ABSTRACT

Introduction: Normally the biceps brachii arises by two heads. The anatomical variations of number of heads of biceps brachii which may be innervated by either musculocutaneous nerve or median nerve or both are most common. The knowledge of these anatomical variations is important for general surgeons, traumatologists, vascular surgeons and radiologists to avoid complications. The aim of the study was to see the variations in the number of heads of biceps brachii.

Material and Methods: 80 upper limbs from 40 adult embalmed cadavers were studied in the dissection hall, department of the Anatomy, Great Eastern Medical School and Hospital, Ragolu, Srikakulam District, Andhra Pradesh, India. The anatomical variations in the number of heads of biceps brachii and their innervations with musculocutaneous nerve or/and median nerve were observed.

Results: Out of 40 adult cadavers, 3 heads of biceps brachii bilaterally in 3 adult cadavers, and 4 heads in right arm and 3 heads in left arm in one cadaver (4th cadaver) innervated by musculocutaneous nerve were reported.

Conclusion: The awareness of these anatomical variations in the number of heads of biceps brachii guides the surgeons and radiologists to avoid complications during diagnostic and therapeutic procedures.

Keywords: Biceps brachii, Brachialis, Coracobrachialis, Median nerve, Musculocutaneous nerve.

INTRODUCTION

The biceps brachii, being one of the muscles of anterior compartment of upper arm crossing two joints (shoulder joint and elbow joint) normally arises by two heads namely long head and short head. The long head takes origin as a tendon from supraglenoid tubercle of scapula, becomes intracapsular but extrasyngival in the shoulder joint, comes out of the joint cavity by passing through the opening in the capsule above bicipital sulcus, runs downwards deep to the transverse humeral ligament within the bicipital sulcus whereas short head of biceps brachii along with upper two heads of coracobrachialis takes origin from the tip of coracoid process of scapula. The bellies of both heads of biceps brachii run side by side to join to form a single belly 7cm above the elbow joint. The belly ends as a tendon which after entering into cubital fossa rotates laterally so that the anterior surface of the tendon becomes lateral surface where as posterior surface becomes medial surface, the medial border the tendon becomes anterior border and vice versa in case of lateral border. The posterior part of lateral surface of the tendon is inserted into posterior part of radial tuberosity. A bursa intervenes between anterior part of lateral surface of tendon of biceps brachii and anterior part of radial tuberosity.1,2 Musculocutaneous nerve (MCN) which is a branch of lateral cord of brachial plexus, after piercing and supplying the coracobrachialis passes downwards and laterally between biceps brachii and brachialis where it gives branches to these two muscles. Later it emerges from the lateral border of biceps brachii 5cm above the elbow bent, runs downwards in the lower part of anterior compartment of arm, pierces the deep fascia to become continued as lateral cutaneous nerve of forearm.1,2 Median nerve (MN) formed by the medial and lateral roots of median from medial and lateral cords of brachial plexus respectively, runs lateral to the 3rd part of axillary artery and upper part of brachial artery, then crosses from lateral to medial and superficial to brachial artery to run downwards along the medial aspect of brachial artery in the lower part of anterior compartment of arm and cubital fossa. Nerve communications are more common between median nerve and musculocutaneous nerve in the axilla and in the anterior compartment of arm.1,2 Current study aimed to see the variations in the number of heads of biceps brachii.

MATERIAL AND METHODS

On routine dissection of pectoral, axillary and arm regions of 40 adult embalmed cadavers in the dissection hall, department of the Anatomy, Great Eastern Medical School, Ragolu, Srikakulam district, Andhra Pradesh, India during 2015 – 2017, 3 heads of biceps brachii bilaterally in 3 adult cadavers, 4 heads in 1 right arm and 3heads in 1 left arms in two cadavers (4th cadaver), and their innervation either with musculocutaneous nerve or median nerve or both were observed and photographed.

STATISTICAL ANALYSIS

Microsoft office 2007 was used for the statistical analysis. Descriptive statistics like mean and percentages were used to interpret the results obtained.

RESULTS

We observed the following variations in the number of heads of biceps brachii in 4 cases and their innervation by either musculocutaneous nerve or median nerve or both out of 40 adult embalmed cadavers in the dissection hall in the department of Anatomy, Great Eastern Medical School and Hospital, Ragolu, Srikakulam district, Andhra Pradesh, India.

In both arms of upper limbs of 3 adult embalmed cadavers and left arms of 4th cadaver (Figures 1 and 2), biceps brachii was seen originating by 3 heads. The long head of biceps brachii was seen originating from supraglenoid tubercle and the short head

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of biceps brachii was found originating from the tip of coracoid process of scapula in common with the origin of coracobrachialis normally. The 2 heads were joined to form a belly which ended into a tendon in the lower part of front of arm. A 3rd head was seen originating from the junction between the insertion of coracobrachialis and origin of brachialis from the anteromedial surface of shaft of humerus. The 3rd head descended downwards and laterally behind the belly and ended in a tendon to join with the above tendon formed by both long and short heads of biceps brachii. Then it was continued downwards as lateral cutaneous nerve of forearm. The level of formation, course, relations, branches and distribution of median nerve were observed normal. No communications were observed between MN and MCN.

**DISCUSSION**


In the present study, 3 heads of biceps brachii bilaterally in 3 adult cadavers, 4 heads in right arm and 3heads in left arm in one cadaver (4th) were observed. Unilateral 3 headed biceps brachii was the commonest anatomical variation to occur but bilateral 3 headed biceps brachii was also reported in 9 male cadavers out of 85 cadavers (Asvat R et al.15), 1 cadaver out of 120 cadavers (Amar Jayanthi A And Elezy MA14), 1 male cadaver out of 48 cadavers (Hitendra kumar et al.18), 1 male cadaver out of 25 cadavers (Parthasarathy BM and Sowmya S19), 1 male cadaver (Sunitha V and Narasingarao B20), 1 male cadaver (Sweiter MG and Carmichael SW16), and in 1 female cadaver (Vaishaly KB et al.19). According to these authors, this bilateral anatomical variation was found more in males than females. In the present study, bilateral tricipital origin of biceps brachii was observed in 3 male cadavers out of 40 cadavers (7.5%) and male preponderance was noted. This study coincides with the studies of the above authors (Table 1). El-Naggar MM and Zahir FI1 described that the two bellies of coracobrachialis muscle associated with the third head of biceps brachii although the coracobrachialis was found to have a normal origin, short head of biceps brachii muscle had separate bellies. In the present study, the 4th head was seen originating along with 2 bellies of coracobrachialis from the tip of coracoid process of scapula in the right arm of 4th cadaver. This study coincides with the study of above authors. The accessory third head of biceps brachii mainly arose from
antero-medial surface of shaft of humerus just lateral to the insertion of coracobrachialis as was reported by Asvat et al1 and Rodriguez- Niedenfuhr et al16, and between the bellies of biceps brachii and brachialis muscles and fused with the posterior aspect of common biceps tendon as described by Swieter and Carmichael.20 According to Kopuz et al.21, the third head of biceps brachii frequently arose from the anterior surface of the humerus distal to the insertion of the coracobrachialis muscle. Kosugi et al.9 observed that the supernumery head of biceps arose from the humerus between the insertion of coracobrachialis and the upper part of the origin of brachialis and/or from the medial intermuscular septum. He also reported that in a few cases, the biceps brachii was seen to be arising from the tendon of the pectoralis major, the deltoid, the articular capsule, or the crest of the greater tubercle. In the present study, 3rd head took origin from the anteromedial surface of shaft of humerus between the insertion of coracobrachialis and the origin of brachialis and coincides with the studies of Asvat et al.5, Rodriguez- Niedenfuhr et al.16 and Kosugi et al.9.

Embryologically there are several different opinions or explanations regarding the occurrence of variations of muscle patterns. (a) Sannes et al. (2000)52 stated that the guidance of the developing axons is regulated by expression of chemo-attractants and chemo-repulsants in a highly coordinated site specific fashion. Any alterations in signaling between mesenchymal cells of somites migrated into the developing limb buds and local mesenchyme and neuronal growth cones can lead to significant variations. (b) The accessory heads of biceps may be due to musculocutaneous nerve that pierces the brachialis muscle and produces a supernumerary head. (c) Some muscle primordia disappear through cell death despite the fact that cells within them have differentiated to the point of containing myofilaments. Failure of muscle primordia to disappear during development may result in the accessory muscles.6 Several authors found a male preponderance of accessory head and the incidence was higher in the right arm, suspecting (d) functional adaptation in people who show excessive physical activity. Ramakrishna Avadhani and Chakravarthy KK (2012)15 explained the presence of supernumery heads due to (e) genetic origin (f) an inheritance carried over from ancient origins.

According to Swieter MG and Carmichael SW (1980)20 the origin of biceps brachii from the humerus shaft may cause unusual bone displacement secondary to fracture. The biceps brachii is known for its powerful elbow flexion and supination of the forearm. It can be argued that the presence of supernumery heads of biceps brachii muscle increase its kinematics. In addition to allowing the elbow flexion irrespective of the shoulder joint position, the third head of biceps brachii may enhance the strength of elbow flexion. Biceps brachii will be useful as a component of flap surgery Mas et al. (2006).27

CONCLUSION

Anatomical variations in the number of heads of biceps brachii are most common. Compression of median nerve and brachial artery may occur when they pass among the supernumery heads of biceps brachii. Entrapment of muscle fibres of accessory heads of biceps brachii at the site of fracture of humerus may result in non-union of the fracture. Hence the knowledge of these anatomical variations is essential for neurovascular surgeons and traumatologists clinically to prevent complications.

REFERENCES


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<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the author</th>
<th>No. of arms/ cadavers studied</th>
<th>No. of cadavers with bilateral tricipital origin of biceps brachii</th>
<th>Percentage of occurrence of cadavers with bilateral tricipital origin of biceps brachii</th>
<th>Presence of total number of cadavers with bilateral tricipital origin of biceps brachii</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Asvat R et al.</td>
<td>170 arms/ 85 cadavers</td>
<td>9</td>
<td>10.58%</td>
<td>Male/ Female</td>
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<td>2.</td>
<td>Amar Jayanthi A and Elezy MA</td>
<td>240 arms/ 120 cadavers</td>
<td>1</td>
<td>0.83%</td>
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<td>3.</td>
<td>Hitendra kumar et al.</td>
<td>96 arms/ 48 cadavers</td>
<td>1</td>
<td>2.08%</td>
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<td>4.</td>
<td>Parthasarathy BM and Sowmya S</td>
<td>50 arms/ 25 cadavers</td>
<td>1</td>
<td>4.00%</td>
<td>1 male</td>
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<tr>
<td>5.</td>
<td>Sunitha V and Narsinga B</td>
<td>2 arms/ 1 cadaver</td>
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<td>100%</td>
<td>1 male</td>
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<tr>
<td>6.</td>
<td>Swieter MG and Carmichael SW</td>
<td>2 arms/ 1 cadaver</td>
<td>1</td>
<td>100%</td>
<td>1 male</td>
</tr>
<tr>
<td>7.</td>
<td>Vaishaly et al.</td>
<td>2 arms/ 1 cadaver</td>
<td>1</td>
<td>100%</td>
<td>1 female</td>
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<tr>
<td>8.</td>
<td>Present study</td>
<td>80 arms/ 40 cadavers</td>
<td>3</td>
<td>7.50%</td>
<td>3 males</td>
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Table-1: Total number of cadavers with bilateral tricipital origin of biceps brachii


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