

# A Third Head of the Biceps Brachii Muscle Originating from the Surgical Neck: Anatomical and Clinical Considerations

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**Abstract** : This case report presents an anatomical variation of the biceps brachii muscle observed during cadaveric dissection, in which a third head was identified on the right side of an 85-year-old Korean male cadaver. The third head of the biceps brachii (THBB) originated from the surgical neck of the humerus, located vertically inferior to the lesser tubercle, and merged with the short head of the biceps brachii. Morphologically, THBB resembles the superior humeral head type but originates more proximally. Morphometric analysis revealed that the total length of the THBB was 25 cm, with a muscle belly length of 16 cm and a thickness of 0.4 cm. Given its close proximity to the surgical neck, a frequent site of surgical intervention for fractures or degenerative conditions, THBB may be at risk during procedures such as internal fixation or joint replacement. This finding suggests that recognizing such anatomical variations may help reduce the risk of iatrogenic injury and contribute to safer surgical practices in the upper limb.

**Keywords** : Biceps brachii, Accessory head, Surgical neck, Anatomical variation

## INTRODUCTION

The biceps brachii (BB) is a key muscle in the anterior compartment of the upper arm, playing a crucial role in elbow flexion and forearm supination. It is classically described as having two heads: a long head originating from the supraglenoid tubercle of the scapula and a short head arising from the coracoid process [1]. The long head of the biceps brachii plays a crucial role in shoulder biomechanics by acting as a depressor of the humeral head during abduction, ensuring its stabilization and centralization within the

glenoid fossa [2]. These heads converge in the upper arm and insert into the radial tuberosity via a common tendon, with the aponeurosis extending to the forearm. While the standard anatomical structure of the BB is well established, variations in its morphology, particularly the presence of accessory heads, have been frequently reported in cadaveric and imaging studies [1,3].

The presence of an accessory head of the biceps brachii is one of the most commonly affected muscles by anatomical variations, with supernumerary heads being the most frequently observed anomaly in the upper limb [2,4]. Super-

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numerary heads have been reported to originate from various structures, including the humerus, coracoid process, pectoralis major, and articular capsule of the shoulder joint [5].

Embryologically, upper limb muscles develop from mesodermal cells that migrate into the limb buds and differentiate into dorsal and ventral muscle masses. The biceps brachii arises from the ventral mass, and anatomical variations such as accessory heads may result from incomplete muscle differentiation or the failure of programmed cell death [6].

The prevalence of accessory heads of the biceps brachii muscle varies across different populations, with rates ranging from approximately 8% to 37.5%, influenced by genetic and environmental factors [7]. A systematic review and meta-analysis reported an overall prevalence of 9.6%, with the occurrence of a single accessory head (three-headed biceps brachii) at 8.4% [4].

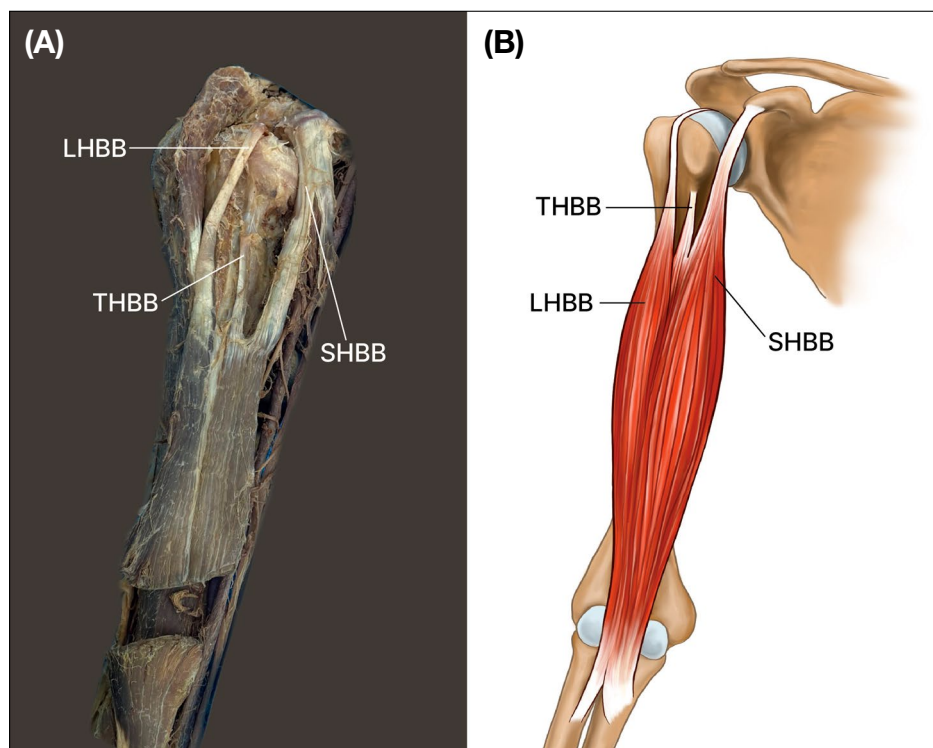
Additionally, accessory heads are often some studies suggest they may contribute to neurovascular compression, altered biomechanics, or increased muscle strength [8]. Understanding such anatomical deviations is essential for clinicians, particularly in the context of surgical interventions, radiological interpretations, and the diagnosis of upper

limb neuropathies [8,9]. Although accessory heads are generally considered asymptomatic, their potential physiological and functional implications remain a subject of speculation. However, the morphometric parameters of the biceps brachii have been largely overlooked in the existing literature and remain insufficiently explored [9].

The aim of this study is to report the occurrence of the third head of biceps brachii in a cadaver. Moreover, we describe its anatomical characteristics, including its origin, insertion, and relationship with surrounding structures, and discuss its potential clinical and developmental implications.

## CASE REPORT

We identified a unilateral third head of the short head of the biceps brachii on the right side during the course of dissection in an anatomical program at a Korean medical school in 2024. This observation was made in an 85-year-old formalin-fixed Korean male cadaver. We removed the skin and fat from the shoulder joint to the upper arm for observation. The proximal and distal attachment points of



**Fig. 1.** (A) Anterior view of the upper limb showing the biceps brachii with its LHBB, SHBB, and THBB. (B) Illustration of the biceps brachii variation showing the THBB originating from the surgical neck, coursing between the LHBB and SHBB, and merging distally with the SHBB. LHBB, Long Head of the Biceps Brachii; SHBB, Short Head of the Biceps Brachii; THBB, Third Head of the Biceps Brachii.

the biceps brachii were then observed and the surrounding fascia was separated. Afterwards, the body of the biceps brachii was cut and observed at the center of the humerus (Fig. 1).

In this study, dissection revealed that the short head of the right biceps brachii muscle had an additional head. The left biceps brachii muscle appeared normal. The third head, discovered as a variation, was observed between the long and short heads of the biceps brachii and appeared to be split from the short head. The third head of the biceps brachii (THBB) originates at the level of the surgical neck of the humerus, which lies within the proximal one-third region and corresponds to an area vertically inferior to the lesser tubercle. It merges distally with the common tendon formed by the short and long heads and inserts into the radial tuberosity of the radius. The long head of the biceps brachii has been observed to originate from the tubercle of the glenoid cavity, while the short head is attached to the coracoid process of the scapula (Fig. 1).

The length from the origin of the bicep head to the insertion was measured as 38 cm for the long head, 32.5 cm for the short head, and 25 cm for the third head. Additionally, the length from the origin of each head to the merged point of the muscle is 18 cm for the long head, 16 cm for the short head, and 8.5 cm for the third head. The thickest area width of each head was measured as 0.9 cm for the long head, 0.9 cm for the short head, and 0.4 cm for the third head.

## DISCUSSION

In the present case, variations appeared the right arm unilaterally with a third head of biceps brachii (THBB). Previous reports, the accessory heads of the BBM may have variably from three up to seven heads [10,11]. Additionally, accessory head of biceps brachii commonly present with minor nerve variations, which may cause changes in sensory nerve distribution [12]. Therefore, it is essential to continuously in human anatomical variation research through cadaver studies.

The embryological development of the biceps brachii involves the differentiation of mesenchymal progenitor cells into dorsal and ventral muscle masses [13]. While the dorsal mass forms the triceps brachii, the biceps brachii arises from the ventral mass. Supernumerary heads may result from aberrant muscle segmentation or failure of apoptosis, where some

primordial myoblasts persist and form additional muscle bellies [6]. Such developmental deviations, particularly in myogenic segmentation, are likely responsible for the anatomical variations observed in this case.

In our case, an accessory muscle was identified, with the THBB originating from the proximal third of the humerus, merging with the common tendons of the short and long heads, and inserting into the radial tuberosity of the radius. Supernumerary heads of the biceps brachii, including variants such as the THBB, have been widely studied their origin, insertion, size, innervation and racial differences [14]. Supernumerary heads of the biceps brachii can originate from various structures, including the glenohumeral joint capsule, humerus, and surrounding muscles. Previous reports (study of 350 arms) classified these into three types: superior, inferomedial, and inferolateral humeral heads [14,15]. They identified five cases (1.5%) where an additional head arose from the humerus between the lesser tubercle and coracobrachialis/brachialis attachments, merging with the short head at its junction with the long head [15]. Our case shares morphological similarities with this superior humeral head type, particularly in its position between the short and long heads and its distal merging pattern. However, unlike the conventional superior humeral head type, the THBB in our case originated more distally at the surgical neck, vertically inferior to the lesser tubercle. This variation highlights the spectrum of morphological diversity in supernumerary heads and underscores the importance of documenting subtle anatomical differences.

In our case, THBB was found to originate at the level of the surgical neck of the humerus, within the proximal one-third region and vertically inferior to the lesser tubercle. This location places the THBB in direct proximity to the operative field commonly accessed during surgical interventions for proximal humerus pathology [16,17]. Proximal humeral fractures and severe degenerative changes of the shoulder joint are frequently managed by procedures such as open reduction and internal fixation (ORIF) and total shoulder arthroplasty (TSA). ORIF involves the realignment and stabilization of fractured bone fragments using plates and screws, whereas TSA replaces the damaged glenohumeral joint with prosthetic components. Both procedures require dissection around the surgical neck of the humerus, an area that overlaps with the origin of the THBB. As a result, unrecognized accessory muscles in this region may be at risk of iatrogenic injury during exposure, fixation, or prosthetic

implantation. Awareness of such anatomical variations is crucial to avoid inadvertent damage in proximal humeral surgeries.

In the present case, the length of the THBB was 250 mm. It coursed between the long and short heads of the biceps brachii and eventually merged with the short head. A previous study conducted in an Austrian population reported a length of 148 mm [18], while studies involving Colombian and Sri Lankan populations described lengths of 118.3 mm [19] and 124.6 mm [20], respectively. In these studies, the accessory head merged with the short head of the biceps brachii, similar to the pattern observed in the present case. These findings suggest that the length of the THBB varies depending on population background, and the present case represents the longest reported measurement. This extended length may be explained by the fact that the THBB in our case originated from the surgical neck of the humerus, rather than from the humeral shaft as described in previous reports. Since the surgical neck is a frequent site of operative intervention, the close anatomical relationship of the THBB to this region underscores its clinical importance and the need for careful consideration during upper arm surgeries.

In conclusion, this case report describes an anatomical variation in which THBB originated from the surgical neck of the humerus, located vertically inferior to the lesser tubercle, and merged with the short head. Morphologically, THBB resembles the superior humeral head type but differs in its more distal origin. Given its proximity to the surgical neck, a common target in proximal humeral surgeries, THBB may hold clinical relevance. Awareness of such variations may reduce the risk of iatrogenic injury and support safer surgical and anatomical practices.

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