Extensor digitorum brevis manus with “X” tendons

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Abstract
During the educational dissection of a 72-year-old Chinese male cadaver, bilateral extensor digitorum brevis manus (EDBM) muscles were observed. The left EDBM muscle originated from the joint capsule ligament, running across the second dorsal interosseous muscle as double tendons (EDBM ulnar tendon and EDBM radial tendon) on the ulnar side of extensor digitorum communis (EDC)-index finger. The EDBM radial tendon positioned ventrally but inserted further to the ulnar tendon so that they made an “X” shape. The right EDBM muscle arose from dorsal radiocarpal ligament, coursing the second dorsal interosseous muscle and inserted into the ulnar side of EDC-index finger.

Keywords: extensor digitorum brevis manus, tendon, insertion, variant.

Introduction
Variations of the extensor muscles and tendons of the hand are very common [1] and their importance in hand surgery has been well-documented [2]. Anomalies are often discovered incidentally during surgery. Some, however, may be associated with dorsal wrist pain, especially when the muscle bellies impinge on and occupy the narrow dorsal compartments of the wrists. It is mandatory to enhance the existing anatomical knowledge of the hand and their common variations whenever reconstructive procedures are planned in this region.

The extensor digitorum brevis manus (EDBM) muscle is an anomalous muscle found on the dorsum of the wrist and hand. It is a rare anomaly and it was first noted by Albinus in 1734 [3]. In a large cadaveric study, the incidence of EDBM was 3% [4], and in other studies, it has varied from 1% to 10% [5–7]. It was bilateral in about 30% of cases [6, 8]. There is no difference between genders [9, 10] and the muscle has seldom been described in children [11]. In the present study, bilateral EDBM muscles were observed. Tendons of the left EDBM displayed an “X” shape.

Materials and Methods
The dissection of a 72-year-old Chinese male cadaver was carried out in the Department of Anatomy of Jining Medical University, Shandong, China. After the removal of the skin and superficial fascia of upper extremities, the extensor retinaculum was longitudinally opened to expose the dorsum of hands. The EDBM muscles were examined carefully and measured with a vernier caliper. Photographic records were taken by a digital camera.

The cadaver was preserved by the injection of formalin-based preservative (10% formalin) and stored at -4°C for at least three months. The dissection was approved by Ethics Committee of the University and the study was conformed to the previous Declaration of Helsinki in 1964.

Results
The left EDBM muscle took origin from the joint capsule ligament and localized dorsally to the second dorsal interosseous muscle as double tendons, the EDBM ulnar tendon and EDBM radial tendon, on the ulnar side of extensor digitorum communis (EDC)-index finger. The EDBM radial tendon positioned ventrally but inserted further to the ulnar tendon so that they made an “X” shape. The right EDBM muscle arose from dorsal radiocarpal ligament, coursing the second dorsal interosseous muscle and inserted into the ulnar side of EDC-index finger.

Discussion
Variations of the origin of EDBM have been reported. The distal row of the carpal bones or metacarpal bases was considered as the origin by earlier reporters [12–14]. The capsule and ligaments of the wrist joint [15–21] and the carpal bones [1, 11, 16, 19, 22–27] were most commonly reported as the site muscle origin, the radius [1, 3, 7, 21, 28] and metacarpals less frequently [7] and the ulna rarely [1]. In the present case, origins of bilateral EDBM were not distinctive as most frequently described. However, they had some differences in size and tendons. Tendons of the left EDBM were seldomly reported previously.

According to their insertions and relationships with the extensor indicis proprius (EIP), the anatomy of EDBM has been classified into three types [4]. In type 1, the EDBM tendon inserted onto the dorsal aponeurosis of the index finger, as would the EIP, although it was absent. In type 2, both the EIP and EDBM inserted on the index
finger. This type was further classified into three subtypes. In type 2a, the tiny or vestigial EIP arose from the ulna but was confluent with the EDBM belly, which inserted on the index finger. In type 2b, the distal end of the EDBM belly joined with the EIP tendon. In type 2c, the EIP inserted normally, but the thin EDBM tendon also inserted more ulnarily than the EIP tendon, often with a membraneous accessory slip, which inserted on the long finger. In type 3, the EIP inserted on the index finger, but the EDBM inserted on the long finger, with or without an accessory EIP to the long finger. Some authors performed anatomical studies to demonstrate the association of the EDBM with the absence of extensor indicis [21]. In the present specimen, the EIP was absent and both EDBM were inserted into the dorsal aponeurosis, ulnar side of EDC-index finger. It belonged to type 1 according to Ogura et al. [4]. However, the tendons and insertions of the left EDBM were not consistent with the above descriptions.

![Image](image_url)

**Figure 1 – Dissection of the dorsum of hands, showing the extensor digitorum brevis manus: (A) Dorsum of the left hand; (B) Dorsum of the right hand. EDBM: Extensor digitorum brevis manus, EDBM-radial: Radial tendon of the extensor digitorum brevis manus, EDBM-ulnar: Ulnar tendon of the extensor digitorum brevis manus, EDC-index: Extensor digitorum communis to index finger, EDC-medii: Extensor digitorum communis to middle finger, EDC-ring: Extensor digitorum communis to ring finger.**

The variations could be explained that embryologically the precursor muscle superficially differentiated into three bundles: the EDC, extensor carpi ulnaris and extensor digiti quinti proprius. Developmental defects were related to alterations in these developing extensor sheets in the forearm [29]. Chevallier et al. [30] pointed out that during limb development the tendons originated from the lateral plate mesoderm, while the limb musculature was derived from the migrating somatic mesoderm. This observation brought into focus the development role in such variations, which should be taken into account. It was likely that there were two EDBM muscles on the left hand at the early stage of development. The two bellies merged together gradually as a single belly but their tendons did not fuse, so that their insertions were so close and created an “X” shape.

It is believed that the EDBM is an atavistic muscle [1, 31, 32] and a remnant from amphibians. In humans, it represents a failure of proximal migration of the ulnar-carpal elements of the antebrachial muscle mass [31, 33]. Boyes [34] considered that in the evolutionary development of the forearm extensors of amphibian, it became tendinos, losing their attachment to the carpus. Kaplan [35] believed this anomaly represented a homologue of the extensor digitorum brevis of the foot. Glasgow [7] favored the view that EDBM represented a delamination of the extensor group and Ogura et al. [4] considered it a variant of the EIP.

Although an EDBM with a wrist ganglion may appear on the same hand [36], the EDBM is usually asymptomatic and may appear as a painful tumor-like mass. The muscle could be misdiagnosed as dorsal wrist ganglion, or a benign soft tissue tumor [10]. Heavy use of the hand could lead to pain over hand. When EDBM is present bilaterally, the symptoms usually occur in the dominant hand [4, 37]. Misdiagnosis can lead to unnecessary surgery [10, 37]. The EDBM has been suggested as a possible graft for tendon transfers to restore malfunctioning muscles.

**Conclusions**

In order to avoid confusion, misdiagnosis and unsuccessful treatment, the clinician must be aware of the possible existence of the EDBM. Further study is necessary to improve diagnostic and treatment procedures.

**Reference**


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