

Study on the supernumerary heads of biceps brachii muscle in Nepalese

PP Poudel and C Bhattarai

Department of Anatomy, Manipal College of Medical Sciences, Pokhara, Nepal

Corresponding author: Phanindra Prasad Poudel, Lecturer, Department of Anatomy, Manipal College of Medical Sciences, Pokhara, Nepal, e-mail: phani_anat@yahoo.com

ABSTRACT

Biceps brachii is a double headed muscle. In terms of number and morphology of its head, it is one of the most variable muscles in the human body. Most common variation is third head, but four, five or even seven heads have been reported. In this study, 32 arms from 16 Nepalese cadavers were studied; supernumerary heads of biceps brachii were observed in 12.5% of 32 arms. Among these three headed biceps brachii was presented on 6.2% and the four headed was also on the same percentage. All the variations were in the right sided arms of males. Third heads of all cases originated from the medial border and adjoining anteromedial surface of humerus distal to the insertion of coracobrachialis thus have been classified as inferomedial humeral head. Fourth head of the four headed biceps brachii originated from the anterior border of humerus nearby the insertion of deltoid muscle. These supernumerary heads might be significant in producing the strong flexion as well as supination of forearm. They may cause compression of neurovascular structures because of their close relationship to brachial artery and median nerve. Variant biceps brachii may confuse a surgeon who performs procedures on the arm and may lead to iatrogenic injuries. The surgeons and traumatologists have to keep such muscular variations in mind.

Keywords: Biceps brachii, variation, Nepalese, compression, iatrogenic injuries.

INTRODUCTION

Biceps brachii muscle is classically described as two headed muscle.¹ Short head arises as a thick flattened tendon from the coracoid apex, together with Coracobrachialis. Long head arises as a long narrow tendon from the supraglenoid tubercle of scapula. The two heads soon fuse in the upper half of the arm to form the bulk of biceps muscle. The muscle ends as a flattened tendon, which passes ventrally, turns backwards and laterally to get inserted into the rough posterior area of the radial tuberosity. This mode of insertion makes biceps a powerful supinator of the forearm. The biceps brachii muscle is innervated by musculocutaneous nerve (C5 and C6 spinal cord segments) and supplied by the brachial and anterior circumflex humeral arteries.² In terms of the number and morphology of its head, biceps brachii is one of the most variable muscles in human body.³ The most common variation is a third head (in 10.0% of cases), but four, five or even seven heads have been reported.²⁻⁴ The supernumerary heads of the biceps brachii muscle have clinical importance as they may confuse a surgeon who performs procedures on the arm and may lead to iatrogenic injuries or they may cause compression of important neurovascular structures in the upper limb.^{1,5}

In the present article, we study the occurrence of third head of biceps brachii in Nepalese population, which has not yet been described. We also discuss the clinical as well as functional significance of the variation.

MATERIAL AND METHODS

Both upper extremities of 16 formalin fixed cadavers (n=32) irrespective of age and sex were dissected during the period of two years (2007-2009 AD) for the undergraduate teaching purpose. All the cadavers were Nepalese. Dissected specimens were preserved in 10.0% formalin. Biceps brachii along with all other related structures in the 32 dissected specimens was studied. Details of the additional heads, in the present cases, were examined. Appropriate photographs were taken.

RESULTS

Three headed biceps brachii muscle was observed unilaterally on the right arm of one adult male cadaver (6.2%), Fig. 1, and four headed biceps brachii muscle was also observed unilaterally on the right arm of other single adult male cadaver (6.2%), Fig. 2, among 16 cadavers (n=32). Anomalous heads of biceps brachii muscle were absent bilaterally in 30 cadavers and unilaterally on the left arm of 2 cadavers.

Usual short and long heads of biceps brachii muscle had their normal attachments and courses. However, the unusual third head of three headed biceps brachii muscle (Fig. 1) originated from the medial border and adjoining anteromedial surface of humerus alongside of brachialis just distal to the insertion of coracobrachialis. Its length and breadth were 16cm and 1.33cm respectively. This anomalous head fused with the deep surface of usual

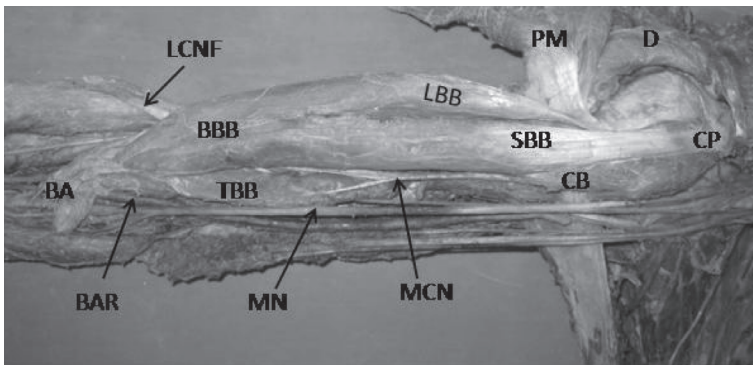


Fig. 1. Triple headed right biceps brachii muscle

CP= Coracoid process, LBB= Long head of biceps brachii, SBB= Short head of biceps brachii,

CB= Coracobrachialis, PM= Pectoralis major, D= Deltoid, MCN= Musculocutaneous nerve,

MN= Median nerve, TBB= Third head of biceps brachii, BBB= Bulk (Belly) of biceps brachii,

BAR= Brachial artery, LCNF= Lateral cutaneous nerve of forearm and BA= Bicipital aponeurosis.

bulk of biceps brachii muscle well before the bicipital tendon and its aponeurosis. Here brachial artery and median nerve ran medial to the third head and musculocutaneous nerve passed in between third head and usual bulk of biceps brachii muscle.

Anomalous third head of four headed biceps brachii muscle in other (Fig. 2) originated from the medial border and adjoining anteromedial surface of humerus distal to the insertion of coracobrachialis and also from the medial intermuscular septum. Its length and breadth were 13cm and 1.83 cm respectively. Fourth head of the same muscle originated from the anterior border of

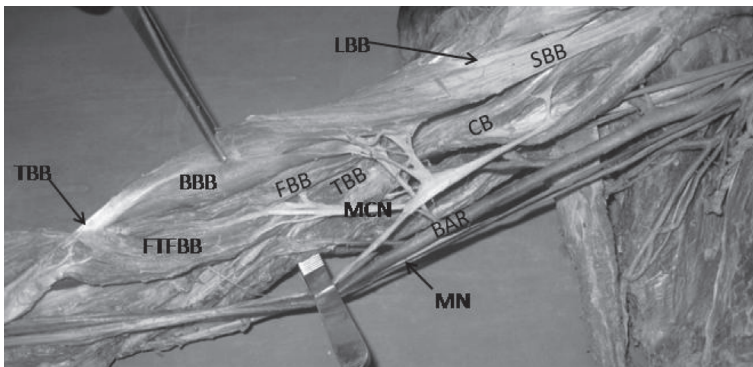


Fig. 2. Four headed right biceps brachii muscle

SBB= Short head of biceps brachii, LBB= Long head of biceps brachii, CB= Coracobrachialis,

BAR= Brachial artery, MN= Median nerve, MCN= Musculocutaneous nerve,

TBB= Third head of biceps brachii, FBB= Fourth head of biceps brachii, BBB= Bulk (Belly) of biceps brachii,

FTFBB= Fused portion of third and fourth head of biceps brachii and TBB= Tendon of biceps brachii.

humerus nearby the insertion of deltoid muscle. Fourth head was smaller than its third head. Its length and breadth were 12 cm and 1 cm respectively. Both third and fourth heads of this muscle fused forming the common belly at the distal part of distal third of arm lying deep to the usual bulk of biceps brachii muscle. The common belly then inserted onto the deep surface of bicipital tendon. In this case also brachial artery and median nerve ran medial to the third head of biceps brachii muscle but musculocutaneous nerve passed in between the third and fourth heads of the biceps brachii muscle.

In both cases the anomalous heads of biceps brachii muscle lay deeper to the medial side of bulk of usual biceps brachii muscle, innervated by a branch of musculocutaneous nerve and supplied by the branches of brachial artery.

DISCUSSION

Till the date there are not any study regarding the supernumerary heads of biceps brachii in Nepalese populations. So, the present study can be significant to fulfill the existing lacunae and the attentions also have been paid to study the variations on biceps brachii muscle because of their clinical, functional, morphological as well as academic importance.

Supernumerary heads were found in 10.2% of 1453 arms.⁶ In about 12.0% of arms, a humeral head is found in addition to those that usually arise from the scapula.⁶ The most common variation is a third head (in 10.0% of

cases), but four, five or even seven heads have been reported.^{2-4,7} Third head of biceps brachii muscle in 10.0% of cases arises from the superomedial part of brachialis and is attached to the bicipital aponeurosis and the tendon of biceps brachii.² Biceps brachii with more than two heads is found in 8.0% of Chinese, 10.0% of white Europeans, 18.0% of Japanese, 20.5% of South African blacks, 8.3% of South African whites, 15.0% of Turkish and 37.5% of Colombians.^{6,8-12} The most common slip is one arising from the humerus near the insertion of coracobrachialis and descending between it and brachialis. This head usually joins the short head, but most of its fibers pass into that part of the tendon which forms the bicipital aponeurosis. In addition, this head may be totally isolated and terminates entirely in the bicipital aponeurosis. Other accessory heads are rare and may take several different forms.

They may arise from the neck of the humerus below the lesser tubercle and behind the pectoral tendon to which they may be more or less united. An accessory slip may arise from the deltoid muscle. At the distal end of biceps, various muscular or tendinous slips have been described that connect biceps with the lower end of the humerus, ulna, radius, antebrachial fascia, or neighboring muscles. Supernumerary heads may also arise from brachialis, brachioradialis, pronator teres or pectoralis major. A fleshy slip occasionally arises from the medial border of biceps brachii and passes to join the intermuscular septum or medial epicondyle over the brachial artery. An accessory head may arise from the coracoid process, capsule of the shoulder joint, or tendon of pectoralis major.^{1,6} Incidence of variations on biceps brachii is more in males comparative to females.^{4,13,14} Different studies on the variation of biceps brachii and its association with the variable neurovascular structures of the arm have been reported. Four-headed biceps brachii muscle and double piercing of one of the supernumerary heads by the musculocutaneous nerve,¹⁵ neurovascular variation like communication between musculocutaneous and median nerves, and high origin of deep brachial artery from the axillary artery, have been reported.⁷ Unusual relation of the median nerve with the accessory head of the biceps brachii also has been found.¹⁶

In the present study on Nepalese cadavers, supernumerary heads of biceps brachii were revealed in 12.5% of the 32 arms. Among these three headed biceps brachii was presented on 6.2% and four headed was also presented on the same percentage. The variations were all in right arms of males.

Depending on origin and location, supernumerary heads of biceps brachii have been classified as superior, inferomedial, and inferolateral humeral heads. Among all, inferomedial humeral head is the most common variation, which originates from the anteromedial surface of humerus just beyond the insertion of coracobrachialis and inserted into the conjoint tendon of biceps brachii.^{17,18} On this reference third heads of all cases of present study have been classified as inferomedial humeral head because of origin of most of the fibres from the anteromedial surface of humerus just beyond the insertion of coracobrachialis.

We believed the supernumerary heads observed in the present study might be significant in producing the strong flexion as well as supination of forearm. They may cause compression of neurovascular structures because of their close relationship to the brachial artery and median nerve. Variant biceps brachii may confuse a surgeon who performs procedures on the arm and may lead to

iatrogenic injuries,^{1,5} the surgeons and traumatologists have to keep such muscular variations in mind.

REFERENCES

1. Lee JH, Choi IJ, Kim DK. The third head of the biceps brachii muscle originated from the pectoralis major muscle. *Korean J Anat* 2008; 41: 231-2.
2. Johnson D, Ellis H. Pectoral Girdle and Upper Limb. Gray's Anatomy. 39th ed. Elsevier Churchill Livingstone 2005: 853.
3. Nakatani T, Tanaka S, Mizukami S. Bilateral four headed biceps brachii muscles: the median nerve and brachial artery passing through a tunnel formed by a muscle slip from the accessory head. *Clin Anat* 1998; 11: 209-12.
4. Asvat R, Candler P, Sarmiento EE. High incidence of third head of biceps brachii in South African populations. *J Anat* 1993; 182: 101-4.
5. Warner JP, Paletta GA, Warren RF. Accessory head of the biceps brachii: case report demonstrating clinical relevance. *Clin Orthop Rel Res* 1992; 280: 179-81.
6. Tountas CP, Bergman RA. Anatomic Variations of the Upper extremity. New York: Churchill Livingstone 1993: 97-9.
7. Nayak SR, Ashwin K, Madhan KSJ, Latha VP, Vasudha S, Merin MT. Four-headed biceps and triceps brachii muscles, with neurovascular variation. *Anatomical Sci Int'l* 2007; 83: 107-11.
8. Bergman RA, Thompson SA, Afifi AK, Saadeh FA. Compendium of human anatomic variation. 1st ed. Baltimore: Urban and Schwarzenberg 1988: 11.
9. Torre FRL, Cegarra JN, Berruero JP. Biceps brachii muscle attached to the extensor carpi radialis brevis muscle: an unreported anatomical variation in humans. *Anat Anz* 1994; 176: 319-21.
10. Kosugi K, Shibata S, Yamashita H. Supernumerary humeral heads of the biceps brachii and branching pattern of the musculocutaneous nerve in Japanese. *Surg Radiol Anat* 1992; 14: 175-85.
11. Kumar H, Das S, Rath G. An anatomical insight into the third head of biceps brachii muscle. *Bratisl Lek Listy* 2008; 100: 76-8.
12. Kopuz C, Sancak B, Ozbenli S. On the incidence of third head of biceps brachii in Turkish neonates and adults. *Kaibogaku Zasshi* 1999; 74: 301-5.
13. Rincon F, Rodriguez IZ, Sancez A. The anatomic characteristics of the third head of biceps brachii muscle in Colombian population. *Rev Chil Anat* 2002; 20: 197-200.
14. Bergman RA, Thompson SA, Afifi AK. Catalogue of human variation. Munich: Urban and Schwarzenberg 1984: 27-30.
15. Vazquez T, Rodriguez-Niedenfuhr M, Parkin I, Sanudo JR. A rare case of a four headed biceps brachii muscle with a double piercing by the musculocutaneous nerve. *Surg Radiol Anat* 2003; 25: 462-4.
16. Mas N, Pelin C, Zagyapan R, Bahar H. Unusual relation of the median nerve with the accessory head of the biceps brachii muscle: An original case report. *Int'l J Morphol* 2006; 24: 561-4.
17. Rodriguez-Niedenfuhr M, Vazquez T, Choi D, Parkin I, Sanudo JR. Supernumerary humeral heads of the biceps brachii muscle revisited. *Clin Anat* 2003; 16: 197-203.
18. Abu-Hijleh MF. Three-headed biceps brachii muscle associated with duplicated musculocutaneous nerve. *Clin Anat* 2005; 18: 376-9.