

Coexistence of a pectoralis quartus muscle, a supernumerary head of biceps brachii muscle and an accessory head of flexor digitorum profundus muscle

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Although anatomical variations in the upper limb are frequent, coexistence of multiple combined variations is rare. During a routine educational dissection at Jeju National University Medical School, three muscular variations were found in a 75-year-old Korean male cadaver, in which a supraclavicular cephalic vein was also found in ipsilateral upper extremity during skinning. Here we describe characteristics of the pectoralis quartus muscle, the supernumerary head of biceps brachii muscle and an accessory head of flexor digitorum profundus muscle, and discuss their coexistence from morphological and embryological points of view. (Folia Morphol 2019; 78, 1: 204–207)

Key words: muscular variations, pectoralis quartus, biceps brachii, Gantzer's muscle

INTRODUCTION

Supernumerary muscles in various regions have been reported. The upper limb is one of the most frequent sites. Although there was an extremely rare case of bilateral multiple variations [25], most multiple variations biased toward unilateral side, including multiple muscular variations in the neck, upper limb, and lower limb of the left side [2] and six combined neuromuscular variations confined to the left upper limb [3].

Nonetheless, coexistence of multiple combined variations is rare. We found three muscular variations in the left upper limb unilaterally: a pectoralis quartus muscle in the pectoral region, a supernumerary head of the biceps brachii muscle in the arm and a Gantzer's muscle in the forearm. Herein we discuss these rare findings from morphological and embryological points of view.

CASE REPORT

During a routine educational dissection at Jeju National University Medical School in 2017, three muscular variations were found in a 75-year-old Korean male cadaver, in which a supraclavicular cephalic vein [7] was also found in ipsilateral upper extremity during skinning.

In the left thoraco-abdominal region, a distinct long and flat muscular mass with about 13.8 cm lining was observed inferolateral to the pectoralis major muscle (Fig. 1A). It was deemed to represent a pectoralis quartus muscle. It originated from the rectus sheath, running parallel to costal head of pectoralis major and inserting into the coracobrachialis fascia.

In the left arm, a supernumerary head of the biceps brachii muscle was found with its origin at the humeral shaft inferior to the insertion of the coracobrachialis muscle (Fig. 1B). This supernumerary

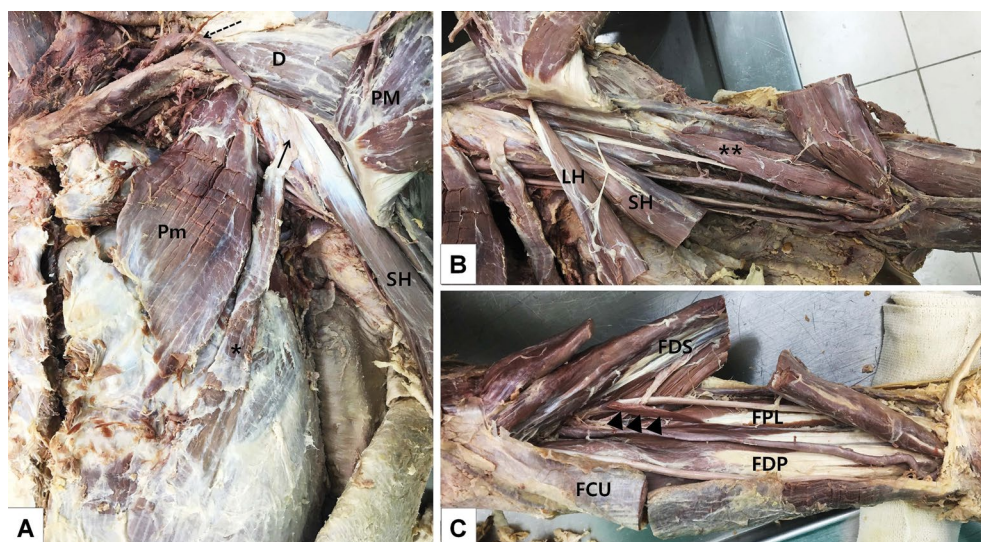


Figure 1. Muscular variations confined to the left upper limb. **A.** The pectoralis quartus muscle (asterisk) runs deep to the pectoralis major (PM) and inferolateral to the pectoralis minor (Pm) muscle and inserts into the fascia of coracobrachialis muscle (arrow); **B.** The supernumerary head of biceps brachii muscle (asterisks) lies deep to the long head (LH) and short head (SH) of biceps brachii muscle and inserts as a common belly; **C.** The accessory muscle of the flexor digitorum profundus, a Gantzer's muscle (arrowheads) originated from the flexor digitorum superficialis (FDS) and inserted into the flexor digitorum profundus (FDP). Dotted arrow, a supraclavicular cephalic vein; D — deltoid; FPL — flexor pollicis longus; FCU — flexor carpi ulnaris.

head, with length of 12.4 cm and width of 3.5 cm, ran downwards deep to the long head of the biceps brachii muscle and inserting into the radial tuberosity afterward they became together. The supernumerary head of the biceps brachii muscle was innervated by a branch of the musculocutaneous nerve.

In the left forearm, the Gantzer's muscle was found (Fig. 1C). It originated from the flexor digitorum superficialis muscle and inserted into the flexor digitorum profundus muscle. The length and width of the Gantzer's muscle were 4.4 cm and 0.9 cm, respectively.

DISCUSSION

Muscular variations in this case are well known due to their relatively high frequency individually. Only a few cases containing multiple muscular variations of the flexor compartment of pectoral region, arm and forearm have been reported [17, 25]. However, the presence of three muscular variations involving all flexor compartments of the upper limb makes this case unique.

Although the pectoralis quartus muscle is considered a rare variation, its incidence has been reported to be 11–16% [4]. The origin and insertion of the pectoralis quartus muscle are known to be constant. It usually arises near the costochondral junction of the fifth and sixth ribs and inserts on or near the lat-

eral lip of the intertubercular groove of the humerus deep to the tendon of pectoralis major muscle [9]. In addition, the pectoralis quartus muscle originates from the rectus sheath [4, 18] and inserts onto the coracobrachialis fascia [3, 23] or the coracoid process [4, 18]. The pectoralis quartus muscle can be innervated by the medial pectoral nerve [5, 8, 22, 23], the intercostal nerve [1], or both [27]. In present study, the pectoralis quartus muscle originated from the rectus sheath, running parallel to the costal head of pectoralis major muscle and inserting onto the coracobrachialis fascia.

Embryologically, the pectoral musculature is derived from ventral limb bud masses arising from myoblasts that migrate out of the last five cervical and first thoracic myotomes into the developing limb buds during the fifth week of development. These pectoral muscles assume their final forms through a combination of migration, fusion and apoptosis of muscle cell precursors. The pectoralis quartus muscle might be a result of failure in fusion to the pectoralis major muscle [14]. Accordingly, the pectoralis quartus muscle could be derived from the pectoralis major muscle [4], which is reinforced by combined anomalies of partial absence of the pectoralis major muscle, the sternalis muscle and the pectoralis quartus muscle [27].

Historically, the biceps brachii muscle is known to be one of the most variable muscles [3, 16, 20]. The two heads of this muscle may be totally separate, fused, or absent. The incidence of the third head of biceps brachii muscle is about 10–12% by meta-analysis [24]. It also varies from one population to another (6.2–20.5%; [3]). The supernumerary head of the biceps brachii muscle might originate from the shaft of humerus at the insertion point of the coracobrachialis muscle, the coracoid process, the deltoid tuberosity, the tendon of the pectoralis major muscle, and the brachialis, the brachioradialis, the pronator teres muscles or the fascia covering them [3]. Contrary to the origin, the insertion of the supernumerary head of the biceps brachii muscle is relatively constant. They might insert into the common belly (73.3%), the tendon (14.7%), the short head (9.3%) and the long head (2.7%) of the biceps brachii muscle. The third head usually receives its innervation and vascular supply from musculocutaneous nerve and brachial artery, respectively [3]. In our case, the supernumerary head originated from midshaft of the humerus between coracobrachialis and brachialis and inserted into the radial tuberosity as common belly.

The Gantzer's muscle is an accessory head of the flexor pollicis longus muscle or the flexor digitorum profundus muscle located in the forearm. Its percentage of occurrence varies greatly according to authors and works analysed. However, only a few authors have reported varying incidence of the Gantzer's muscle, an accessory head of the flexor pollicis longus or the flexor digitorum profundus muscle, respectively [6, 10, 21]. The incidence of the accessory head of the flexor pollicis longus muscle has been reported to be about 48.39% (120/248) and that of the flexor digitorum profundus muscle has been reported to be 15.73% (39/248). Although the prevalence of the Gantzer's muscle varies by races, it is persistently found in about 57.24% (83/145) of Koreans: 66.7% (48/72) of an accessory head of flexor pollicis longus muscle [19] and 47.95% (35/73) of an accessory head of flexor pollicis longus and/or the flexor digitorum profundus muscles [28]. The accessory head of the flexor digitorum profundus muscle has been observed to arise from the flexor digitorum superficialis muscle, medial epicondyle and the coronoid process of ulna, and inserted onto the flexor digitorum profundus muscle at the level of the wrist [6, 10, 21]. The Gantzer's muscle, especially an accessory head of the flexor digitorum profundus muscle, is innervated by

the median and the anterior interosseous nerve [10, 11, 15]. In our case, the Gantzer's muscle originated from flexor digitorum superficialis muscle and inserted into the flexor digitorum profundus muscle.

During the fourth week of development, somatic mesoderm invades the limb buds and forms ventral and dorsal condensations. The ventral condensation gives rise to flexors and pronators of the upper limb [12]. Triceps and biceps musculatures are derived from the dorsal and ventral muscle masses of the upper limb bud, respectively. Accessory muscles may have formed during this period of development [26]. Flexor muscles of the forearm that develop from the flexor mass are divided into two layers: superficial and deep. The flexor pollicis longus, the flexor digitorum superficialis, and the flexor digitorum profundus muscle originate from the deep layer [13]. The existence of accessory muscles connecting the flexor muscles could be explained by incomplete cleavage of the deep layer of the flexor mass during development [10].

CONCLUSIONS

The upper extremity is a frequent site of injury. Thus, various surgical and invasive procedures are performed in this region. Combined multiple variations in the upper limb found in the present case are not only of interest to anatomists, but also to clinicians who are dealing with this area.

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