ORIGINAL ARTICLE

Multiple Tendons Variations were Observed in a Male Old Cadaver

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Abstract

Background: Anatomical variations and arrangements of muscles have great importance in many clinical and surgical procedures.

Objectives: To record any anatomical variation during the complete dissection of a 75 years old male cadaver.

Methods: Complete dissection of a preserved embalmed male cadaver about 75 years old under guide of Cunnigham's Manual of Practical Anatomy for academic year 2018-2019 undergraduate students, at the department of human anatomy at Napata College.

Result: Many anatomical variations were recorded during the dissection. There was agenesis of palmaris longus muscles in both sides, the abductors pollicis longus muscles, extensor digiti minimi muscles were presented with two tendons in both sides. Extensor digtorum tendons on the right side was doubled to the ring finger, there was no independent tendon to the little finger, the lateral tendon of the ring finger gave off intertendinous connection to the lateral tendon of extensor digiti minimi. Extensor digtorum tendons on the left side had four tendons the tendon for little finger was divided into two slips joining the ring tendon and medial tendon of extensor digit minimi. Moreover intertendinous connection of the extensor digitorum tendons in both sides was seen, between the little and ring fingers tendons of the left side while the medial tendon of the ring finger provided an intertendinous connection to middle finger on the right side.

Conclusion: Awareness of these anatomical variations has a significant importance in academic and clinical practice.

Key Words: Cadavers, Dissection, Palmaris longus, Extensor digitorum and variations.

Introduction:

The palmaris longus muscle arises from the common flexor origin and is inserted in the flexor retinaculum and palmar aponeurosis. The muscle is innervated by median nerve, it is a weak flexor of the wrist and by its attachment to the palmar aponeurosis. The muscle produces minimal flexion at the metacarpophalangeal joints of the fingers [(1)].

Four hundred and fifty healthy subjects Malaysia's 3 major ethnic groups were examined for the palmaris longus muscle variation. The tendon was absent unilaterally in 6.4% and bilaterally in 2.9% of a study group [(2)].

The Abductor pollicis longus (APL) originates from the posterior surface of the proximal halves of ulna, radius, and interosseous membrane and gain to be inserted into the base of the first metacarpal bone. Th posterior interosseous nerve (C7, C8) innervates it, the muscle is involved in thumb abduction and extension of carpometacarpal joints [(3)].

A study of APL muscle tendon in 1 of 110 upper limbs showed a division of the APL tendon into 7 slips [(4)].

The EDM tendon persisted as a single tendon in 8.4% of specimens, doubled in 75.8% and tripled in 15.8%. In most cases the tendons were inserted into the extensor expansion of the little finger [(5)].

Extensor digitorum commonly had multiple tendons for the middle and ring fingers, its contribution to the little finger was usually by a bifurcating tendon common with that of the ring finger. The index finger always received a single tendon. Intertendinous connections between the various tendons of the extensor digitorum were variable but were most observed between ring and middle fingers [(6)].

Material and methods:

The current study was conducted at the department of human anatomy at Napata College. A preserved embalmed male cadaver about 75 years old for academic year 2018-2019 for undergraduate students was completely dissected under guide of Cunnigham's Manual of Practical Anatomy. The skin, superficial fascia, deep fascia and muscles were separated using a scalpel and forceps, all the structures of

the body were properly dissected and demonstrated. The variations found were recorded and photographed.

Results:

Multiple anatomical variations were noted during the dissection of the preserved embalmed male cadaver about 75 years old for the purpose of a practical session for undergraduate students academic year 2018-2019, at the department of human anatomy at Napata College. Anterior and posterior compartments of the forearm showed multiple anatomical variations as followed; there was agenesis of palmaris longus muscles in both sides, the abductors pollicis longus muscles and extensor digiti minimi muscles were presented with double tendons in both sides. Extensor digtorum tendons in the right side had double tendon to the ring finger, there was no independent tendon to the little finger, the lateral tendon of the ring finger gave off intertendinous connection to the lateral tendon of extensor digiti minimi. Extensor digtorum tendons in the left side had four tendons, the tendon for little finger was divided into two slips joining the ring tendon and medial tendon of extensor digit minimi. Intertendinous connection of the extensor digitorum tendons in both sides was observed between the 4th and 5th fingers tendons of the left side while the medial tendon of the 5th finger provided intertendinous connection to middle finger on the right side (Table 1).

Table (1): show the encountered anatomical variations

NO	Muscle	Variation
1	Palmaris longus	Agenesis bilaterally
2	Abductor pollicis longus	Double tendon bilaterally
3	Extensor digiti minimi	Double tendon bilaterally and tendonous interconnection with ED tendon of 4^{th} bilaterally
4	Right extensor digitorum	Double tendons to the ring finger, absence of EDM tendon of the little finger and tendonous interconnection between tendons of 4^{th} and 5^{th} fingers
5	Left extensor digitorum	Tendon of the ring finger was divided into two slips joining the lateral tendon of EDM and the second joins the tendon of the ring finger and intertendonous connection between tendons of 4^{th} and 5^{th} fingers

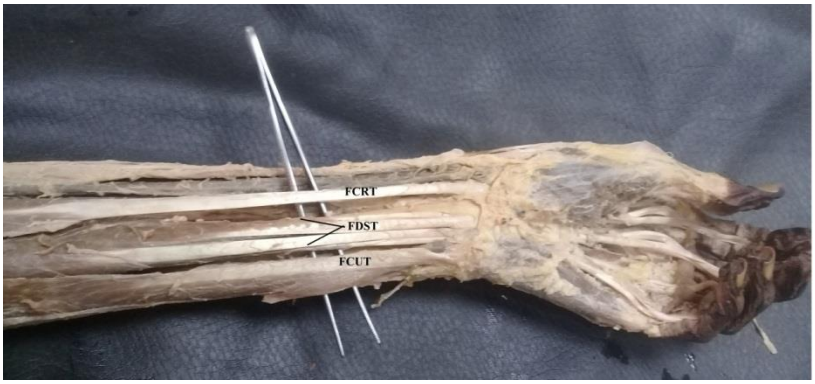

Figure (1): Left Forearm and Hand show Agenesis of the Plarmaris longus muscle and tendon. Flexor carpi radialis tendon (FCRT), Flexor digitorum superficialis tendons (FDST) and Flexor carpi ulnaris tendon (FCUT.)

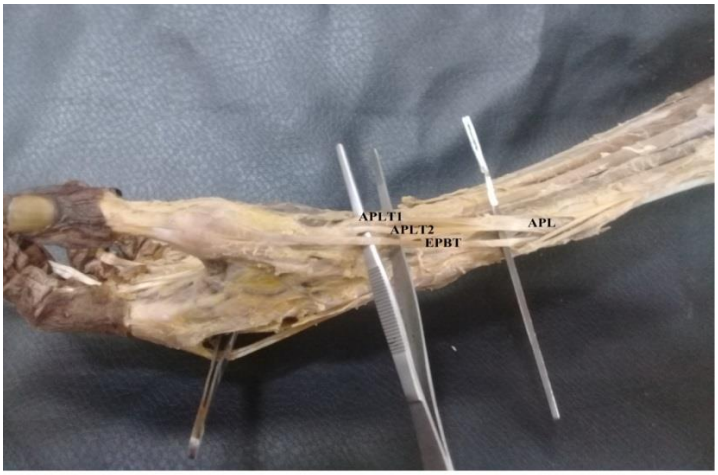

Figure (2): Left side Forearm and Hand Radial side show splitting of Abductor pollicis longus tendon into two (APLT1 and APLT2). Extensor pollicis brevis tendon (EPBT).

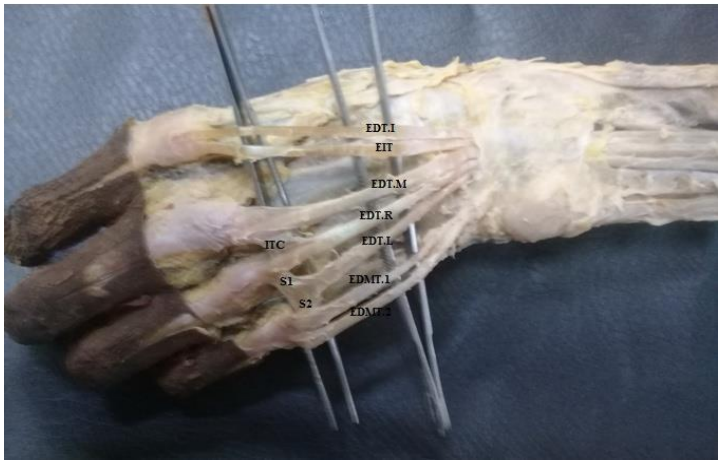

Figure (3): Dorsum of the left side hand and wrist viewed extensor tendons with variations; Extensor digit minimi tendon divided into two tendons (EDMT1 and EDMT2). Extensor digitorum tendon for little finger (EDT.R) was splitting into two slips(S1 and S2) slip 1 join the Extensor digitorum tendon for ring finger, slip 2 join the lateral tendon of Extensor digiti minimi (EDMT1). There was intertendonous connection (ITC) was seen between Extensor digitorum tendon for middle and ring finger(EDT.M and EDT.R)

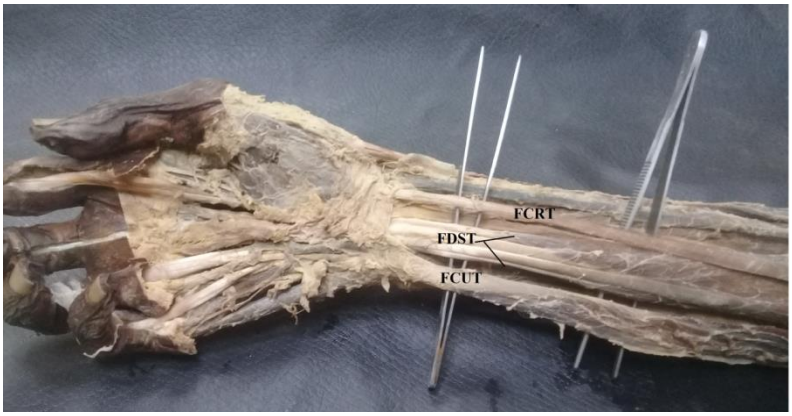

Figure (4): Right side Forearm and Hand show Agenesis of the Plarmaris longus muscle and tendon. Flexor carpi radialis tendon (FCRT), Flexor digitorum superficialis tendons (FDST) and Flexor carpi ulnaris tendon (FCUT).

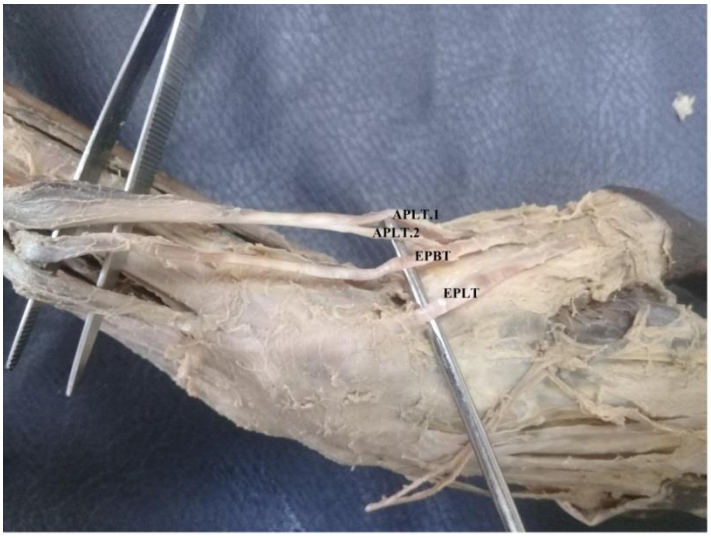

Figure (5): Right side Forearm and Hand Radial side show splitting of Abductor pollicis longus tendon into two (APLT1 and APLT2). Extensor pollicis brevis tendon (EPBT) and Extensor pollicis longus tendon (EPLT).

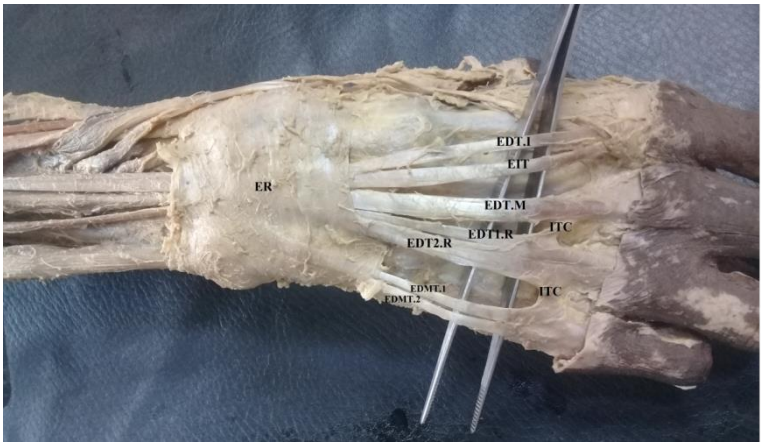

Figure (6): Dorsum of the right side hand and wrist viewed extensor tendons with variations; Extensor digit minimi tendon divided into two tendons (EDMT1 and EDMT2). Extensor digitorum tendon for ring finger was doubled (EDT1.R and EDT2.R), Extensor digitorum medial tendon for ring finger(EDT2.R) join the lateral tendon of Extensor digiti minimi (EDMT1) by intentendonous connection (ITC). There was another (ITC) was seen between Extensor digitorum tendon for middle and ring finger (EDT.M and EDT 1.R)

Discussion:

Knowledge of anatomical variations facilitates following the clinical manifestations of diseases affecting the upper limbs muscle [(7)].Palmaris longus muscle is often described as one of the most variable muscles in the human body, it was absent in about 14% of people on one or both sides [(3)].Absence of palmaris longus was found to be 12.6% (8% Unilateral and 4.6% Bilateral) [(8)]. Absence of the palmaris longus muscle will not affect the hand function [(9)]. Ebrahim et al 2016. The palmaris longus in the literatures was reported usually absent on the left side, its tendon represent a useful guide to the median nerve at the wrist as the nerve lies slightly under it on its ulnar side. The absence of palmaris longus muscle is hereditary in nature [(10)].

In this study the Palmaris longus showed agenesis of two sides (Fig 1 and 4), the other flexor group muscle were demonstrated toward their insertions, they were normally arranged.Sarikcioglu et al reported that APL exhibited with seven

tendon slips in one case, on the right side was noted with three bellies [11]. A case report of 75 years showed the abductor pollicis longus muscle had a tripled tendons on the left side [12].The APL splitting 2-6 tendons in all the cases, no single APL tendon was found [13].

El-Beshbishy et al studied 50 wrists the APL was found with single tendon in 2, double in 31, triple in 8, and quadruple in 8 upper limbs [6].

In contrast to the present study, the APL were doubled in both limbs, at the sides of anatomical snuff box on their way to be inserted in the base of the first metacarpal (Fig 2 and 5). The extensor digiti minimi had separate double tendons not belonging to extensor digitorum tendons [1]. A study of fifty hand extensor tendons distribution showed that the extensor digiti minimi divided into two tendons. A tendon slip from the extensor digiti minimi to the ring finger was observed in one hand [14]. Extensor digiti minimi had two tendons in most data. It was always joined to ED either by receiving one or part of its tendon or by an intertendinous connection [15].In the current study the EDM presented with doubled tendons to the of little finger bilaterally similar to last, el-Badawi et al and Zilber et al reports, they were joining the dorsal digital expansion. (Fig 3 and 6). On the right side the EDM received tendonous interconnection from lateral tendon of the ring finger and hence there was no separable tendon from ED to the little finger in agreement with Zilber and Oberlin 2004(Fig 6). On the left side of the tendon of ED for the digiti Minimi divided in tow slips, the lateral one was linked to the medial tendon of EDM in correspondence with El-Badawi et al as they mentioned that it received part of its tendon from ED (Fig 3). In 77% of the specimens, the ED distally had tendons to the middle three fingers, multiple tendons were common especially for the middle and ring fingers [16].The finding of the present study found that the ring finger of right was only doubled while the little finger had no separate tendons in both sides (Fig 6).

The intertendonous connection were identified between 2 adjacent tendons of ED in the 2nd, 3rd and 4th intermetacarpal spaces of hands[5]. In contrast to the present investigation, there were differences, the intertendinous connection of the

extensor digitorum was observed in 3rd and 4th spaces on both sides. ED tendons on the right side were doubled to the ring finger, no independent tendon to the little finger, the lateral tendon of the ring finger gave off intertendinous connection to the medial tendon of extensor digiti minimi. ED tendons on the left side had four tendons the tendon for little finger was divided into two slips joining the ring tendon and medial tendon of extensor digit minimi. Intertendinous connections may restrict independent extension of the finger (Fig 3 and 6).

Intertendinous connections were categorized according to nature of the band into 3 types: type 1 with a filamentous band, type 2 with a fibrous band, and type 3 with a tendinous band [(17)]. The present intertendonous connection were type three according to the previous classification.

Anatomical variations may have an impact on symptomatology, clinical examination, investigations and management [(18)]. The palmaris longus tendon is the first choice as a donor tendon because it fulfills the necessary requirements so it can be used without producing any functional deformity [(19)]. The palmaris longus tendon is often used for tendon replacement of the long flexors of the fingers, and of the flexor pollicis longus tendon [(20)]**.**

Conclusion:

Anatomical knowledge of such variations has great clinical significant especially in the field of reconstructive surgery. Presence of accessory tendons will be helpful for tendons transfer for their availability. Also, there was academic benifial of teaching Anatomical variations of tendons as future doctors taking in their account unusual observations.

Recommendation:

The radiologist, clinicians and surgeons should be aware of this kind of variations in dealing with hand anatomy. The tension should be considered for Palmaris longus agenesis in both sides as its one such option of tendon transfer graft. Another method of assessments like MRI and CT should be used in detecting the tendon variations in living persons to avoid the confusion and increase the knowledge of anatomical variation.

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