

Bilateral Three-headed Biceps Brachii Muscle and its Clinical Implications

Abstract

Biceps brachii muscle frequently exhibits variant morphology in terms of origin, insertion, and mode of innervation. Nevertheless, the three-headed biceps brachii is described to be the most common variation. During routine cadaveric dissection, we came across a unique case of tricipital biceps brachii present on both the sides and variant course and branching pattern of musculocutaneous nerve. The third-headed biceps brachii emerged from the deep investing fascia of the brachialis muscle on both the sides. The musculocutaneous nerve (MCN) did not pierce the coracobrachialis muscle on the right side and terminated by supplying the muscles of the anterior compartment of the arm. However, a normal course was pursued by the MCN on the left side. Thus, scrupulous knowledge of the variant morphology of the biceps and associated structures may facilitate preoperative diagnosis and management of the upper limb diseases and circumvent iatrogenic injuries.

Keywords: *Musculocutaneous nerve, supernumerary heads, third head of biceps brachii, variant*

Introduction

The biceps brachii is a dominant muscle of the anterior compartment of the arm and is characteristically illustrated as a large, fusiform muscle with two heads.^[1] The short head originates from the tip of the coracoid process, and the intracapsular tendon of long head arises from the supraglenoid tubercle of the scapula. The two tendons lead into closely applied elongated bellies to terminate in a flattened tendon about 7 cm from elbow joint and get inserted into the rough posterior area of the radial tuberosity. The tendon gives a broad medial expansion, the bicipital aponeurosis, which merges with the antebrachial fascia.^[2]

Biceps brachii is one of the most variable muscles in the body showing variant morphology and attachments. The most frequently reported variation is the biceps with three heads of origin, though up to six heads have been documented. The third head of biceps generally arises from the humerus between the attachments of the coracobrachialis and the brachialis muscles. However, it can originate from the tendon or fascia of the neighboring muscles, the intermuscular septum, the capsule of the shoulder joint and the neck, lesser tuberosity or the anteromedial surface of the humerus. The occurrence of the

supernumerary head of the biceps brachii is also often coupled with variations of MCN which may incorporate a peculiar branching pattern, the absence of the nerve or its duplication.^[1]

Meticulous knowledge of the variant morphology of the biceps brachii (BB) muscle is vital, as they may confuse surgeons during upper limb operations or they may cause compression of adjacent neurovascular structures.^[3] We report an important variation of BB muscle exhibiting bilateral three heads of origin and unilateral variant course of the musculocutaneous nerve (MCN).

Case Report

During routine cadaveric dissection of the upper limbs of a 64-year-old male who donated his body voluntarily, we observed variant biceps brachii with three heads of origin. The third head of the biceps brachii (THB) originated from the anterior investing fascia of the brachialis muscle on the right side [Figure 1]. The origin of the THB extended from the insertion of coracobrachialis to 3 cm above the elbow joint. After arising from the brachialis fascia, the THB traversed deep to the tendon of biceps to finally blend with it. The common tendon then inserted into the rough posterior area of the radial tuberosity, and bicipital aponeurosis merged with the

**Sandeep Saluja,
Sushant Swaroop
Das¹,
Dinesh Kumar¹,
Preeti Goswami¹**

*Department of Anatomy,
GS Medical College and
Hospital, Hapur, Uttar Pradesh,
¹Department of Anatomy,
Maulana Azad Medical College,
New Delhi, India*

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Address for correspondence:

*Dr. Sandeep Saluja,
Department of Anatomy,
GS Medical College
and Hospital, Pilkhuwa,
Hapur - 245 304,
Uttar Pradesh, India.
E-mail: sandeep.saluja1980@
gmail.com*

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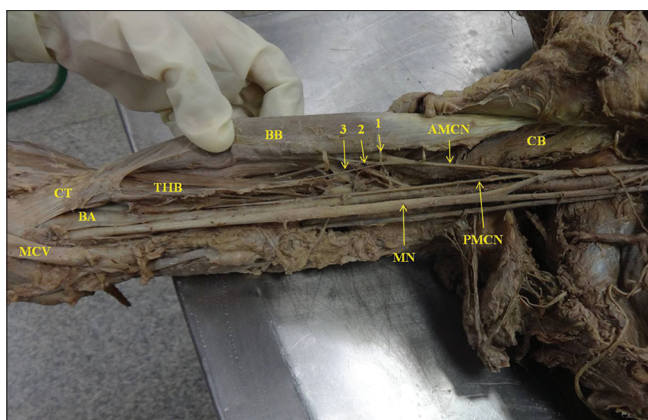


Figure 1: Dissection of right arm showing third head of biceps (THB) and musculocutaneous nerve dividing into anterior (AMCN) and posterior (PMCN) branches. AMCN is dividing into three branches (1, 2, 3). (BB: Biceps brachii muscle, CT: Common tendon of biceps brachii, CB: Coracobrachialis muscle, MN: Median nerve, BA: Brachial artery and MCV: Median cubital vein)

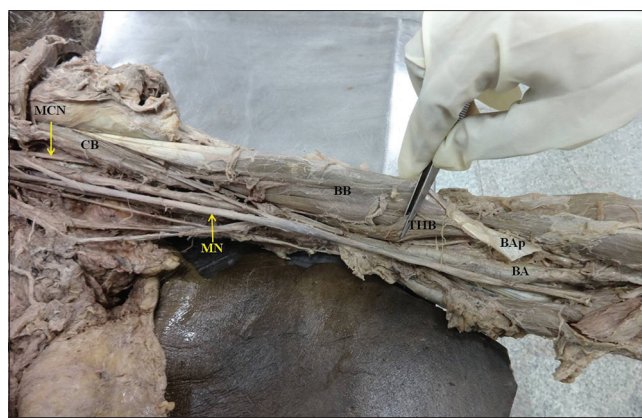


Figure 2: Dissection of left arm showing third head of biceps (THB) and musculocutaneous nerve (MCN) piercing the coracobrachialis (CB). (BB: Biceps brachii muscle, BAp: Bicipital aponeurosis MN: Median nerve and BA: Brachial artery)

antebrachial fascia of the forearm. The origin, course, and termination of the left THB was analogous to the right side [Figure 2]. Further, the attachment and trajectory of the long and short head of biceps were observed to be normal on both the sides. The three heads of the biceps brachii were innervated by the MCN on both the sides.

The MCN exhibited a variant course on the right side. Just after arising from the lateral cord, MCN divided into anterior (AMCN) and posterior branches (PMCN). Anterior branch of MCN traversed in front of the coracobrachialis and supplied without piercing it. Adjacent to the insertion of coracobrachialis, AMCN divided into three branches which terminated by supplying the long, short and the third head of biceps brachii. The PMCN descended along the lateral side of the brachial artery (BA) and ceased by innervating the THB and brachialis. We did not find any cutaneous branch of MCN on the right side. In contrast, the origin, course, and termination of the MCN were normal on the left side [Figures 1 and 2].

Discussion

BB muscle exhibits a wide array of variable morphological characteristics.^[4] Supernumerary heads of the biceps brachii (SNB) muscle have been extensively investigated pertaining to their attachments, innervation, gender, and racial differences.^[5] The SNB have variable prevalence among different populations, being 8% in Chinese, 10% in Europeans, 12% in Africans, and 18% in Japanese.^[1] Asvat *et al.* elucidated on the gender difference in prevalence of third head of biceps brachii, describing it as a primarily male condition.^[6] We report a peculiar case of three-headed BB muscle present on both the sides and variant course of MCN in a 64-year-old male cadaver. In the present case, the third head of biceps brachii was seen to originate from anterior investing deep fascia of brachialis muscle which was similar to the finding of Reilly and Kamineni.^[1]

Embryologically, the first sign of limb musculature is noticed in the 7th week of development as a mesenchymal condensation close to the origin of the limb buds. This mesenchyme develops from dorsolateral cells of the somites that drift into the upper limb bud.^[7] This bud further becomes compact to form ventral and dorsal muscle masses. The triceps muscle is derived from dorsal muscle mass while biceps brachii originates from ventral muscle mass of the upper limb bud. During this stage of development, SNB may arise due to variable segmentation of the ventral muscle mass.^[5]

Variant anatomy of the SNB has numerous clinical and functional connotations. The SNB have been implicated in compression of adjoining neurovascular structures which can manifest as symptoms of high median nerve entrapment, thrombosis and oedema by compression of BA and veins, respectively. Furthermore, a unilateral variation of SNB can lead to misconception of soft tissue tumors which should be identified by routine MR imaging.

Functionally, the THB augments its kinematics by enhancing the strength of flexion and supination of the forearm. Moreover, it permits the elbow flexion irrespective of the position of the shoulder joint.^[8] Ultimately, supernumerary heads can be a reason for abnormal dislocation of fragments of fractured humerus.^[1]

Variations of the MCN are frequently linked with SNB and often exhibit a modified course. The MCN can pass anteriorly, posteriorly, or through the supernumerary head and sometimes can be compressed by it.^[8,9] Familiarity with such variations is vital for detection and effective management of nerve entrapment.^[8]

Hence, meticulous knowledge of the variant morphology of biceps brachii and associated structures would provide a clinical strategy for diagnosis and management of the upper limb diseases and minimize the neurovascular injury.

Declaration of patient consent

The authors certify that they have obtained all appropriate permissions from the relatives of the deceased. Relatives have given their consent for utilization of the deceased for teaching and research purpose. The relatives understand that his names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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