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SUPERNUMERARY HEADS OF BICEPS BRACHII MUSCLE IN SOUTH INDIAN CADAVERS

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SUMMARY

Biceps brachii is a muscle of the anterior compartment of the arm having a long head and a short head. Distally both heads unite to form a common tendon inserting into the radial tuberosity and the bicipital aponeurosis. Most commonly it may have an additional head but presence of four heads and more is relatively very rare. The present study documents the incidence and morphological characteristics of supernumerary head of biceps brachii in adult South Indian cadavers. We studied 40 arms of 20 adult formalin fixed cadavers in the Department of Anatomy, Kasturba Medical College, Manipal, India. The presence of number of additional heads and their details of attachments were studied. We observed presence of supernumerary heads of biceps brachii in 6 (15%) cases, in which having three heads observed in five cases (12.5%) and four heads in one case (2.5%). In one case, we noticed bilateral incidence with three heads on left side and four heads on right side. Knowledge of incidences of such variable numbers of additional heads and pattern of their attachment may facilitate the preoperative diagnosis in addition to the surgical procedures of the upper limbs.

Key words: Biceps brachii, supernumerary heads, additional heads

INTRODUCTION

Biceps brachii is one of the muscles of flexor compartment of the arm, arises by two heads (Williams et al., 2000). The short head takes origin from the tip of the coracoid process together with coracobrachialis (CB) and the long head arises from the supraglenoid tubercle of the scapula. Since the long head of the biceps is intracapsular, it also takes origin from glenoidal labrum. Both the heads after their separate origin distally unite to form a common tendon inserting into the posterior rough part of the radial tuberosity. At its site of insertion, it gives off an extension called bicipital aponeurosis. Biceps brachii is innervated by musculocutaneous nerve (MCN). It is a strong supinator when the forearm is flexed, in addition to flexion of the elbow. Human being may possess one or more additional head of biceps brachii. Biceps brachii has been stated as one of the muscles that shows frequent anatomical variations. Among those variations, an accessory head originating from the shaft of the humerus is known to be the most common anomaly (Ilayperuma et al.,2011). Existence of additional heads of biceps brachii may lead to certain clinical complications as it may mislead the surgeons operating the arm, or it may result in various nerve impairments as the bulky heads compress the neighbouring nerves (Warner et al., 1992). Previous studies on the presence of supernumerary heads of biceps brachii documented different incidences among different population (Kosugi, 1992, Kumar et al., 2008 and Kopuz et al., 1999). Hence the aim of this study is to report on the incidence and morphology of its supernumerary heads among the south Indian population.

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MATERIALS AND METHOD

Forty upper limbs of 20 formalin fixed adult (four female and sixteen male) cadavers were studied. The flexor compartment of the arm of all 40 limbs (20 right and 20 left) were dissected for the detailed study of origin, insertion and presence of supernumerary heads of biceps brachii muscle. Careful isolation of variant heads of biceps brachii was done in order to note the separate or fused origins of aberrant heads of the muscle. Detailed observations of their proximal and distal attachment in addition to their pattern of innervation were also noted. Observation was made to ensure the occurrence of supernumerary heads of biceps brachii muscles bilateral or unilateral. The percentage incidences of presence of classical two heads and also for each additional heads were calculated.

RESULTS

In all study subjects, the classical long and short heads of biceps brachii muscles had their normal attachments and relations. Out of 40 dissected upper limbs, we observed supernumerary heads in six arms (15%). Among the six cases, presence of three heads observed in five arms (12.5%) and 4 heads in one arm (2.5%). Out of five cases with the incidence of three heads, one was from female and remaining four from male cadavers. Similarly, three of which were observed in right upper limb and two in left upper limb (Table-1). We did not notice any case in which bilateral presence of three heads of the muscle. However, we observed the presence of four heads in a case with concurrent bilateral supernumerary heads of biceps brachii in which biceps with four heads was present on the right limb, and three heads on left limb.

Regarding the pattern of attachments of an additional head in the cases of biceps brachii with three heads, in four out of five cases, it took origin from anteromedial surface of humerus distal to the insertion of coracobrachialis (CB) (Fig 1). In addition to this, in two cases it also originated from medial intermuscular septa. In remaining one case, the additional third head was noted to be arising from the shaft of the humerus in common with the brachialis muscle and it is unique in our study (Fig 2).

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 CB & the origin of brachialis and its fourth head was from anteromedial surface of humerus distal to the insertion of CB and from medial intermuscular septa (Fig 3)

In all cases, irrespective of presence of number of supernumerary heads, the additional heads were inserted into conjoined tendons of corresponding biceps brachii and received nerve supply from MCN. Neither the dual fascial origins nor the dual nerve supply has been observed in the current study.

Table 1: Profile of incidence of supernumerary heads of biceps brachii muscle

Number of heads	No. of cases (n=40)	Percentage of incidences	Right arm (n= 20)	Left arm (n= 20)
2heads	34	85%	16	18
3 heads	5	12.5%	3	2
4 heads	1	2.5%	1	-

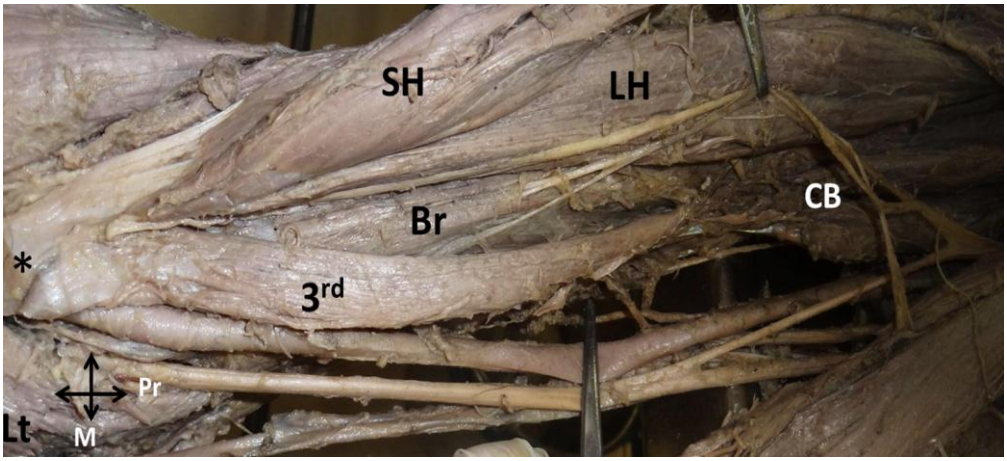

Figure 1: Showing 3rd head of biceps brachii originating from humerus distal to the insertion of coracobrachialis (**CB**). **LH**- Long head, **SH**- short head of biceps brachii, **3rd** - additional head of biceps, **Br**- brachialis, * bicipital aponeurosis.

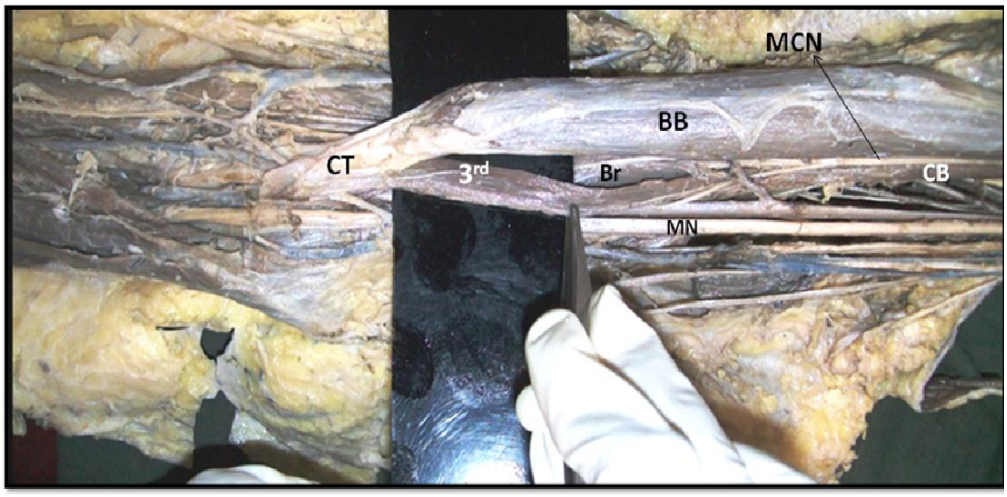

Figure 2: Showing third head (**3rd)** of biceps brachii originating in common with brachialis (Br). **BB**: Biceps brachii, **CB**- coracobrachialis, **CT**: Common tendon of biceps, **MN**: Median nerve, **MCN**: Musculocutaneous nerve

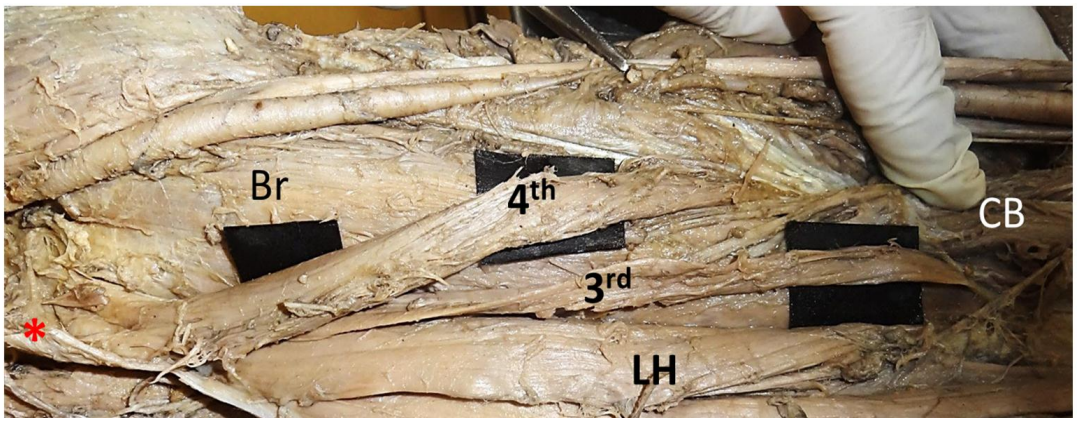

Figure 3: Showing 2 additional heads of (4 headed) biceps brachii in Right (Rt) upper limb. **LH**- Long head of biceps brachii , **SH**- short head of biceps, **3rd** – third head of biceps, **4th** – fourth head of biceps **CB**- coracobrachialis, Br- Brachialis,***** bicipital aponeurosis

DISCUSSION

Biceps brachii has been stated as one of the muscles that shows frequent anatomical variations. The most common variation is having supernumerary heads. Presence of three heads in contrary to its normal two heads is the most common incidence. (El-Naggar et al., 2001, Kumar et al., 2008 and Kopuz et al., 1999) However, biceps brachii with four, five, or even seven heads has been reported (Nakatani et al., 1998, Kosugi, 1992 and Rodríguez et al., 2003). Although different authors reported the different incidences of presence of supernumerary heads of biceps brachii with respect to different geographical regions, the occurrence of additional head of biceps is not very common [Table 2] (Kosugi, 1992, Kumar et al., 2008 and Kopuz et al., 1999). There is racial variation in the presence of biceps brachii with three heads also been documented by comparative studies between Brazilian whites and black subjects conducted by Santo Neto et al., (1998), and between South African whites and blacks by Asvat et al., (1993). Study conducted by Ilayperuma et al (2011) on Srilankan population also noticed a racial difference.

Gender differences in the occurrence of supernumerary heads of biceps brachii muscles were observed by Bergman et al., (1988), Asavat et al., (1993) and Ilayperuma et al., (2011). Their findings were in favour of being higher incidence in male than females. However, there is no specific functional explanation for these findings in terms of sex or racial differences (Asavat et al., 1993).

Reports on presence of biceps brachii with 4 heads in the available literature are scanty. Vazquez et al., (2003) reported one of such unilateral incidence in 2003. However, Nakatani et al., in 1998 reported bilateral presence of four-headed biceps brachii. In this case, a tunnel was formed by a muscle slip from an accessory head giving passage to median nerve and brachial artery. Nayak-Soubhagya et al., (2008) reported the rarest variation of concurrent presence of four headed biceps and triceps. In our study, we observed a case of presence of bilateral supernumerary heads of biceps brachii muscle with three heads on left side and 4 heads on right side.

Table 2: Incidence of supernumerary heads of the biceps brachii

Author	Population	Number of heads
El-Naggar et al., 2001	Saudi Arabia	3
Kosugi, 1992	Japanese	5
Rodríguez et al., 2003	Spain	7
Kumar et al., 2008	India	3
Kopuz et al., 1999	Turkish	3
Nakatani et al., 1998	Japan	4

The origins of the multiple heads were varied. A study conducted in Japan by Kosugi (1992) reported varied sources of origins of additional heads, which were from humerus, medial intermuscular septum, tendon of pectoralis major or the deltoid and even from articular capsule or from the crest of greater tubercle. Nevertheless, in our study we observed an additional head arising in common with brachialis muscle. Kumar et al., (2008) reported the presence of third head of biceps in 3.33% cases. In their study, they observed a bilateral presence of three heads. Regardless of number of additional heads and their varied pattern of origin, their insertion was to the tendon of the biceps and or to its aponeurosis. Kopuz et al., (1999) reported the origin of 3rd head from anterior surface of the humerus and distal to the insertion of the coracobrachialis in majority of cases as we observed in our study.

Developmentally, the third head of biceps brachii originates from the brachialis muscle and its insertion has translocated from ulna to the radius thus the nerve supply by musculocutaneous nerve as most studies reported in the literature (Testut & Laterjet, 1981). However, when the third head presents dual origin, partial innervation from the axillary nerve is also possible as the fibres of the third head intermingle with those of the deltoid (Asvat et al., 1993). Morphologically the third head of biceps brachii represents the long head of the coracobrachialis as it commonly originates from the point of insertion of coracobrachialis (Asvat et al., 1993).

Functionally, the presence of supernumerary heads in biceps brachii may enhance the strength of elbow flexion (Swieter & Carmichael, 1980) as well as may exaggerate its kinematics. Regardless of presence of number of additional heads, it is fact that, supernumerary heads of the biceps brachii muscle compressing the neighbouring neurovascular structures resulting in misinterpretations during surgical procedures (Warner et al., 1992). It may also affect the course and branching of the MCN as it occasionally winds around the muscle (Kosugi, 1992).

Conclusion: The knowledge of existence of supernumerary heads of biceps brachii may mislead the surgeons who perform surgical procedures on the arms. It may become significant in preoperative diagnosis and during surgery of upper limb as well as in diagnosing the nerve impairments as the bulky additional heads may compress the musculocutaneous nerve.

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