The presence of extensor digiti medii muscle—anatomical variant

Jonathan S. Carlos MD^{a,*}, Emile Goubran MD, PhD^b, Samir Ayad MD^c

^a Assistant Professor, Department of Basic Sciences, Southern California University of Health Sciences, Whittier, CA 90604

^b Professor Emeritus, Department of Basic Sciences, Southern California University of Health Sciences, Whittier, CA 90604

^c Associate Professor, Department of Basic Sciences, Southern California University of Health Sciences, Whittier, CA 90604

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Abstract

Objective: This study reports the presence of the extensor digiti medii muscle (EDM) in a population of cadavers dissected by students at a chiropractic college anatomy laboratory and determines its frequency, bilaterality, innervation, and sex differences.

Methods: Dissection of upper extremities of 47 human cadavers (24 males, 23 females) was conducted. Both upper extremities were examined for bilaterality. The long extensor tendons were exposed, separated, and cut to expose the EDM. Identifying the innervation of the variant muscle was attempted. The specimens were then photographed.

Results: In this report, the prevalence of EDM is at 7.4%. The EDM was discovered in 5 male cadavers and 1 female cadaver (5:1 ratio). It also revealed that the EDM was prevalent on the left forearm than on the right forearm at a ratio of 5:2. Out of the 47 cadavers studied in this report, only one was observed to have EDM bilaterally (2.1%). In 2 cadavers, the EDM appeared to be supplied by the posterior interosseous nerve. The branch piercing through the extensor indicis muscle continued to give off a small branch entering the belly of the EDM.

Conclusion: The findings obtained in this report support previous observations regarding its prevalence in males more than females. The report also shows that the EDM occurs more in the left forearm than the right forearm as opposed to other reports of equal incidence between left and right forearms. This report also supports one previous study showing that the posterior interosseous nerve innervates the EDM.

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* Corresponding author. 16200 E. Amber Valley Dr, Whittier, CA 90604. Tel.: +1 562 947 8755x628; fax: +1 562 947 5724.
E-mail address: jonathancarlos@scuhs.edu (J. S. Carlos).

Introduction

Multiple variations in the muscles and tendons of the extensor compartment of the forearm and dorsum of the hand have been reported in the literature. One of the anatomical variations is the extensor digiti medii muscle (EDM). According to Bergman et al,¹ there are 2 forms of this muscle: a longus and a brevis type. The type of muscle found in this study was of the longus type and attached exclusively to the middle finger. This muscle type is found in the deep layer of the extensor compartment of the forearm, arising from the ulna immediately distal to the origin of the extensor indicis muscle and inserting to the dorsal aspect of the base of the proximal phalanx of the middle finger.²

In the early stages of embryological growth, the precursor extensor mass differentiates into 3 layers: a superficial layer destined to become the extensor digitorum muscle, extensor carpi ulnaris muscle, and extensor digiti minimi muscle; a radial layer, which forms the brachioradialis muscle and the extensor carpi radialis longus and brevis muscles; and a deep layer, which gives rise to the abductor pollicis longus muscle, extensor pollicis brevis muscle, extensor pollicis longus muscle, and extensor indicis muscle,³ often called the *outcropping muscles*. Comparative studies suggest that the superficial and radial components of the extensors exhibit marked phylogenetic stability; but the deep layer seems to be highly unstable and still to be undergoing considerable evolutionary changes, as can be seen from the great variation in its expression in the different species of primates.³ It is therefore suggested that the present anatomical variation may represent an evolutionary remnant.³ Awareness of such anatomical variations in the extensor compartment of the forearm may help in the identification and repair of these structures.

Differences among authors abound in reporting the prevalence of such variation in the extensor compartment of the muscles of the forearm, in reporting both their frequency and their prevalence in one sex over the other.^{2,4-9} The purpose of this study is to report the presence of the EDM in cadavers in the anatomy dissection laboratory and to ascertain their frequency, bilaterality, innervation, and sex differences.

Methods

The study population comprised 24 embalmed male cadavers and 23 female cadavers located at the Southern California University of Health Sciences, Los Angeles

College of Chiropractic. Both upper extremities of each cadaver were examined to determine bilateral presence of the EDM. The long extensor tendons were carefully exposed and separated. When an EDM was present, the other long extensor tendons were cut to fully expose the variant muscle. An attempt was made to identify the source of nerve supply of the variant muscle by tracing the nerve branch proximally toward its principal nerve. The specimens were then photographed.

Results

Of the 47 cadavers studied, the EDM was present in 6 cadavers (12.8%). The EDM was discovered in 5 male cadavers and 1 female cadaver (5:1 ratio). The variant muscle was observed on the left forearm of 3 males (specimens 1-3) and the 1 female (specimen 4) (Fig 1). In 1 male specimen (specimen 5), the EDM was found on the right hand (Fig 2); and in another male specimen (specimen 6), it was observed bilaterally (Fig 3). In this study, the prevalence of EDM in the studied population is at 7.4%. It also revealed that the EDM was prevalent on the left forearm than on the right forearm at a ratio of 5:2. Out of the 47 cadavers studied in this report, only one was observed to have EDM bilaterally (2.1%).

The muscle was found in a plane deep to the tendons of the extensor digitorum muscle (Fig 4). The muscle belly is fusiform, measuring approximately 3 to 4 cm in length and approximately 4 to 5 mm in width at the midpoint of its length. Further dissection revealed that the muscle attaches proximally to the ulna just distal to the attachment of the extensor indicis muscle. It had a

Fig 1. Extensor digiti medii muscle on left hand.

Fig 2. Right EDM attaching to the distal ulna (A) and proximal phalanx of the middle finger (B).

single long tendon inserting to the dorsal aspect of the base of the proximal phalanx of the middle finger (Fig 2). There were no tendinous connections between any portion of the EDM and any other extensor tendon. In 1 male and 1 female specimen, with an EDM on the left hand, the posterior interosseous nerve appeared to provide innervation to the muscle (Figs 5 and 6). In both cadavers, the posterior interosseous nerve was traced from its origin as it emerged from the supinator muscle. The nerve sent several branches to the bellies of the extensor carpi ulnaris muscle, the extensor pollicis longus muscle, and the extensor indicis muscle. The branch piercing through the extensor indicis muscle continued to give off a small branch entering the belly of the EDM (Fig 6). The nerve supply of the

Fig 4. Extensor digiti medii muscle (arrows) deep to the plane of extensor digitorum (ED).

EDM could not be identified in the other specimens in this population.

Discussion

Presence of the EDM appears to be based mostly on cadaveric studies.^{2,4-8,10} According to Abu-Hijleh, “No clinical or surgical cases of such occurrence have been reported and therefore it is doubtful whether an accurate estimate of the prevalence of EDM can be made.”² However, Pfeiffer¹¹ discovered an EDM while operating on the hand of a 28-year-old patient. Previous investigators have reported its prevalence ranging from 1% to 12% of cadavers.^{2,4-8,10} The current report shows the prevalence is at the middle of this range (7.4%). A higher incidence is reported by von Schroeder and Botte,⁴ with a 12% prevalence of the EDM. They also report that the variant muscle appears to be less frequent in females compared with males.⁴ The current report supports this observation, in which 5 cadavers showing EDM are males and 1 cadaver with EDM is female. Previous reports record an equal incidence of EDM between right and left forearms.^{4,5} However, in this study, the EDM was prevalent on the left forearm than on the right forearm at a ratio of 5:2. Some reports indicate that a bilateral presence of EDM is a rare occurrence.^{3,5} Only 1 cadaver in a total of 47 showed bilateral presence of EDM (2.1%) in this study.

As in other reported cases, the muscle took origin from the dorsal surface of the lower part of the ulna, just distal to the origin of the extensor indicis and inserting into the base of the proximal phalanx.^{2,6} The EDM

Fig 3. Extensor digiti medii muscle on both hands.

Fig 5. Posterior interosseous nerve at arrow, probe (A) under nerve to EDM, and probe (B) under the tendon of EDM.

appears to cause extension of the middle finger at the metacarpophalangeal joint when its tendon is pulled. Some authors reported the nerve supply to the EDM arising from the deep branch of the radial nerve.⁷ The authors of this study were able to demonstrate the innervation of the EDM in 1 male and 1 female specimen. As in 1 previous study, the EDM muscle on the left side appeared to be supplied by the posterior interosseous nerve, which is the nerve supply of the outcropping muscles of the forearm.^{3,7}

There are also other variations reported in the dorsum of the hand, and increasing multiplicity was noted toward the ulnar side of the hand.⁴ In an anatomical study of 416 Japanese adults using 832 upper limbs, Yoshida classified the variations into 13 types according to the muscle arrangements and insertions.⁹ The most frequent type of forearm muscle variation involved the presence of both extensor pollicis longus muscle and extensor indicis muscle, found at an incidence of 79.8%.⁴ Another type of anatomical

Fig 6. Probe (A) under the posterior interosseous nerve, probe (B) under nerve to extensor indicis, and probe (C) under nerve to EDM.

variation involved the presence of both extensor indicis muscle and EDM at an incidence of 8.1%.¹¹

Recognition of the anatomy and variations of the extensor tendons of the dorsum of the hand by physicians, surgeons, and other allied health practitioners dealing with musculoskeletal conditions is necessary for proper assessment, treatment, and management of the traumatized or diseased hand, especially when considering tendons for transfer or tendon reconstruction.^{2,4,5,10} Increased awareness of these anatomical variations of the hand and forearm will enable health practitioners to appreciate the varying clinical manifestations of diseases affecting the hand and forearm.^{4,5,8,10}

One limitation to this study is that the presence of EDM could be overlooked by anatomy students and instructors in gross anatomy laboratories considering that this muscle is not very conspicuous, having only a thin tendon and being covered by the extensor digitorum muscle.

Conclusion

The reporting of the presence of the EDM in the literature is widely variable. In this study, the presence of EDM appeared to have an incidence of 7.4%, which is in the midrange of previous reports. Contrary to previous reports that recorded an equal incidence of the muscle between the left and right forearm, this study reveals that the incidence of the muscle is twice on the left hand than on the right. The bilateral occurrence of this muscle is indeed quite rare as in previous reports. This study supports previous findings in which the EDM occurs more frequently among males than females. The significant incidence of EDM clearly demonstrates the need to be aware of numerous anatomical variations in the extensor compartment of the forearm when

performing surgical repair of the tendons on the dorsum of the hand.

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