

Morphological and Clinical Significance in Prevalence of Third head of Biceps Brachii: A Cadaveric Study

¹Dr. P.S. Zion Natha Raj, Professor, Dept. of Anatomy, Sarada Krishna Homeo Medical College, Kulasekharam, Kanyakumari.

²Dr. Anju Choudhary, Assistant Professor, Department of Anatomy, All India Institute of Medical sciences, Bathinda.

³Dr. Nego Zion, Junior Resident, Department of Orthopedics, IMS and SUM Hospital, Bhubaneswar, Odisha.

⁴Dr. Muhamed Faizal, Assistant Professor, Department of Anatomy, All India Institute of Medical Sciences, Deoghar.

Corresponding Author: Dr. Muhamed Faizal, Assistant Professor, Department of Anatomy, All India Institute of Medical Sciences, Deoghar

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Abstract

Biceps is a double headed fusiform muscle located in the flexor compartment of arm. It is responsible for powerful forearm supination and flexion of elbow joint. Here during routine gross anatomy cadaveric dissection of upper limb in the department of anatomy, Sarada Krishna Homeo Medical College, Kulasekharam, Kanyakumari, we found a case with a third head of biceps brachii in flexor compartment of left arm in a 55 year old embalmed male cadaver. We observed that the muscle belly of the supplementary head lies below the insertion of coracobrachialis and continues inferiorly to merge with the other two heads to form a common tendon to get inserted to the radial tuberosity at the left side. The muscle belly was thin as compared to the both the long and short heads of the main muscle bellies.

Median nerve and brachial artery are the main neurovascular structures present in the flexor compartment of arm. The supplementary head may lead to neurovascular compression syndromes. Abnormal biceps brachii may confuse a surgeon or traumatologists who performs surgical procedures on the arm and may lead to iatrogenic injuries. The surgeons have to keep such muscular variations in mind during upper limb surgery. Understanding of these extra heads is significant to radiologists, orthopaedic surgeons and neurosurgeons in handling injuries of the muscle and in tendon reconstruction surgeries for augment pre-operative assessment before surgical procedure in arm and improve postoperative outcomes.

Keywords: Biceps brachii, Neurovascular compression, Iatrogenic injuries.

Introduction

Biceps brachii regarded as an extrinsic muscle of arm as it crosses three joints, glenohumeral, elbow, and superior radio-ulnar joints. It has a long head from the supraglenoid tubercle within the capsule of the shoulder joint as a long narrow tendon and a short head from the apex of the coracoid process of the scapula as thick flattened tendon together with coracobrachialis. [1] Both the heads of biceps brachii join together and inserts into the radial tuberosity. They also form a broad medial expansion known as the bicipital aponeurosis, which extends across the cubital fossa and blends with the deep fascia of the forearm on the medial side where the flexor muscles originate. It is a simple flexor of the elbow and primary supinator of the forearm. [2] Muscle is innervated by musculocutaneous nerve (C5 and C6 spinal cord segments) [3], supplied by brachial and anterior circumflex humeral artery. [4,5] Occasional presence of a third head arising from the superomedial part of brachialis has been reported. [6,7] More than three heads of biceps brachii have also been reported. [8,9,10]

As reported by previous studies, additional heads of biceps brachii can be correlated to clinical as well as surgical practice. Unusual bone displacement during fracture of humerus, [11,12] neurovascular compression, [13,14,15], and Duran et al. Proclaimed that chances of iatrogenic injuries are high during surgical procedures of the upper limb. [16] The aim of this report is to describe and study the gross anatomical features and morphology of additional head of biceps brachii.

Case study

55 years male cadaveric upper extremities of both sides preserved in 10% formalin was dissected for the undergraduate teaching purpose in the Sarada Krishna

Homeo Medical College, Kulasekharam, Kanyakumari Dist; Tamil Nadu. Dissection was carried out layer by layer following skin, brachial fascia to expose the origin and insertion of anterior compartment muscles especially biceps brachii along with all other related structures in the supine position. Variation of biceps brachii in the form of third head was found unilaterally in the anterior compartment of the left side arm (Figure-1). Gross anatomy of the supplementary head of biceps brachii was examined. No other abnormality was observed in the limb.



Figure 1: dissected sample with variation of biceps brachii, showing fusion of third head along with long and short heads on left male cadaver.

Supplementary head appeared to be flat muscular belly and originated from the anteromedial surface of the humerus distal to the insertion of coracobrachialis and proximal to the origin of brachialis (Figure-1). Fibers were noted to also arise from the medial intermuscular septum. Additional head was observed to run downwards and to join with main bulk of muscle before formation of tendon and broad triangular membranous medial expansion the bicipital aponeurosis.

Its length, breadth and thickness were measured (Table-1).

Sn.	Muscle	Length (in cm)	Breadth (in cm) 14 cm from tip of coracoid process	Thickness (in mm) 14 cm from tip of coracoid process
01	Long head	28.5	1.6	7 mm
02	Short head	23.5	1.3	5 mm
03	Third head	10.5	0.4	2 mm
04	Distal Tendon	4.7	-	-

Table 1: Showing length, breadth and thickness of long, short and third head of biceps brachii.

Median nerve and brachial artery were found medially to the additional head (Figure-1). Blood supply and nerve innervations of the additional head were distinguished. Third head have direct blood supply from brachial artery. Hence it can be considered as separate muscle belly. All heads were found innervated by the Musculocutaneous nerve (Figure-2). We did not observe any other variations of the muscles of arm and forearm. Variations of biceps brachii muscle and associated relations were photographed and documented.



Figure 2: Photograph of the dissected sample of musculocutaneous nerve (Yellow arrow) showing its branches to long, short heads and third head.

Discussion

Muscle variations in upper and lower extremity are not uncommon. Ghatak et al. Reported that incidence of third head of biceps femoris in lower limb. [17] In addition to that many researchers reported Biceps brachii also exhibits extensive sequence of variations. [7, 18] Anatomists, neurologist and surgeons are very much interested in changes of the arm region due to neurovascular and orthopedic involvement.

Long and short head of biceps brachii normally originate from supra glenoid tubercle and coracoid process of scapula respectively. Both bellies unite and form cord like tendon and flat aponeurosis which attach to the radial tuberosity and antebrachial fascia respectively. [19]

Ek ET et al. And Coratella G et al. Reported short head assist forearm pronation and long head helps in flexion of elbow. [20,21] Supernumerary third head may increase the muscle mass. Asvat R et al. And Kao CH et al. Confirmed that large muscle mass is significant in strong muscular power in pre-frail community-dwelling

older adults. [22,23] This should be legitimate in current case. Hence additional muscle belly may produce strong flexion as well as supination movement of forearm and strengthened elbow joint more than normal ones.

Current study found that the third head originated from the middle of the humerus at its anteromedial surface as well as medial inter muscular septum between coracobrachialis and brachialis. Similar findings were reported in recent researches. [9,24]

The supernumerary third head of biceps brachii muscle variation explained in the light of embryogenic development. Upper limb bud derived from activation of lower six cervical and upper two thoracic segments of mesenchyma of the lateral plate mesoderm. At 5th week of development, mesoderm condenses to form ventral and dorsal muscle masses. All muscles develop from these masses. During this condensation period, supplementary head of biceps brachii may have formed. [25]

Gupta C et al. Reported that unusual bone displacement after fracture of humerus observed in the presence of the third head of biceps brachii. [12] Hence awareness of such variation is applicable in orthopaedic surgical procedures.

Knowledge of the existence of the third head of the biceps brachii may become significant in preoperative diagnosis and during surgery of the upper extremity to avoid complications during and after surgical procedures. Szewczyk et al. Reported that, additional head of biceps brachii can be used for flap surgeries and plastic surgeries due to its flexibility rather than that the long and short heads. [26]

Kervancioglu et al. Reported that unilateral variations in the biceps brachii can produce dissymmetry of arm region. [27] It can be confused with pathological

conditions such as tumours as quoted by Bansal et al. [28]

Musculocutaneous and median nerve compression may become more significant in hypertrophied additional biceps brachii muscle in body builders and heavy lifting workers. The presence of nerve compression may occur between third head and other bellies of biceps brachii muscle. In addition, these slips may produce paresthesia and ischemic vascular symptoms due to neurovascular bundle compression because of their close relationship to brachial artery and median nerve. Such clinical neuro vasculopathy has been found in literature. Signifying such clinically pertinent aspects of this anatomic disparity, our reporting is considerable.

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