

Case Report



Four-headed biceps brachii muscle with variant course of musculocutaneous nerve: anatomical and clinical insight

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ABSTRACT

A rare case of four-headed biceps brachii muscle with variation in the course of musculocutaneous nerve was observed in left arm of a 48-year-old embalmed male cadaver. One of the extra head (third) was fleshy throughout, originated from anteromedial surface of shaft of humerus and merged with the deep surface of short head. Fourth thin tendinous head originated just below lesser tuberosity of humerus and joined with the third head. Both accessory heads were lying under cover of short head of biceps. Musculocutaneous nerve was coursing between two supernumerary heads and subsequently between third head and short head of biceps brachii muscle. Origin of third head from shaft of humerus led to passage of nerve between this head and short head, before acquiring normal position between biceps brachii and brachialis muscles, and emerging out as lateral cutaneous nerve of forearm. Intramuscular course of nerve may be a potential site for nerve compression by hypertrophied biceps associated with strenuous regular physical activity of biceps or weight lifting. © IJAV. 2009; 2: 127–130.

Key words [variation] [biceps brachii] [musculocutaneous nerve] [anatomy]

Introduction

Biceps brachii, most superficial muscle of anterior arm typically arises by two heads from supraglenoid tubercle and tip of coracoid process of scapula [1]. Its variations may be seen as group of additional fasciculi or heads arising from the middle third of shaft, intertubercular sulcus, pectoralis major muscle and articular capsule of shoulder joint [2,3]. Variant multiple heads of the muscle may add to its bulk, thereby augmenting the strength of the muscle. Isolated injury to musculocutaneous nerve (MCN) is a rare finding. Hsu et al. [4] reported a small case series of injuries of this nerve with varied mechanism ranging from strenuous exercise to weight lifting, throwing of football etc. Entrapment of musculocutaneous nerve at coracobrachialis level or between biceps and brachialis muscles is a well-known phenomenon. The presence of supernumerary heads of biceps brachii muscle may pose an additional threat to musculocutaneous nerve compression during its passage between supernumerary heads. This possibility is further increased with biceps hypertrophy secondary to its rigorous exercise.

Case Report

Variations were encountered in biceps brachii muscle and in the course of musculocutaneous nerve in left arm of a 48-year-old embalmed male cadaver during routine cadaveric dissection in 2008. All necessary measurements were taken with a sliding vernier caliper (accuracy to 0.02 mm; Mitutoyo, Kawasaki Kanagana

Japan). Highest point of greater tuberosity was taken as reference point.

Besides short and long heads, two accessory heads of biceps brachii muscle were noticed (Figures 1, 2). One of the supernumerary heads (third head) took linear fleshy origin from anteromedial surface of shaft of humerus in line with insertion of teres major muscle. Few slips originated from tendinous insertion of teres major muscle. This line of origin extended 25 mm to 143 mm distal to greater tuberosity (GT). Origin was found to be sandwiched between coracobrachialis and upper part of brachialis muscle. It merged with deeper surface of short head of biceps, 190 mm distal to GT, i.e. at the junction of middle and lower third of arm. Fourth head originated as thin shiny tendon from anterior surface of lesser tuberosity, 15.9 mm inferior to anatomical neck and 4.4 mm lateral to lateral lip of intertubercular sulcus. This tendon after traversing for 27.3 mm became fleshy and merged with anterior surface of third head, 150 mm distal to greater tuberosity. Thicknesses of three tendinous heads of origin were 5.1 mm, 5.1 mm and 0.5 mm respectively for short, long and fourth head. Common tendon of insertion of biceps brachii close to radial tuberosity was 5.8 mm and bicipital aponeurosis was 13.0 mm wide. Circumference of different heads at the widest part of fleshy part was measured with non-stretchable thread (Table 1). Length of arm from greater tuberosity to lateral epicondyle of humerus was 28.5 cm.

Table 1. Circumference of each head of four-headed biceps brachii.

| Head of biceps | Circumference (mm) | Percentage of total circumference |
|----------------|--------------------|-----------------------------------|
| Long | 86 | 42.16 |
| Short | 80 | 39.22 |
| Third | 32 | 15.69 |
| Fourth | 6 | 2.94 |

Musculocutaneous nerve after emerging out of coracobrachialis muscle passed deep to fourth thin head, then between third and fourth head under cover of short head before traversing between brachialis and biceps brachii. It finally exited as lateral cutaneous nerve of forearm.

Musculocutaneous nerve before entering deep to fourth head gave a branch about 109 mm distal to greater tuberosity which bifurcated into two; one of which entered into deep surface of short head, 118 mm distal to greater tuberosity and other longer one entered superficial surface of third head 148 mm distal to greater tuberosity. Second branch arising from the trunk of

musculocutaneous nerve passed deep to fourth head and then entered the deep surface of long head; 150 mm distal to greater tuberosity. Nerve to brachialis was a solitary branch, arising 140 mm distal to greater tuberosity which entered the anterior surface of muscle, 198 mm distal to greater tuberosity in midline of arm.

Discussion

Anatomical variations of the biceps brachii muscle have been described by various authors [3,5]. Three-headed biceps has been reported in different ethnic groups with varied frequency ranging from 2-20.5% [6,7]. Higher incidence in blacks as compared to whites was reported by Neto et al. [8]. Asvant et al. [9] and Bergman [5] in their studies have demonstrated predominance in males. Relatively smaller incidence (2%) relative to other population groups has been reported in Indian population [10]. Four-headed biceps brachii is a relatively rare entity. Nakatani et al. reported bilateral four-headed biceps in Japanese population in 2 of 50 arms [11]. Vazquez et al. reported four heads of biceps in right arm of 87-year-old Spanish female [12]. Soubhagya et al. presented a case report of four-headed biceps in left arm of an Indian male cadaver [13]. In our case, presence of four-headed biceps with variation in intra biceps course of musculocutaneous nerve makes this case clinically important.

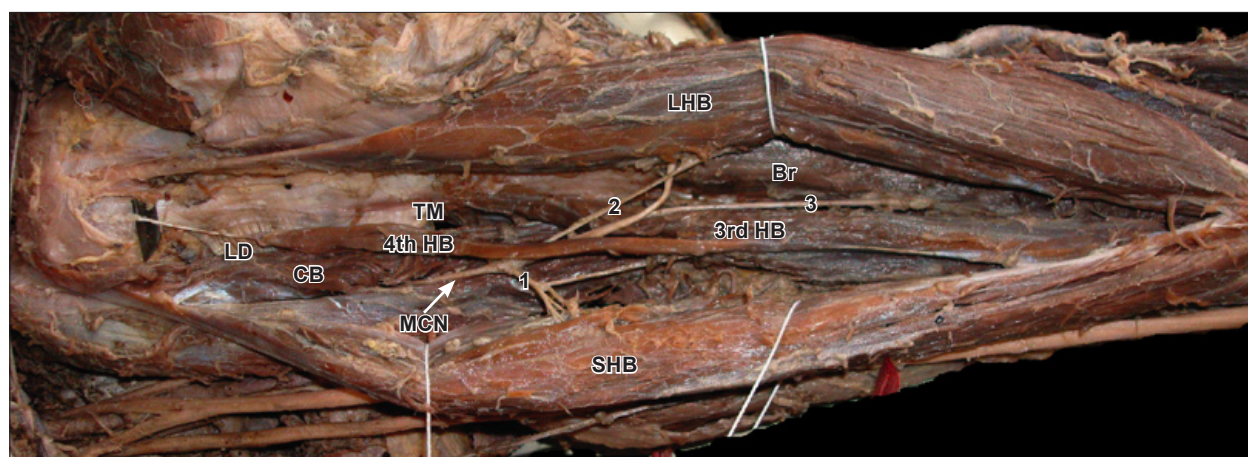


Figure 1. Left arm after retracting short and long heads of biceps brachii muscle to uncover supernumerary third and fourth heads and the course of musculocutaneous nerve. (LD: latissimus dorsi; CB: coracobrachialis; TM: teres major; LHB: long head of biceps; SHB: short head of biceps; Br: brachialis; 3rd HB: 3rd head of biceps; 4th HB: 4th head of biceps; MCN: musculocutaneous nerve; 1: branch to short head; 2: branch to long head; 3: branch to brachialis)

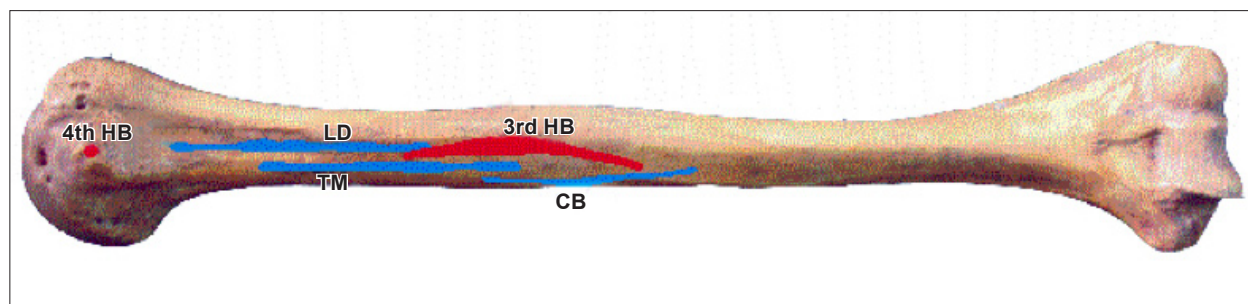


Figure 2. Exact site of attachment of supernumerary heads of biceps brachii muscle on humerus. (LD: latissimus dorsi; CB: coracobrachialis; TM: teres major; 3rd HB: 3rd head of biceps; 4th HB: 4th head of biceps)

Site of origin has been variously described. Rodriguez-Niedenfuhr et al. classified the supernumerary heads based on origin and location into superior, inferomedial and inferolateral types [14]. Soubhagya et al. [13] reported a supernumerary origin from distal part of intertubercular sulcus and anteromedial aspect of humerus close to coracobrachialis insertion. In the study of Vazquez et al., origin of one supernumerary head was between lesser tuberosity, and coracobrachialis and brachialis, other supernumerary head from lower part of anteromedial surface of humerus in continuation with attachment of coracobrachialis [12]. In our case, third head originated from anteromedial surface of shaft of humerus in line with insertion of teres major muscle, with few slips originating from anterior surface of tendon of teres major muscle. On extensive review of literature no such case has previously been reported. Fourth head originated from area below lesser tuberosity. This head was partly tendinous and partly fleshy. Third head was totally fleshy. Nature of accessory heads has not been mentioned in literature. In present study, fourth head was running parallel to long head. In our study, both supernumerary heads inserted into the short head. In most of the studies, supernumerary heads joined with common bicipital tendon [11–13].

If extra heads are large enough, they may give additional strength to biceps [15]. In the present case third head constituted 15.69%, and the fourth head 2.94% of total circumference of all heads of biceps brachii muscle (Table 1). Nakatani et al. [11] compared the heads of biceps by weight; third and fourth heads weighing 10% and 1% of total bulk of biceps brachii muscle respectively. As the bulk of third head in our case was substantial enough, it might contribute to action of biceps but the contribution of fourth head appeared negligible. Embryological observation may support this hypothesis as the translocation of some of fibers of brachialis to common tendon of biceps brachii may enhance primary supination and secondary flexion of forearm. This may explain high incidence of third supernumerary head of biceps in right arm [16].

Aggressive weight lifting has been known to be associated with musculocutaneous palsy; this may possibly be due to entrapment of nerve under the edge of hypertrophied coracobrachialis. Usual result of nerve compression in biceps is reduction in the power of elbow flexion and supination of forearm and paraesthesia along lateral border of forearm.

Consideration of the possible anatomic variations of musculocutaneous nerve is important for understanding certain unexplained signs and symptoms. Acute entrapment of musculocutaneous nerve under the edge of hypertrophied coracobrachialis muscle is known. Variant origin of third head may lead to intramuscular course of musculocutaneous nerve between third and fourth heads, later between third and short heads. Thus it can be a potential site for nerve compression, especially between third and short heads during contraction of biceps. This variant course may become more important in hypertrophied biceps brachii muscle in professional weight lifters or

body builders. It has been stated that musculocutaneous nerve piercing brachialis muscle produces separation of biceps, but subsequent studies demonstrated that this hypothesis was erroneous as the musculocutaneous nerve passes not only behind supernumerary head but also in front of it. It is not yet known whether or not the extra heads of biceps is a specific functional adaptation characterized by continuous physical activity [12,14]. Kopuz et al. attributed the appearance of this variant to evolutionary and or racial trend [6]. Medial humeral origin of accessory head may contribute to pronation of forearm irrespective of shoulder joint position.

Injury to musculocutaneous nerve is usually associated with lesion of other nerves of brachial plexus. Isolated non traumatic musculocutaneous nerve palsy is very rare and has been related to weight lifting and strenuous physical activity. Several theories for this condition has been set forth; most often cited cause is impingement of nerve from coracobrachialis hypertrophy. Another reason may be traction of nerve from biceps as it is anchored by coracobrachialis. Musculocutaneous nerve has segmental origin (C5, C6). This nerve usually passes through coracobrachialis then between biceps and brachialis and at elbow it becomes lateral cutaneous nerve of forearm.

Musculocutaneous nerve passing between supernumerary heads, or supernumerary heads pierced by musculocutaneous nerve has been reported [12]. This intramuscular course of musculocutaneous nerve is usually reported to be associated with its interconnection with median nerve [12]. In our study, no such communication was observed. Intramuscular course is a potential compression site and compression of nerve in between heads of biceps may lead to paraesthesia and weakness of elbow flexion and supination due to involvement of brachialis and nerve to long head of biceps.

According to Swieter and Carmichael [15], the origin of biceps brachii from the humerus shaft may cause unusual bone displacement secondary to fracture. In present study third accessory head was supplied by branch to short head biceps muscle.

In our study, two branches from the main trunk of nerve for short and long heads arose 17.7 mm proximal to medial epicondyle, quite close to other studies [17]. Branch to brachialis arose more distally as compared to biceps. Brachialis may be solely affected if nerve is compressed between short and third heads thus sparing biceps. Nerves were found entering short head, long head and third head of biceps, 118 mm, 150 mm and 148 mm respectively, i.e. in the middle third of arm whereas nerve to brachialis entered 198 mm distal to greater tuberosity (approximately just below the junction of middle and lower third of arm). The knowledge of nerve entry points may prove to be useful at the time of giving botulinum toxin injection for relieving spasm [18].

Variant heads of biceps muscle may play a role in pathogenesis of pain in posterior aspect of arm or weakness of muscle power.

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