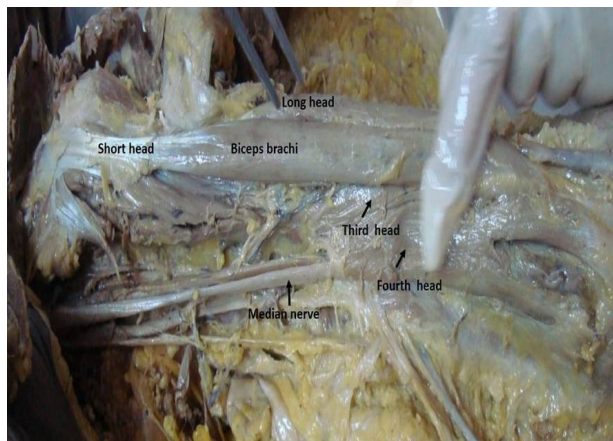


Accessory heads of the biceps brachii muscle were found in 5 out of 50 dissected upper limbs 10%. Among these five limbs, presence of three heads was observed in three right arm (6%), presence of four headed biceps bilaterally in one cadaver (4%). The supernumerary heads joined with the other two heads to form a common tendon which was inserted into the tuberosity of the radius and bicipital aponeurosis. The accessory head also received the nerve supply from musculocutaneous nerve.

Regarding the pattern of attachments of an additional head in the cases of biceps brachii with three heads, the third head originated from

anteromedial surface of humerus distal to the insertion of coracobrachialis (Fig 1). In the case where the biceps brachii with four heads was observed, its third head was arising from anteromedial surface of the humerus at the junction between the insertion of the coracobrachialis & the origin of brachialis and its fourth head was from medial intermuscular septa and a tunnel was formed by the muscle slip from an accessory heads giving passage to median nerve and brachial artery (Fig 2 and 3).

Fig. 3: Showing the four Heads of Biceps Brachii.



DISCUSSION

The biceps brachii muscle is one of the most frequent anatomical variations. The accessory head presents as a group of accessory muscle fascicles which may originate from bones like coracoid process, proximal head of the humerus or may arise from the tendon of Pectoralis major or articular capsule of the humerus [7]. Kosugi et al observed that the supernumerary head of biceps arose from the humerus between the insertion of coracobrachialis and upper part of origin of brachialis, from medial intermuscular septum, from the tendon of the pectoralis major, the deltoid tuberosity, the articular capsule, or the crest of the greater tubercle [8]. Rodriguez-Niedenfuhr et al, classified the supernumerary heads from humerus based on origin and location into superior, inferomedial and inferolateral types. The most common type of third head is described as the inferomedial type that arises from the anterior surface of humerus between the insertion of coracobrachialis and origin of brachialis [9]. In the present study it was noted that all the accessory heads were inferomedial type.

Several authors found a higher incidence of supernumerary head in males and in right arm, suspecting a functional adaptation in people who show excessive physical activity. In the present study it was noted that all the accessory heads were in male and four out of five were right side [4, 5]. The result of the present study is compared with other authors and has been tabulated in the given Table 1.

Table 1: Percentage of presence of accessory heads in different population.

	Population	Percentage
Kosugi K et.al [8]	Japanese	13.70%
Suhani S et al[10]	South Indians	15%
Lokanadham et al. [11]	South Indians	5%
IllyperumaS et al. [12]	Srilankan population	3.70%
Poudel et al. [13]	Nepalese population	90%
Asvat et al. [14]	South African black	20.50%
	South African white	8.30%
P. Kervancioglu et al. [15]	Turkish	8.30%
Present study	South Indians	10%

Embryological basis: The myogenic precursor cells that arise from ventral dermomyotome of somites induce the development of muscles of front of arm. The activation of muscle regulatory genes like Pax 3 and Myf 5 and expression of transcription factors like Myo D, myogenin and myogenic regulatory factors induces the development of muscles. Fusion of myoblast and myotubes results in growth of muscle, later are invested by connective tissue². Altered signaling or stimulus between mesenchymal cells results in variation of muscle patterns. Different views exist for the presence of supernumerary heads of biceps brachii especially the inferomedial type. According to some authors, these accessory heads of biceps may be due to the musculocutaneous nerve piercing the biceps and results in longitudinal splitting of myotubules which get a covering of connective tissue and becomes separate muscle belly. Testut suggested that supernumerary head as a portion of brachialis muscle where its distal insertion has been translocated from ulna to the radius and may enhance primarily supination and secondary flexion of the forearm. This supports the hypothesis of functional adaptation [16]. Lokanatham described that presence of accessory heads was due to the musculocutaneous nerve piercing the brachialis

muscle and producing separate head [11].

Phylogenetically, accessory head of the biceps brachii muscle is a remnant of a tuberculose-ptale" head. They are present in hylobates, but in humans and anthropoids it is a product of regression. The third head of the biceps brachii has been described as a remnant of the long head of the coracobrachialis which belong to inferiomedial type accessory head, which was noted in the present study [17].

The biceps brachii is powerful flexor of elbow and supinator of forearm. Many researchers have stated that the presence of accessory heads of biceps brachii muscle may increase its power of flexion and supination of the forearm [18].

The knowledge of accessory head is of immense importance during surgical intervention of the arm especially after humeral fracture, where they may be displacement of fracture fragments of humerus. In the present study, the neurovascular bundle was entrapped between the third head and fourth head in four headed biceps brachii. Accessory heads of the biceps brachii muscle have been one of the causes for compression of neurovascular structures because of their close relationship to brachial artery and median nerve. Such variations may confuse a surgeon who performs procedures on the arm and may lead to iatrogenic injuries [10].

The knowledge about the supernumerary head and its innervations is important for clinicians for selective motor nerve blocks, to treat the nerve impairments and for plastic surgeons as biceps brachii is used as component of flap surgery [14]. Thus surgeons should have thorough knowledge about these muscular variations during surgical procedures.

The action of Biceps brachii at three joints makes it suitable for pitching. Repetitive overhead throwing produces a significant mechanical stress on the shoulder and elbow joint. Biceps brachii can give rise to pain not only in the shoulder region in softball pitching but also towards the medial aspect of the arm due to origin of the accessory head of biceps brachii. Thus the knowledge of these variations also helps orthopaedician and physiotherapist who are dealing with sports medicine [15].

CONCLUSION

The thorough preoperative knowledge for recognizing accessory head of biceps brachii muscles will avoid operative complications that may arise from them. It is also useful in diagnosing the nerve impairments as the bulky additional heads may compress the musculocutaneous nerve. Thus the study will be useful to not only anatomist as well as surgeons, plastic surgeons, orthopaedician and physiotherapist.

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Conflicts of Interests: None

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