Introduction

The biceps brachii is located in the flexor compartment of the arm and is classically described as a large, fusiform muscle with two heads.\(^1\) The short head takes its origin from the lateral coracoid apex along with the coracobrachialis.\(^1\) The long head is a long thin tendon which originates from the supraglenoid tubercle within the shoulder capsule, and is an intra-articular structure.\(^1\) This tendon is surrounded by a double tubular sheath which is an extension of the shoulder capsule, and distally courses over the humeral head, exiting the joint deep to the transverse humeral ligament.\(^1\) These two heads form elongated muscle bellies that are adherent to each other, but can be easily separated from one another until about 7 cm proximal to the elbow joint, where they amalgamate into a common tendon.\(^1\) This common tendon twists about its long axis before it inserts onto the tendon of the short head of the biceps brachii. We believe this to be a previously unreported point of origin for a supernumerary head of the biceps brachii muscle. Supernumerary heads become clinically important as they can be a source of confusion for surgeons operating in this region and may be mistaken for soft tissue tumors when they are unilateral. An understanding of such variations is important.

Keywords: biceps third head; elbow; shoulder; supernumerary biceps brachii

Unusual origin of three headed biceps brachii muscle

Accessory heads can be just as variable as their origins. The current literature reports them inserting into the individual muscle bellies of the normal long and short heads, into a common muscle belly, the common tendon or onto the bicipital aponeurosis. There have been multiple population based studies which attempt to determine the prevalence of supernumerary heads. The overall prevalence has traditionally been reported as 10% in white Europeans, 12% in black Africans, 8% in Chinese and 18% in Japanese populations. Significant differences between populations have been identified, but the data can vary widely between studies of the same population and trends based on race are difficult to identify (Table 1). For example, one study found that a third head of the biceps was more frequent in South African blacks than whites, but was absent in those of Zulu ancestry. Supernumerary heads appear to be distributed evenly between right and left limbs and a higher incidence in males has been reported in some studies. The incidence of bilaterally symmetric supernumerary heads is also variable between studies and has been reported to be between 3.3% and 29.3%.

All reported supernumerary heads of the biceps brachii are innervated by the musculocutaneous nerve, with the rare exceptions where accessory heads are innervated by the median nerve. However, the presence of supernumerary head of the biceps is also frequently associated with musculocutaneous nerve variations which include anything from the absence of the nerve, to unique branching patterns, to duplication. Le Double hypothesized in 1897 that the altered muscle anatomy was responsible for the anomalous route of the nerve, however, Lee reports statistical analysis that the two variations develop independently.

Case Report

During routine dissection of a 72 year old male cadaver in our lab, a tricipital biceps brachii was noted. A well-developed muscular slip was observed to originate from the anterior deep investing fascia of the brachialis muscle (Figures 1 and 2). This muscle belly continued distally as an individual tendon and this tendon joined with the short head of the biceps brachii, before inserting onto the radial tuberosity. The musculocutaneous nerve was deep to this third head of the biceps and gave off small branches to this accessory muscle.

To our knowledge, this is the first report of a third head of the biceps solely originating from the fascia of the brachialis muscle. Poudel et al. mention that supernumerary heads may arise from the brachialis muscle, however, this origin was not noted in Poudel’s study of the Nepalese population. Two authors report cases of an accessory head primarily originating from the anterome-
dial humerus just lateral to the brachialis and that this head had some fibers originating from the fascia surrounding the brachialis muscle. Extensive literature search did not find any case reports of a third head only arising from the brachialis fascia as seen in our specimen.

Discussion
Supernumerary heads of the biceps brachii are a well-documented anatomic variation. Studies of comparative anatomy, especially of the gibbon and orangutan, have lead anatomists to hypothesize that the variation results from a remnant of an additional head of the coracobrachialis muscle which is seen in these animals, and that it regressed as humans transitioned to upright walking, relying less on the upper extremities for weight bearing.

Two relatively large studies have categorized the origins and insertions of supernumerary heads in an attempt to identify the most frequent variations. Rodriguez-Niedenfuhr et al. identified three different points of origin: superior, infero-lateral, and infero-medial. Their data is summarized in Table 2. These authors propose that case reports of up to seven biceps brachii heads are combinations of the superior, infero-lateral and infero-medial origins with duplication of the long or short heads. Our specimen does not fit into this classification system. The other classification system, summarized in Table 3, was proposed by Kosugi et al. They grouped supernumerary
head origin into three regions: the shaft of the humerus between coracobrachialis and the brachialis, the intermuscular septum, or from any other region like the shoulder joint capsule or pectoralis major tendon. Our specimen fits into this system because of their use of the third “catch all” category. They also classified specimens with four or more heads as combinations of their three categories.

Despite its novel origin, the variation seen in our specimen inserted onto the tendon of the short head, which is the second most common insertion according to Kosugi et al.

**Clinical implications**

Of course, the kinetic effects of supernumerary heads are somewhat dependent on their point of origin and their size. There are rare reports of accessory heads originating from the scapula, but in general, they only cross the elbow joint and this may allow for flexion at the elbow regardless of shoulder position as well as contribute to increased forearm supination.

There are also several important clinical implications to bear in mind. These accessory muscle bundles have been reported to cause neurovascular compression or entrapment. This can result in high median nerve entrapment symptoms, thrombosis from brachial artery compression and edema from brachial vein compression.

As mentioned above, the musculocutaneous nerve very often has an anomalous course associated with the presence of supernumerary heads of the biceps brachii and this can contribute to nerve entrapment, but is also important for surgeons operating in this region. The deltopectoral interval is a common route of entry into the arm and supernumerary heads can cause confusion leading to development of incorrect intervals during this approach, especially when they originate from the pectoralis major. Additionally, this is usually a unilateral variation which can lead to concern for soft tissue tumors. Accessory muscle heads should be able to be differentiated from soft tissue tumors with routine MR imaging. Finally, supernumerary heads can cause unusual displacement of humeral fragments after fracture.

**Conclusion**

The variations of the biceps brachii are well documented. However, to our knowledge, an accessory head originating from the investing fascia of the brachialis muscle, like we observed in our specimen, has not been reported. Understanding the varying origins of this muscle is essential for surgeons operating in this region as supernumerary heads can cause confusion intraprocedure.

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### Table 2

Rodriguez-Nidenfuhr classification of supernumerary humeral heads of biceps brachii muscle.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Origin</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior</td>
<td>Humerus between the lesser tubercle and the insertion of the coracobrachialis muscle and origin of the brachialis muscle</td>
<td>5/350 (1.5%)</td>
</tr>
<tr>
<td>Infero-medial</td>
<td>Anteromedial humerus, continuous with insertion of the coracobrachialis muscle</td>
<td>31/350 (9%)</td>
</tr>
<tr>
<td>Infero-lateral</td>
<td>Lateral intermuscular septum between the insertion of the deltoid muscle and the origin of the brachioradialis muscle</td>
<td>1/350 (0.3%)</td>
</tr>
</tbody>
</table>

### Table 3

Kosugi et al. classification of supernumerary humeral heads of biceps brachii muscle origin and insertion.

<table>
<thead>
<tr>
<th>Origin</th>
<th>Prevalence</th>
<th>Insertion</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft of humerus between coracobrachialis and brachialis muscles</td>
<td>54.7%</td>
<td>Common belly</td>
<td>74.7%</td>
</tr>
<tr>
<td>Intermuscular septum</td>
<td>2.7%</td>
<td>Common tendon</td>
<td>14.7%</td>
</tr>
<tr>
<td>Other regions (i.e. Tendon of pectoralis major, deltoïd, shoulder capsule)</td>
<td>12%</td>
<td>Short head of biceps brachii</td>
<td>16%</td>
</tr>
<tr>
<td>Shaft of humerus and intermuscular septum</td>
<td>36%</td>
<td>Long head of biceps brachii</td>
<td>4%</td>
</tr>
<tr>
<td>Shaft of humerus and other regions</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ly.[4,15,22] It is also important for clinicians to be aware of this relatively frequent variation, and that it can be a cause of unusual displacement of humeral bone fragments with fractures, nerve entrapment or can be mistaken for soft tissue tumors.[2,4,15,19,22,24,27,30,33,40]

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**References**


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