Original Research Paper

Volume-10 | Issue-1 | January - 2020 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anatomy

STUDY OF VARIATIONS IN THE EXTENSOR TENDONS OF THE HAND BY THE DISSECTION METHOD IN CADAVERS

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ABSTRACT Between dorsal carpal ligament and carpal bones six compartments are formed for passage of tendons. The presence of accessory muscle and tendons in hand is of great interest to hand surgeons. These extra muscles often present as ganglion, soft tissue tumor or mass in hand, which could be quite misleading to surgeon.
Variations were observed during routine dissection of cadavers.
RESULTS: Variations were observed in extensor tendons present in dorsal of hand in 3 cases out of 14 hands. In one case extensor indices was absent and in another 2 cases, presence of additional tendon to ring finger was present.
CONCLUSION: The extensor tendons of hand are in superficial position; consequently, they are highly susceptible to injury. These variations are important during tendon transplant, for tendon rerouting or transplants.

KEYWORDS : extensor digitorum, hand, variations

INTRODUCTION

The extrinsic tendons pass through extensor retinaculum on dorsum of hand. This structure is divided into six compartments. Found on dorsum of hand are tendons of extensor pollicis longus, extensor digitorum communis, extensor indicis and extensor digiti minimi. However, existence of variant muscles on dorsum of hand has been documented in numerous publications[1-4.] The extensor tendons of hand are in relatively superficial position; consequently, they are highly susceptible to injury. We review anomalous extensor muscles of the hand.

We also present analysis of developmental significance of these anomalous extensor muscles, indicating those that may be of embryologic significance and those that represent evolutionary variants.

MATERIAL AND METHOD

The tendons were studied by dissection method on 7 embalmed adult human cadavers of known sex. They included 5 males and 2 females' cadavers. They were collected from the dissection hall of department of Anatomy of M G V Dental College, Nashik, in Maharashtra.

The synopsis of study protocol was submitted to Institutional Ethics Committee and approval was obtained.

The exclusion criteria were presence of abnormal mass or growth, evidence of trauma or surgical scar on dorsum of hand.

The study period was 2yrs.

A thorough dissection of these specimens was done with routine dissection instruments.

Materials used were:

Scalpel, Blade no.21, Blunt and toothed forceps, Scissors (pointed, curved, blunt) & Photography kit.

Skin, subcutaneous tissue and antebrachial fascia of upper limb, forearm were dissected carefully. The origin and tendons of various extensors present on dorsum of hand were traced.

The tendons were exposed and cleaned. The relations of extensor tendons to each other were observed.

Data analysis:

The detailed data was entered. Values were reported as in percentage.

RESULTS:

During routine cadaveric dissection classes for purpose of teaching, variations were noted in female cadavers fixed in 10% formaline. In 7 cadavers (5M & 2F), extensor tendons were studied and 3 (21.4%) of 14 hands were found to have variations. The variations were more commonly found in 2 females than male cadavers. Variations were 2 cases (14.28%) on the right side and on left side in 1 case (7.14%).

Variations encountered in relation to extensor tendons are as follows:
In one case, extensor indices was absent in left hand of female cadaver. In another 2 cases, presence of additional tendon inserting to the ring finger was present in right and left hands of female cadaver. Additional tendon was long and of similar caliber as they passed along extensor digitorum tendon. In both cases, it was seen that the tendon was inserted into the ulnar aspect of dorsal digital expansion of the ring finger. When traced upward it was seen that the tendons originated from lower end of ulna and interosseous membrane and inserted on digital expansion of the ring finger on ulnar side of extensor digitorum. (PIC 2)

DISCUSSION:

Anomalous extensor muscles of hand are not uncommon. The vast majority are asymptomatic. These anomalies are often found incidentally during surgery, like during removal of ganglion. Some, however, may be associated with dorsal wrist pain, particularly if muscle bellies impinge on and occupy narrow dorsal compartments of wrist. The extensor indices (EI) normally arises from posterior surface of distal third of ulna and adjacent interosseous membrane passes distally within fourth dorsal compartment deep to extensor digitorum (ED) tendons and inserts into dorsal expansion of index finger on ulnar side of insertion of ED.

The clinical significance of EI of hand was first appreciated by Garcia in 1936.[5] The term extensor indicis proprius syndrome was coined by Ritter and Inglis and is used to describe cases of tenosynovial proliferation is found surrounding bulky musculotendinous portion of EI.[6] Pain is characteristically elicited by extension of index finger against resistance with wrist in flexion (extensor indicis proprius test); absence of pain during this test rules out the condition. Conservative treatment consisting of rest, splinting, steroid injection. Shortwave diathermy, paraffin path, immobilization and drugs have been routinely used.[7]

The anatomy of Extenor Digitorum Brevis (EDB) has been classified into 3 types according to their insertion and relationship with EI[8]. In type I, EI is absent and EDB tendon inserts, as would EI.

In type II, both EI and EDB insert on index finger. This type is further divided into 3 subtypes and their relative incidence noted. In the type IIa, the vestigial EI arises from ulna but is confluent with EDB belly, which inserts on index finger. In type IIb, the distal end of EDB belly joins with EI tendon. In type IIc, the EI inserts normally, but thin EDB tendon also inserts more ulnarly than EI tendon, often with membranous accessory slip inserting on middle finger. In type III, the EI inserts on index finger, but EDBM inserts on middle finger with or without accessory EIP to middle finger. Insertions to ring and little fingers have been described.

In our case EDB was arising from lower end of ulna and interosseous membrane and inserted on digital expansion of ring finger. EI present normally. So this variation may include in type III.

The extensor medii proprius (EMP) is a muscle analogous to EI in that it has similar origin, although it inserts into middle finger, and it has

incidence between 0.8% and 10.4%[9,10]. The extensor indicis et medii communis (EIMC) (as in type IIC) is EI muscle with its tendon that splits to insert into both the index and middle fingers; it has an incidence between 2.0% and 6.5%[11,12,13].

The developmental importance of anomalous extensor muscles has been discussed in several reports[14, 10]. The precursor extensor muscle mass of forearm differentiates into 3 parts. A radial portion differentiates into brachioradialis and extensor carpi radialis longus and brevis. It then divides into superficial portion and deep portion. The superficial portion forms ED, extensor carpi ulnaris, and extensor digiti minimi. The deep portion, which is innervated by posterior interosseous nerve, gives rise to abductor pollicis longus and extensor pollicis brevis on radial side; extensor pollicis longus and EIP on ulnar side[10, 11]. Comparative anatomy studies suggests that superficial and radial grouping exhibit stability within major divisions of phylum of animal species, while deep portion appears to be highly unstable and undergoes considerable evolutionary change. Therefore the greatest variations occur within deeper portion.

In humans, this muscle has disappeared in upper limbs, its function being taken over by forearm muscles with long tendons to digits [15].

Most investigators believe that EDB is atavistic, representing parts of old extensor brevis [11,14,16].

Bunnell[17] encountered 3 patients who had either 1 or 2 slips of atavistic EDBM. He considered that in evolutionary development of forearm extensors of amphibian. Kaplan[18] believed this anomaly to represent homoloque of extensor digitorum brevis of foot. Glasgow[19] favored that EDBM represents delamination of extensor group; Ogur[20] et al considered it to be variant of EIP. Its origin at distal radius suggests extrinsic origin, which is further supported by it often joins EIP with same nerve[19] and arterial supply[20], namely, posterior interosseous nerve and posterior branch of anterior interosseous artery.

The common origin of EI, EMP, and EIMC suggests common embryologic origin of these muscles[13].

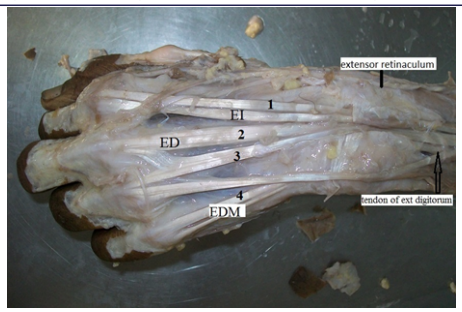
The consistent maintanence of EI may be explained teleologically by relative importance of development of pinch and functional importance of radial side of hand, which is closer to body with forearm pronated [13].

The EIP is more likely to cause symptomatology; its belly traverses its dorsal compartment beneath extensor retinaculum. It is present in most voluminous compartment.

CONCLUSION

Symptoms related to these anomalous muscles are attributed to mechanical problems, namely, increased volume within small rigid compartment that may cause pain from muscle ischemia or inflammatory synovitis. Persons with these types of variant tendons who are involved in sports such as golf, cricket, tennis, weight lifting were excessive wrist movement is involved, may show some symptoms. Dorsal wrist pain should only be attributed to anomalous extensor muscles if the following conditions are met: (1) symptoms are intermittent on repeated movements, (2) pain can be documented on active resistive extension, (3) their presence has been proven either by operative intervention or imaging, (4) there are no associated conditions like ganglion that are treated, (5) surgical decompression of fourth dorsal compartment (for EIP) or surgical reduction of muscle belly (for EDB) leads to symptomatic relief.. It should be remembered that vast majority of anomalous muscles do not cause symptoms and that if suspicions do arise it is usually aEIP.

PIC 1: absence of extensor indices



PIC 2: Additional tendon inserting on ring finger. ED: 1-4 tendon of ext digitorum, EDM- ext digiti minimi, EI- ext indices

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