

# A Case Series on Morphological Variations of Biceps Brachii in Adult Human Cadavers and its Clinical Implications

Ramanathan Shalini<sup>1\*</sup>, Kaliyaperumal Pushpa<sup>2</sup>, Jayamurugavel Gayathri<sup>3</sup>,  
Thiagarajan Sivakami<sup>4</sup>

<sup>1,2,3</sup> Assistant Professor, Department of Anatomy, Thanjavur Medical College, Tamilnadu, India.

<sup>4</sup> Professor and Head, Department of Anatomy, Thanjavur Medical College, Tamilnadu, India.

**Corresponding Author:** Dr Ramanathan Shalini,

**Email:** [shaliniulags@gmail.com](mailto:shaliniulags@gmail.com)



## Abstract

Biceps brachii, a powerful forearm supinator, is a muscle in which many anatomical variations have been reported. Biceps brachii anomalies may play an important role in neurovascular compression syndromes in the arm and also affect shoulder joint movements. Three significant morphological variations in Biceps brachii were noted during routine dissection of upper limbs used for undergraduate teaching purposes. An extra articular origin of tendon of long head of Biceps brachii which was passing through the subpectoral tunnel formed by Pectoralis major was observed in one right upper limb. Non-fusion of two bellies of Biceps brachii with an accessory bicipital tendon was observed in one right upper limb. Presence of one supernumerary head of Biceps Brachii with a communicating branch between Median and Musculocutaneous nerves was observed in one right upper limb. Knowledge of these variations is essential for Surgeons and Orthopaedicians during surgery involving shoulder, arm and elbow regions.

**Key words:** Biceps brachii, Supernumerary heads, Extra articular.

## Introduction

Biceps brachii is a powerful forearm supinator, present in the anterior compartment of arm. It has two proximally attached heads. The long head arises within the capsule of the shoulder joint from the supraglenoid tubercle of the scapula. The short head arises from the apex of the coracoid process. The two heads of Biceps brachii form elongated bellies, which join together to form a bicipital tendon, which is attached to the rough posterior surface of the radial tuberosity. The tendon gives a broad medial expansion- the bicipital aponeurosis, which passes medially and fuses with the deep fascia of front of forearm.<sup>1</sup>

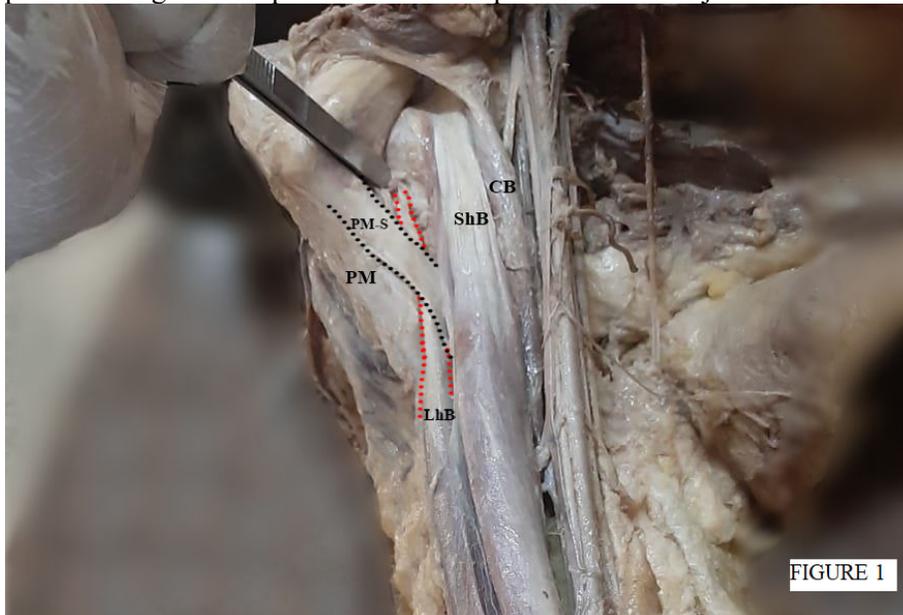
Biceps brachii is a muscle in which many anatomical variations have been reported.<sup>2</sup> Presence of supernumerary heads of Biceps brachii in humans have been reported with varying frequency in different ethnic groups.<sup>3</sup> Presence of extra articular origin of long head of Biceps brachii have been noted

during arthroscopic examination of the shoulder joint.<sup>4</sup> Unusual occurrences of nonunion of two heads of Biceps brachii and also bicipital aponeurosis merging with brachioradialis have also been reported.<sup>5</sup> Muscle anomalies may play a role in neurovascular compression syndromes. Partial entrapment of Musculocutaneous and Median nerves have been reported in cases with supernumerary heads of Biceps brachii.<sup>6</sup> Brachial artery compression can also occur in the presence of supernumerary heads of Biceps brachii.<sup>6</sup>

In this case series, we describe three cases of significant morphological variations in Biceps brachii noted in cadaveric upper limbs used for undergraduate teaching purposes at the Anatomy Department of Thanjavur Medical College, Tamil Nadu. Ethics committee approval was waived for the present article, as it was a cadaveric study conducted during routine dissection of upper limbs used for undergraduate teaching purposes.

### Case 1:

A rare occurrence of extra articular origin of the tendon of long head of Biceps brachii was observed in one right upper limb of a male cadaver (Figure 1). The tendon of long head of Biceps brachii was found to arise from the lesser tubercle of humerus. A tendinous slip from the tendon of Pectoralis major was found to encircle the tendon of long head of Biceps brachii. The tendon of long head of Biceps brachii passed through the subpectoral tunnel deep to Pectoralis major.

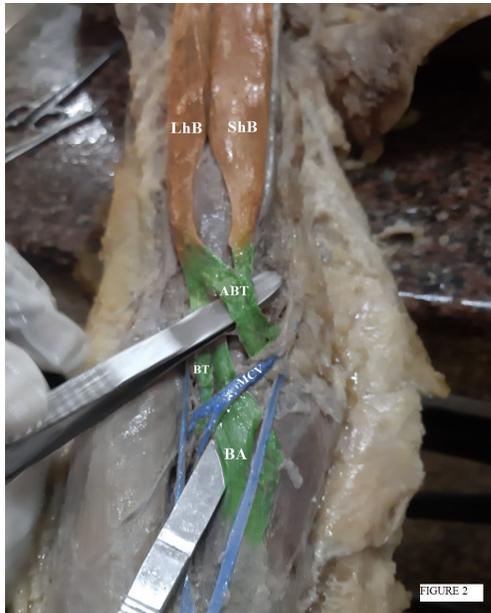


**Figure 1. Extra articular origin of long head of Biceps brachii from the capsule of shoulder joint**

\* PM- Pectoralis major; PM-S- a slip from Pectoralis major; CB- Coracoclavicular; LhB- Long head of Biceps brachii; ShB- Short head of Biceps Brachii.

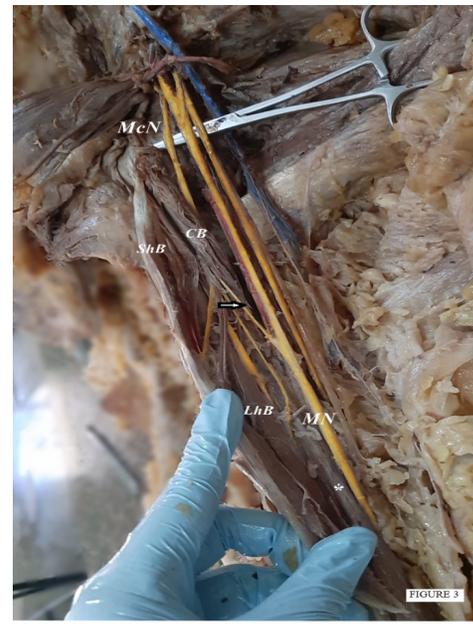
### Case 2:

Non-fusion of two bellies of Biceps brachii was observed in one right upper limb of a male cadaver (Figure 2). The long head of Biceps brachii formed the bicipital tendon which was inserted into the posterior part of the radial tuberosity. Few fibers from the long head joined with the short head and formed an accessory bicipital tendon which was inserted into the coronoid process of ulna. Bicipital aponeurosis was found to arise from the medial side of the bicipital tendon. The median cubital vein passed superficial to the bicipital aponeurosis.



**Figure 2. Non-fusion of 2 bellies of Biceps brachii with accessory bicipital tendon**

\* LhB- Long head of Biceps brachii; ShB- Short head of Biceps Brachii; MCV- Median cubital vein; BA- Bicipital Aponeurosis; BT- Bicipital tendon; ABT- Accessory bicipital tendon



**Figure 3. Third head of Biceps brachii**

McN- Musculocutaneous nerve; CB- Coracobrachialis; MN- Median nerve; Lhb- Long head of Biceps brachii; ShB- Short head of Biceps brachii,

⇒ Communicating branch.

### Case 3:

A bulky supernumerary head- considered as third head of Biceps brachii was observed in one right upper limb of a female cadaver (Figure 3). The third head was found to arise from the middle of the anterior surface of shaft of humerus, below the insertion of Coracobrachialis. The third head was also found to arise from the medial intermuscular septum. Inferiorly, few fibers of the third head passed on to the bicipital tendon in the cubital fossa. But most fibers formed a band along with bicipital aponeurosis. All three heads of Biceps brachii were supplied by Musculocutaneous nerve. Median nerve received a communicating branch from the Musculocutaneous nerve, which then pierced the substance of third head of Biceps brachii. The Median nerve and Brachial artery were found to be buried deep under the arch of third head in the cubital fossa.

### Discussion

Extra articular origin of long head of Biceps brachii has been reported, but the passage of the long head of Biceps brachii in the subpectoral tunnel is a rare occurrence. Andreoli et al,<sup>4</sup> reported a case of long head of Biceps brachii arising from the rotator cuff during diagnostic shoulder arthroscopy in a patient with complaints of pain in the shoulder region. Charmode,<sup>7</sup> had reported an occurrence of extra capsular origin of long head of Biceps brachii, which was arising from the lesser tubercle of humerus. Katsuki et al,<sup>8</sup> have reported a case of long head of Biceps brachii arising from the lesser tubercle, combined with a scar tissue. They considered this variation to be a result of rupture of long head of Biceps brachii tendon in the shoulder joint. The distal part of the ruptured Biceps tendon had formed a scar on the articular

capsule and the scar had expanded to the lesser tubercle. In the present case 1, there was no scar tissue and no evidence of surgery in the upper limb.

During embryological development, the tendon of Biceps brachii develops from the capsule of the shoulder joint and can be found as an independent structure in fetus around 9 weeks of gestation. Interruptions to development or abnormalities over the course of development of the tendon of long head of Biceps brachii may result in such variations.<sup>9</sup>

Extra articular origin of long head of Biceps brachii can lead to instability of shoulder joint and can cause dislocation of head of humerus.<sup>10</sup> Biceps brachii tendon may also be compressed in the subpectoral tunnel during contraction of Pectoralis major muscle and can cause pain in the shoulder joint.<sup>4</sup>

In the present case 1, extra articular origin of long head of Biceps brachii observed was partially similar to the findings of Charmode<sup>7</sup> and Katsuki et al,<sup>8</sup> with the origin of long head from the lesser tubercle of humerus. But the passage of tendon of long head of Biceps brachii in the subpectoral tunnel is a rare occurrence.

Insertion of Biceps brachii is important, because it can present as partial or complete tears, which needs to be differentiated from naturally occurring anatomical variations.<sup>11</sup> Avadhani and Chakravarthi,<sup>5</sup> reported an occurrence of nonunion of two heads of Biceps brachii, in which the short head continued as bicipital aponeurosis and the long head formed the bicipital tendon. Agarwal and Gopal,<sup>12</sup> reported a case of non-fusion of two heads of Biceps brachii, in which the short head was ending in a musculotendinous slip going towards the belly of Flexor carpi radialis. Daimi et al,<sup>13</sup> reported a case of insertion of Biceps brachii by two tendons. A common tendon was inserted into the posterior part of radial tuberosity. Another accessory tendon was inserted into the radial tuberosity distal to the insertion of the common tendon. Non-fusion of two bellies of Biceps brachii observed in the present case 2, was partially similar to the findings of Daimi et al.<sup>13</sup> In the present case 2, the accessory bicipital tendon was inserted into the coronoid process, which has been rarely reported.

Occurrence of third head of Biceps brachii has been reported to be as high as 10% in Gray's Anatomy.<sup>1</sup>

Occurrence of third head of Biceps brachii has been reported with a varying frequency from 2.3% to 16% in different ethnic groups.<sup>12</sup> According to the position of supernumerary head of Biceps brachii- it is classified as Superior, Inferomedial or Inferolateral head.<sup>14</sup> In the present case 3, inferomedial origin of third head of Biceps brachii was observed, as it was found to arise from the shaft of humerus below the insertion of Coracobrachialis and also from the medial intermuscular septum.

Inferiorly, the third head of Biceps brachii is most commonly reported to join the bicipital tendon.<sup>5</sup> Singh et al<sup>15</sup> reported a case in which the third head of Biceps brachii was inserted into the bicipital aponeurosis. In the present case 3, few fibres from the third head joined the bicipital tendon, but most fibres joined the bicipital aponeurosis inferiorly.

Agarwal and Gopal<sup>12</sup> reported that the Musculocutaneous nerve passes between the supernumerary heads of Biceps brachii or the supernumerary heads may be pierced by the musculocutaneous nerve. The Musculocutaneous nerve, during its intramuscular course has been reported to have interconnections with the Median nerve.<sup>12</sup> In the present case 3, the third head was supplied by the Musculocutaneous nerve and a communicating branch between Median and Musculocutaneous nerve was found to be present.

## Conclusion

Knowledge of variations in the origin, insertion and presence of supernumerary heads of Biceps brachii along with nerve communications are important for surgeries involving shoulder, arm and elbow regions.

## References

1. Standring S, editor. Gray's Anatomy: the anatomical basis of clinical practice. Forty- first edition. New York: Elsevier Limited; 2016. 1562p.
2. Testut L. En: Tratado de Anatomio Humana. Barcelona: Salvat, 1902: 1022.

3. Asvat R, Candler P, Sarmiento EE. High incidence of third head of biceps brachii in South African populations. *J Anat.* 1993; 182: 101- 104.
4. Andreoli CV, Esteves LR, Figueiredo E, Belangero PS, Alberto de Castro Pochini, Ejnisman B. Tendon of the long head of biceps originating from the rotator cuff- An uncommon anatomical variation: case report. *Rev Bras Ortop.* 2016; 51(1): 96-99.
5. Avadhani R, Chakravarthi KK. A study on morphology of the biceps brachii muscle. *NUJHS.* 2012; 2(3): 2-5.
6. Gupta C, D'souza AS. A morphological study of third head of biceps brachii in human cadavers with its clinical implications. *Saudi J Health Sci.* 2014; 3(3): 129-132.
7. Charmode SH. Variation in the origin of biceps brachii muscle. *Journal of Research in Human Anatomy and Embryology.* 2016; 2(2): 1-2.
8. Katsuki S, Terayama H, Tanaka R, Ning Qu, Tanaka O, et al. Variation in the origin of the long head of biceps brachii tendon in a cadaver. *Medicine.* 2018; 97(20): 1-4.
9. Audenaert EA, Barbaix EJ, Van Hoonacker P, Berghs BM. Extraarticular variants of the long head of Biceps brachii: a remainder of embryology. *J Shoulder Elbow Surg.* 2008; 17Suppl.1: 114S- 7S.
10. Egea JM, Melguizo C, Prados J, et al. Capsular origin of the long head of biceps brachii tendon: a clinical case. *Romanian journal of Morphology and Embryology.* 2010; 51(2): 375-7.
11. Bharambe VK, Kanaskar NS, Arole V. A study of biceps brachii muscle: Anatomical considerations and clinical implications. *Sahel Med J.* 2015; 18: 31-7.
12. Agarwal J, Gopal K. Variations of biceps brachii muscle and its clinical importance. *Journal of Clinical and Diagnostic Research.* 2020; 14(7):1-3.
13. Daimi SR, Siddiqui AU, Wabale RN, Gandhi KR. Additional tendinous insertion of biceps brachii: a case report. *Pravara Med Rev.* 2010; 2(1): 16-18.
14. Rodriguez-Niedenfuhr M, Vazquez T, Choi D, Parkin I, Sanudo JR. Supernumerary humeral heads of biceps brachii revisited. *Clinical Anatomy.* 2003;16(3): 197-203.
15. Singh P, Tandon A, Bhatnagar R, Pokhrel R. Bilateral three headed biceps brachii muscle. *Medical Journal of Shree Birendra Hospital.* 2013; 12(2): 58-60.