

A rare variation of the extensor indicis proprius tendon with important clinical implications

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Abstract

Introduction: Anatomical variations of the extensor tendons to the fingers are of great clinical interest, due to the relatively high frequency of tendon injury in clinical practice. **Material and methods:** During routine dissection of the right upper limb of a 67-year-old female preserved corpse, the extensor indicis proprius (EIP) muscle belly originated 3 independent tendons, each with a separate fascial sheath, forming a triple EIP tendon. There was a larger tendon, which occupied a central position, that represented the usual single EIP tendon. In addition, there were two thinner radial and ulnar accessory EIP tendons. The radial-EIP tendon crossed deep to the extensor digitorum communis (EDC) tendon to the index finger in the distal half of the dorsum of the hand to reach the radial side of the extensor expansion hood of the index finger. **Discussion:** According to the literature, the frequency of a triple EIP tendon ranges from 0%, to as high as 7%, although most authors do not acknowledge the presence of this variant in their series. This variant of the EIP tendon, in which the radial-EIP terminated laterally to the termination of the tendon of the EDC to the index finger, may be a source of confusion intraoperatively, as the EIP tendon has traditionally been identified on the basis of its ulnar location with respect to the EDC tendon. **Conclusion:** The possibility of a triple EIP tendon should certainly be born in mind by all surgeons when performing tendon repairs, tenoplasties or tendon transfers.

Keywords: extensor indicis proprius, extensor digitorum communis, variation, hand surgery, repair.

1 Introduction

Anatomical variations of the extensor tendons to the fingers have been documented for well over 100 years (LE DOUBLE, 1897; SCHMIDT and LANZ, 2004; ZILBER and OBERLIN, 2004). In spite of this, new variants of these tendons and/or more precise determinations of the frequency of previously known variants continue to be reported to this day (MESTDAGH, BAILLEUL, VILETTE et al., 1985; GODWIN and ELLIS, 1992; EL-BADAWI, BUTT, AL-ZUHAIIR et al., 1995; VON SCHROEDER and BOTTE, 1995; HIRAI, YOSHIDA, YAMANAKA et al., 2001; ZILBER and OBERLIN, 2004; JEON, SEOK, PARK et al., 2010).

The weight given in the literature to this subject is undoubtedly due to the importance of a thorough knowledge of the extensor tendon anatomy to fully understand the consequences of tendon injury at various levels, as well as to plan and undertake repair both in the acute and chronic setting (ROCKWELL, BUTLER and BYRNE, 2000; SCHMIDT and LANZ, 2004; CAMPOS, NAZER, BARTHOLDY et al., 2010; SHAPIRO and KRAHE, 2010). Moreover, spontaneous rupture of the extensor tendons of the hand is common, especially in patients with rheumatoid arthritis, distal radioulnar joint osteoarthritis, ulnar plus variance, and ulnar head dislocation (ZILBER and OBERLIN, 2004).

Among the extensor tendons of the fingers, the extensor indicis proprius (EIP) tendon is one of the most frequently injured (NOLAN, 2006). In addition, the EIP tendon, having an independent muscle belly, is often used as a donor tendon

for transfer (NOLAN, 2006; TARAS and LEE, 2010). In fact, the same extension of the index joints can be achieved with either the EIP or the extensor digitorum communis (EDC) tendon to the index finger (VON SCHROEDER and BOTTE, 1993, 1995, 1997, 2001; NAYAK, MADHAN-KUMAR, KRISHNAMURTHY et al., 2007; CELIK, BILGE, PINAR et al., 2008).

Therefore, a sound grasp of the anatomy of the extensor tendons to the fingers, and, in particular of the EIP tendon, is of vital importance to successfully solve problems frequently encountered in daily clinical practice.

In this paper we describe a rare variant of the EIP tendon in a cadaveric dissection study, and discuss its clinical implications.

2 Case report

During routine dissection of the right hand and forearm of a 67-year-old female preserved corpse, following the recommendations of a Human Anatomy dissection manual (ESPERANÇA-PINA, BENSABAT-RENDAS, CORREIA et al., 2001), an unusual configuration of the extensor tendons of the index finger was noted (Figures 1 and 2). There was no history or evidence of trauma or surgery to the upper limbs. The EIP muscle belly originated in the distal quarter of the forearm 3 independent tendons, each with a separate fascial sheath, forming a triple EIP tendon (CELIK, BILGE, PINAR et al., 2008). These three tendons joined the ulnar and deep aspect of the tendon of the EDC to the index finger, and then passed deep to



Figure 1. Photograph of the dorsum of the right hand showing a triple extensor indicis proprius tendon. 1) extensor digitorum communis tendon to the index finger; 2) radial extensor indicis proprius tendon; 3) extensor indicis proprius tendon; 4) ulnar extensor indicis proprius tendon; 5) extensor expansion hood of the index finger; 6) central slip of the extensor apparatus of the index finger; 7) lateral band of the extensor apparatus of the index finger; 8) medial band of the extensor apparatus of the index finger; 9) extensor digitorum communis tendon to the middle finger; 10) extensor digitorum communis tendon to the ring finger; 11) extensor digitorum communis tendon to the fifth finger; 12) extensor digiti minimi tendon; 13) intertendinous connections; 14) extensor retinaculum.

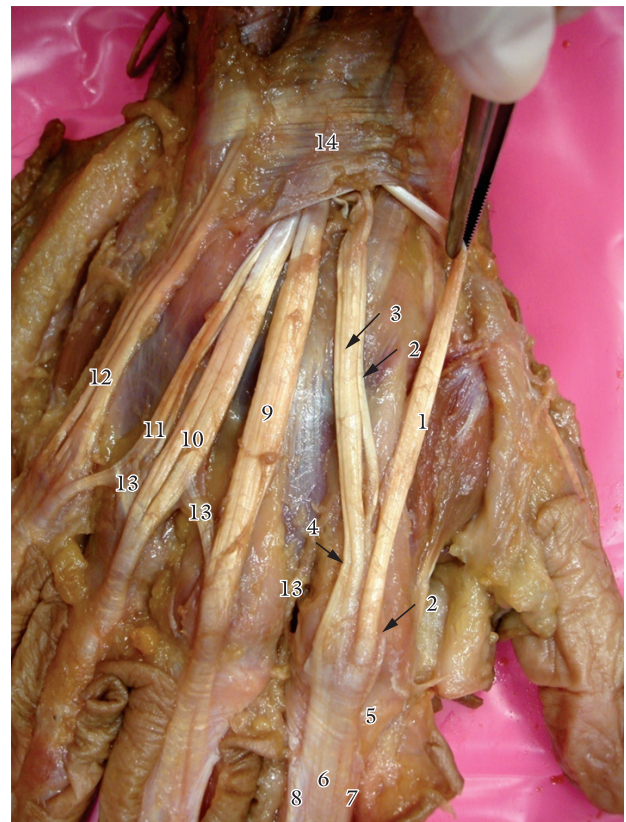


Figure 2. Photograph of the dorsum of the right hand showing a triple extensor indicis proprius tendon after retracting the extensor digitorum communis tendon to the index finger. 1) extensor digitorum communis tendon to the index finger; 2) radial extensor indicis proprius tendon; 3) extensor indicis proprius tendon; 4) ulnar extensor indicis proprius tendon; 5) extensor expansion hood of the index finger; 6) central slip of the extensor apparatus of the index finger; 7) lateral band of the extensor apparatus of the index finger; 8) medial band of the extensor apparatus of the index finger; 9) extensor digitorum communis tendon to the middle finger; 10) extensor digitorum communis tendon to the ring finger; 11) extensor digitorum communis tendon to the fifth finger; 12) extensor digiti minimi tendon; 13) intertendinous connections; 14) extensor retinaculum.

the extensor retinaculum through the tendinous sheath of the EDC and EIP (Figure 1). On the dorsum of the hand, the 3 tendons emanating from the EIP muscle were clearly distinct. There was a larger one, which occupied a central position, that represented the usual single EIP tendon. In addition, there were 2 thinner radial and ulnar accessory EIP tendons (Figure 2). The radial-EIP crossed deep to the extensor digitorum tendon to the index finger in the distal half of the dorsum of the hand to reach the radial side of the extensor expansion hood of the index finger (Figure 2). In contrast, the ulnar-EIP and the EIP were continuous with the ulnar side of the extensor expansion hood of the index finger (Figure 2). The extensor tendons to the fingers in the opposite limb presented no deviations from what is currently described in the literature, with no supernumerary EIP tendons being found.

The protocol for this research did not include any specific issue that needed to be approved by the Ethics Committees of our institutions. The work conformed to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000).

3 Discussion

Le Double was the first to systematically study in humans the division of the extensor tendons to the fingers in the latter half of the 19th century (LE DOUBLE, 1897). He reported his and other authors' findings in his treatise on the variations of the human muscular system that was published in 1897 (LE DOUBLE, 1897). Since then, numerous works have been published on the presence and number of the extensor tendons to the fingers (MESTDAGH, BAILLEUL, VILETTE et al., 1985; GODWIN and ELLIS, 1992; EL-BADAWI, BUTT, AL-ZUHAIR et al., 1995; VON SCHROEDER and BOTTE, 1995; HIRAI, YOSHIDA, YAMANAKA et al., 2001; ZILBER and OBERLIN, 2004; CELIK, BILGE, PINAR et al., 2008; MOTOURA, SHIOZAKI and KAWASAKI, 2010).

Table 1. Number of tendons of the extensor indicis proprius muscle according to different authors.

Number of tendons of the extensor indicis proprius muscle	Mestdagh, Bailleul, and Vilette et al. (1985)	Godwin and Ellis (1992)	Von Schroeder and Botte (1995)	El-Badawi, Butt, Al-Zuhair (1995)	Hirai, Yoshida, Yamana et al. (2001)	Zilber and Oberlin (2004)	Celik, Bilge, Pinar et al. (2008)	Total number of Cases	Global frequency of each variant (%)
	N = 150	N = 50	N = 43	N = 181	N = 548	N = 50	N = 54	N = 1076	
Absent	1%; n = 1	0%; n = 0	0%; n = 0	1%; n = 2	0%; n = 0	4%; n = 2	0%; n = 0	5	0,5
Single	93%; n = 140	92%; n = 46	77%; n = 33	90%; n = 163	86%; n = 471	78%; n = 39	100%; n = 54	946	88,0
Double	6%; n = 9	8%; n = 4	16%; n = 7	5%; n = 9	14%; n = 77	18%; n = 9	0%; n = 0	115	10,6
Triple	0%; n = 1	0%; n = 0	7%; n = 3	4%; n = 7	0%; n = 0	0%; n = 0	0%; n = 0	10	0,9

According to the majority of the authors, the extensor apparatus of the index finger is composed of a single tendon from the EDC muscle, which is almost invariably present, and of a tendon from the EIP, which is present in the majority of cases (MOORE and DALLEY, 2006; CELIK, BILGE, PINAR et al., 2008). However, the EIP tendon may be absent, single, double or may even be triple, as in the case we describe in this paper. Table 1 depicts the frequency of these variants, according to different authors. The frequency of a triple EIP ranges from 0%, to as high as 7%, although most authors do not acknowledge the presence of this variant in their series (Table 1). Globally, according to the literature review we performed, the frequency of a triple tendon of the EIP should be around 0,9%. Other frequent variants of the EIP tendon are the accessory tendons to the middle and ring fingers, forming the so called extensor medii proprius, and the extensor digiti annularis (SCHMIDT and LANZ, 2004; ZILBER and OBERLIN, 2004). The extensor medii proprius can be present in up to 3,5 to 13% of specimens, according to several authors, whereas the extensor digiti annularis is much more rarely found (VON SCHROEDER and BOTTE, 1995, 1997; SCHMIDT and LANZ, 2004; ZILBER and OBERLIN, 2004).

Interestingly, in the case we are describing, the radial accessory EIP tendon terminated in the radial aspect of the extensor expansion hood of the index finger, that is to say, laterally to the termination of the tendon of the EDC to the index finger (Figure 2). This may be a source of confusion intraoperatively or in the dissection room, as the EIP tendon has traditionally been identified on the basis of its ulnar location with respect to the EDC tendon to the index finger (SCHMIDT and LANZ, 2004; ZILBER and OBERLIN, 2004; NOLAN, 2006; SHAPIRO and KRAHE, 2010; TARAS and LEE, 2010).

The fact that the triple EIP tendon was only found on the right side is in agreement with recent works that confirm that the extensor tendons to the finger are often not symmetrical (ZILBER and OBERLIN, 2004; CELIK, BILGE, PINAR et al., 2008). In addition, both the lack of symmetry, and the variations in the extensor tendons to the fingers, as in the present case, could be due to the stochastic changes the extensor limb myotomes undergo during ontological development, namely regression, retention, or reappearance (CHEVALLIER, KIENY and MAUGER, 1977; CELIK, BILGE, PINAR et al., 2008).

Regardless of their cause, anatomical variations of the EIP tendon, as the one described in this paper, are of great anatomical and clinical interest, and should certainly be born in mind by all surgeons when performing tendon repairs, tenoplasties or tendon transfers (ZILBER and OBERLIN, 2004; CELIK, BILGE, PINAR et al., 2008; HANZ, SAINT-CYR, SEMMLER et al., 2008).

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