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### RESEARCH ARTICLE

#### A STUDY ON THE MORPHOLOGY AND VARIATIONS OF BICEPS BRACHI IN HUMAN CADAVERS

Dr. M.P. Sultana<sup>1</sup>, Dr. T. Neeraja<sup>2</sup>, Dr. D.A.V.S Sesi<sup>3</sup> and Dr. Lalitha C.<sup>4</sup>

1. Assistant Professor, Department of Anatomy, Government Siddartha Medical College, Vijayawada, Andhra Pradesh India.
2. Assistant Professor, Rangaraya Medical College, Kakinada, Andhra Pradesh, India.
3. Professor, Government Siddartha Medical College, Vijayawada, Andhra Pradesh.
4. Post Graduate, Government Siddartha Medical College, Vijayawada, Andhra Pradesh.

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#### Abstract

**Introduction:** Biceps brachii is the functionally important muscle of front of the arm. As the name indicates biceps brachii has two heads of origin and inserts on the posterior surface of radial tuberosity. Variations may be present in the form of additional heads at the origin or they may be present at its insertion. These variations may affect action of muscle and may cause compression of nearby neurovascular structures.

**Aim:** To determine the Morphology and variation in anatomy of biceps brachii with respect to its origin, insertion, length, width and distance of union of heads and its nerve supply.

**Materials and Methods:** The present study was conducted on 30 bodies 60 arms each of embalmed cadavers (including both right and left) of Department of Anatomy, Govt. Siddartha Medical College, Andhra Pradesh, India from 2019-2022. The dissection of arm was done according to standard guidelines and biceps brachii muscle was cleaned. The origin, insertion, length, width and nerve supply of biceps brachii muscle was observed and noted for any variation.

**Results:** In the present study an additional head of origin of biceps on right and left side of a cadaver were found. In present study there were variations in length and breadth of the muscle, mostly due to stature and occupation all these were noted. Nerve supply-variations were also noted. Absent MCN was observed in 2 cadavers only on one side of limb both on right side. Its distribution is carried out by Median nerve.

**Conclusion:** There are several variations seen in biceps brachii in way of origin, insertion, nerve supply which can put a surgeon in dilemma and it may result in iatrogenic injuries. Hence, it is important to have a knowledge about its variations so that such injuries can be prevented.

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#### Introduction:-

Biceps brachii is one of the muscles of the front of arm [1]. As the name indicates biceps brachii is having two heads of origin—long head of biceps arises from supraglenoid tubercle and capsule of shoulder joint and short head arises from tip of coracoid process of the scapula. It inserts on the posterior surface of radial tuberosity, after giving

**Corresponding Author:- Dr. M.P. Sulthana**

Address:- Assistant Professor, Department of Anatomy, Government Siddartha Medical College, Vijayawada, Andhra Pradesh India.

bicipital aponeurosis. This muscle is supplied by the musculocutaneous nerve. It performs screwing movement and supination at radioulnar joints. It partially flexes the elbow joint [1] and acts as strong supinator. Variations are not usual findings in biceps brachii muscle. If variations are present then they may affect action of muscle. The action of muscle may become weak or strong [2]. The length and width of the muscle and the point of fusion of 2 heads determines the action of the muscle and owes to occupation, and stature. According to their position the supernumerary heads of biceps brachii muscle are classified into superior, infero-medial and inferolateral heads [16].

Presence of extra heads may be injured by surgeons during surgeries on shoulder joint or arthroscopy of the joint, which may cause injury to neurovascular structure of upper limb [3]. Additional heads may cause bone displacement after fracture. Sometime musculotendinous slips from muscle may insert at more than one place, then it may result in independent function of each part of the muscle [4]. These variations are important and surgeons should keep in mind during surgeries. Embryologically, the development of the biceps brachii muscle may affect the course and the branching pattern of musculocutaneous nerve [5,6]. The bulky third head causes compression of the musculocutaneous nerve which leads to variable clinical symptoms. So, importance of these variations lies during surgical operations of the arm.[7].

Therefore, the clinical importance of biceps muscle motivates us to carry out this study with an aim to determine variation of biceps brachii with respect to its origin, insertion and its nerve supply.

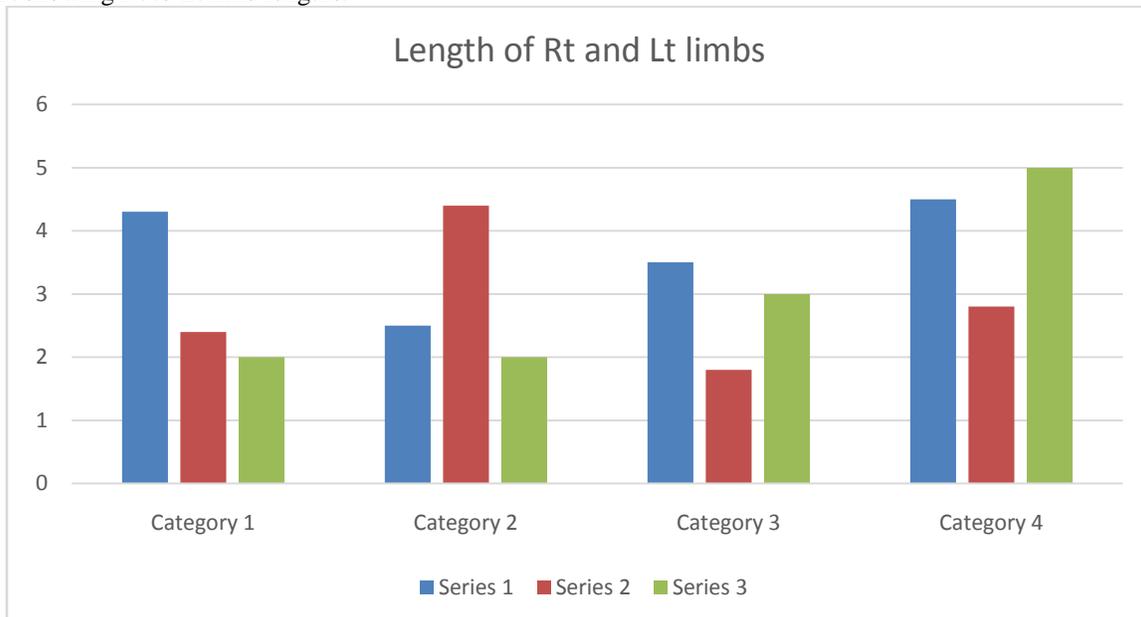
**Materials And Methods:-**

The present study was conducted on 30 bodies 60 arms each of embalmed cadavers (including both right and left) of Department of Anatomy, Govt. Siddartha Medical College, Andhra Pradesh, India from 2019-2022. The dissection of arms was done according to standard guidelines during the routine dissection before lock down and after lock down. Biceps brachii muscle was cleaned. The origin, insertion, length, was measured by thread and tape, the fusion of the fibres from their origin was also noted. Width was measured by Wernier calipers. Insertion length from origin that is bicipital tendon is also noted. Nerve supply of biceps brachii muscle was observed and noted for any variation. Details of additional heads and morphophology was done and findings noted.

**Observations:-**

Among 60 limbs the place of origin, insertion is same for 56 limbs both on right and left. The mean for total length of right limb is 34.4 cms in Rt limb and Lt. limb is 33.4 cms (Table:1). The length of biceps ranged from its origin to insertion (bicipital tendon) as 30-36 cms. Average length is 31.2 cms.

Chart showing Rt to Lt limb lengths.



The mean for length from origin to union of 2 heads is 7.5 cms on Rt. Limb and Lt limb is 7.3 cms. (Ref: 23) According to authors Jyothietal in their study the distance was 7 cms. In one limb it was noted that the union of tendons on Rt side was long about 16 cms and Lt. limb is 10Cms. {Fig: 1 } It was studied as fusion at upper 1/3<sup>rd</sup> of arm, middle 1/3<sup>rd</sup> and lower 1/3<sup>rd</sup>. We calculated the length of union from origin (Table 1). In the same cadaver on Rt limb absent MCN noticed, Coracobrachialis and biceps are supplied by Median nerve by the twigs. Even the size of lateral cord is larger than medial cord, The course was similar to MN and the Mn gave a branch which continued as lateral cutaneous nerve of fore arm (FIG:2) In cadaver number 3 on the rt side trifurcation of brachial art noted. Rest is normal. the anomaly is absent on Lt limb. FIG:3., Two cadavers – only rt limb and 16 – both limbs (table 1). Showed three heads of bicep, supplied by MCN only. The length of union of the 3 heads is very short, seen in upper one third about 3 -5 cms from origin and all 3 were united at the same place. FIG:4 The tendinous sheath of % th cadaver is seen compressing the neurovascular bundle.

Fig 1:



Fig2:



Fig 3:



Fig 4:

The chart showing Rt limb length to breadth ratio:

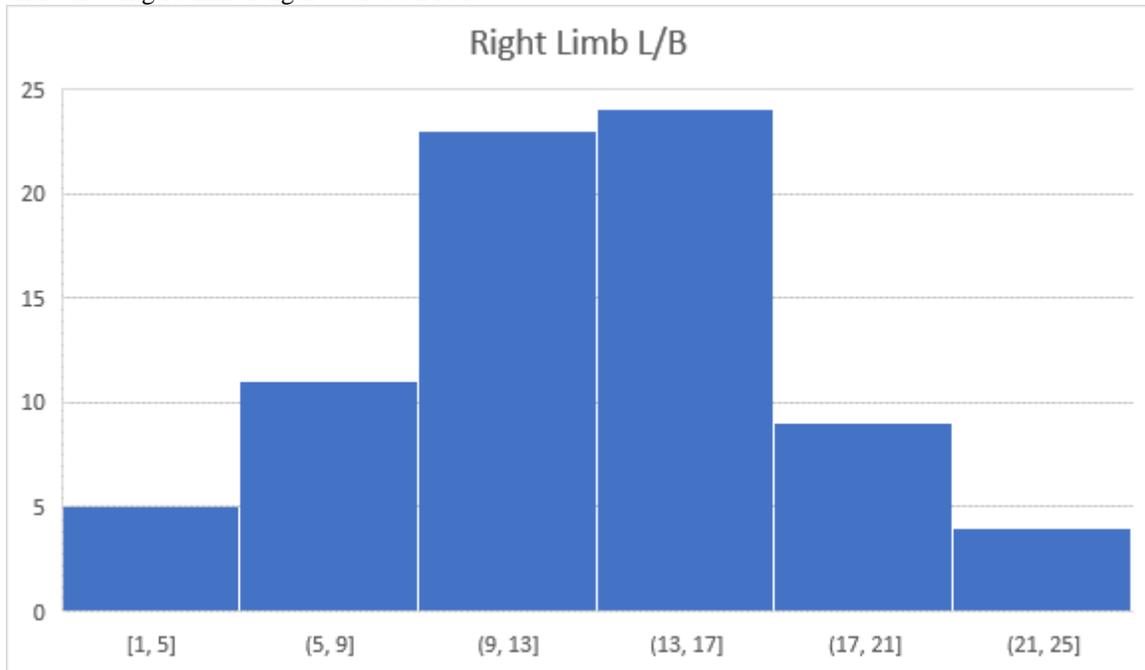
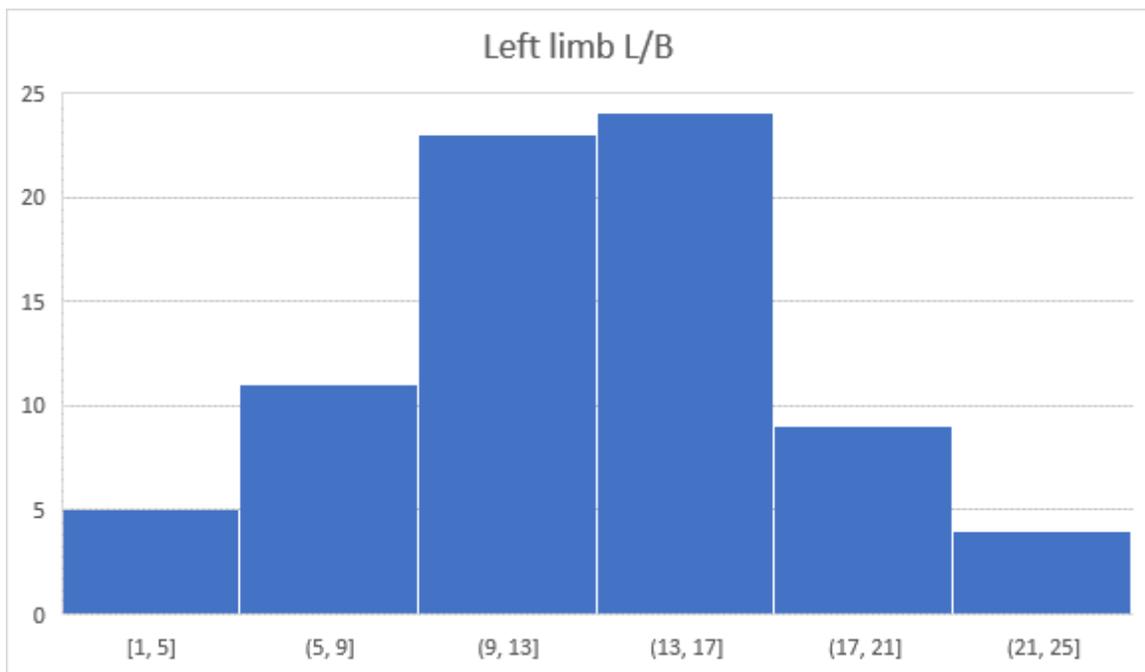


Chart Showing Lt limb L/B



**Discussion:-**

Percentage of incidence of extra third head of origin of biceps brachii is described in [Table/Fig-4]. The insertion of biceps tendon was sam3 cms in Rt limb of cadaver 5 as like others and seen compressing the NVB. The tendon of long head of biceps was inserted on radial tuberosity. This extra head was present and seen uniting with the other heads at a distance of [Table/Fig-4].In the cadaver 16 present in both limbs but united at 5 cms from origin, thus escaping the impingement of Neurovascular bundle. These additional heads of biceps brachii were supplied by the musculocutaneous nerve. In present study 96% Cadavers biceps was having two head of origin. [Table/Fig-2]:

Depicts presence of additional head (arrow) taking origin from anteromedial surface of humerus, long head (single star) and short head (double star) on left side.

Authors Incidence of extra heads of origin of biceps brachii muscle Avadhani R and Chakravarthi KK [9] 16.66% Ambali Manoj P et al., [10] 11.53% Cheema P and Singla R [11] 2.3% Kervancioglu P and Orhan M [12] 8.33% Kumar H et al., [6] 3.3% Lokanadham S and Subhadra Devi V [2] 5% Bharambe VK et al., [13] 13.3% Present study 6.25% [Table/Fig-5]:

Comparison of percentage of incidence of extra third head of origin of biceps brachii [2,6,9-13]. Is shown in Table 2. Biceps brachii muscle is supplied by the musculocutaneous nerve. This type of variation should be kept in mind to avoid pitfalls while performing reconstructive surgeries of tendon and repair in cases of avulsion. Paval J and Mathew JG reported a case in which main tendon was inserted on the radial tuberosity, while few of its fibres from the medial side, below the middle of arm created muscle belly.

Embryologically, the upper limb musculature develops from somites myotome that migrate to form the limb bud. By differential growth and apoptosis, under higher molecular regulation somites lead to muscle formation. Due to unevenness in the expression of Hoxgenes and process the variations of the muscle arise usually, therefore resulting in absence, presence or abnormal orientation of the muscle or its part [15] can be expected. Avadhani R and Chakravarthi KK observed three headed biceps brachii, and in these heads the third head was of humeral origin, which was also inserted into the radial tuberosity by forming common tendon with the long and short heads [9]. They found incidence of third head of biceps brachii and similar type of variation i.e., three headed biceps brachii was reported in present study. The incidence of additional head of origin of biceps brachii is to be as much as 10% as reported by Gray's Anatomy [1]. These findings are similar to the findings of present study. Testut L reported Acromial, labial and pectoral heads of supernumerary heads of biceps brachii [17]. In present study, inferomedial origin of biceps brachii was observed. The supernumerary bicipital head originated from the anteromedial surface of the humerus just below the insertion of coracobrachialis as observed by Abu-Hijleh MF [18]. These findings also endorsed present study findings. Gupta C and D'souza S found that the three headed biceps brachii was present unilaterally in three male cadavers, one belonging to the left side and two to right side [8]. While in present study, equal incidence of presence of additional head on the right and left side was observed. Sweiter MG and Carmichael SW reported that the incidence of the third head of the biceps was more on the right side as compared to left side [19], while equal incidence of presence of additional head of biceps brachii on the right and left side was found in present study. Musculocutaneous nerve passing between supernumerary heads, or supernumerary heads pierced by musculocutaneous nerve has been reported. This intramuscular course of musculocutaneous nerve is usually reported to be associated with its interconnection with median nerve [20]. In present study, additional heads of biceps brachii which are supplied by musculocutaneous nerve was found. The presence of communicating branch connecting musculocutaneous and the median nerve was also observed. Hsu JC et al., reported a small case series of injuries of this nerve with varied mechanism ranging from strenuous exercise to weight lifting, throwing of football etc., [21].

Biceps brachii will be useful as a component of flap surgery. In such cases the knowledge of the innervation of accessory head as well as the compression of vasculature will be very much required by surgeons [22].

Limitation(s): The present study may include larger number of cadavers but it depends upon availability of cadaver. More studies are needed to observe communicating branch between median and musculocutaneous nerve.

### **Conclusion(S):-**

The additional heads of biceps brachii may be significant in producing the strong flexion as well as supination of forearm. They may cause compression of brachial artery and median nerve. Variation of biceps brachii may confuse a surgeon who operates on the arm and which may lead to iatrogenic injuries. Presence of communicating branch between musculocutaneous and median nerve may be at risk of intermuscular compression which may result in various neural symptoms like tingling, weakness of movements, etc. The musculotendinous slip which was superficial to median nerve and brachial artery may compress these structures. The additional head may be injured in shoulder joint surgeries. Care should be taken for the same.

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