A classification system for anomalies of the extensor pollicis longus

Tolga Türker · Gregory A. Robertson ·
Sunil M. Thirkannad

Published online: 21 May 2010
© American Association for Hand Surgery 2010

Abstract

Introduction Variations of the long extensor tendon to the thumb are very rare.

Materials and Methods We present three cases in which there was a supernumerary long extensor tendon to the thumb. In all three cases, the supernumerary tendon emerged from the fourth dorsal compartment and had a parallel course to the extensor pollicis longus.

Results Details of the anomalies are described along with a meta-analysis of relevant literature. A classification system of these anomalies is also proposed.

Keywords Extensor tendon · Thumb ·
Supernumerary tendon · Anomalies

Introduction

Variations of the extensor tendons to the thumb have been known and become important in cases that require repair or transfer of these tendons. Currently available reports on extensor tendon variations of the thumb mostly focus on tendons within the first extensor compartment. So far, only a few articles have been published which describe variations of the long extensor tendon of the thumb [1–6,

8, 10]. We present three surgical cases with different variations of the long extensor tendon of the thumb.

Case report 1 Our first patient was a 76-year-old female patient who was taken to surgery for reconstruction of a left scapholunate dissociation. During surgery, two tendons were found to arise from the forearm and run to the distal phalanx of the left thumb. One of them emerged from the third extensor compartment and its course, thickness and action precisely matched that of a native extensor pollicis longus (EPL). The second tendon was found between the EPL and extensor digitorum communis tendon of the index. This anomalous tendon emerged from the fourth extensor compartment. Its thickness was half that of the original EPL but its course was parallel to the EPL and traction on this tendon produced extension of the thumb interphalangeal joint (Fig. 1). It appeared that each of these two tendons had separate attachments to the base of the distal phalanx. When each tendon was retracted individually, the distal phalanx of the left thumb extended.

Case report 2 Our second patient was a 16-year-old male patient who was taken to surgery for open reduction and internal fixation operation of a left scaphoid nonunion. During surgery, two tendons were noted to arise from the forearm and run to the distal phalanx of the left thumb (Fig. 2). One of them was the EPL. The other tendon was located between the EPL and extensor digitorum communis tendon of the index. This anomalous extensor tendon of the left thumb emerged from the fourth extensor compartment. Its thickness was a third that of the original extensor pollicis longus and its course was parallel to that of the EPL. When this supernumerary tendon was retracted, the distal phalanx of the left thumb and the entire index finger extended simultaneously.

T. Türker · G. A. Robertson · S. M. Thirkannad
Christine M. Kleinert Institute for Hand and Microsurgery,
225, Abraham Flexner Way Suite 850,
Louisville, KY 40202, USA

S. M. Thirkannad (✉)
225 Abraham Flexner Way. Suite 810,
Louisville, KY 40202, USA
e-mail: tmsunil@kleinertkutz.com

Figure 1 Photograph shows the supernumerary extensor pollicis tendon emerging from the fourth dorsal compartment. Its thickness was half that of the EPL.

Case report 3 Our third patient was a 32-year-old female patient who was taken to surgery for excision of a left carpal boss and release of DeQuervain's tenosynovitis during surgery, two tendons were noted to arise from forearm and run to the distal phalanx of the left thumb. The configuration observed was exactly the same as that in case 2.

Discussion

Variations in tendon anatomy are important during surgeries involving repair or transfer of tendons. Variations in the long extensor tendon to the thumb are very rare and so far only isolated case reports have been published. Wood, in 1867, reported the existence of a supernumerary long extensor to the thumb, and since it was also connected to the index finger, he termed it *extensor pollicis et indicis*. LeDouble, in 1897, then reported the existence of a supernumerary long extensor tendon connecting only to the thumb [4]. More recently, supernumerary extensor tendons of the thumb have been reported by several authors [8, 9, 12, 13].

We undertook a meta-analysis of all the various reports available in literature to organize the anomalies into a two-part classification (Table 1). The first part relates to true supernumerary long extensor tendons of the thumb—it has six subtypes. The second type relates to aberrant interconnections between the long extensor tendon to the thumb and neighboring tendons—this has four subtypes.

Supernumerary Long Extensor Tendons of the Thumb

In our first case, a supernumerary tendon was present which traveled through the fourth compartment, as opposed to the

EPL, which traveled in the third. Beyond the extensor compartment, this tendon then ran parallel to the EPL tendon, and attached to the distal phalanx of the thumb. When retracted, it extended the distal phalanx of the thumb without affecting the other fingers. Such a variation has been previously described by Chiu's [4] and Papaloizos's [10] (during cadaveric dissection) and Cohen's [6] (during synovectomy surgery), and we choose to classify this as type 1a. While we could not dissect out the origin of our tendon, Chiu found that the muscle belly of his supernumerary tendon arose very close to, if not overlapping, the origin of the EIP.

Beatty et al. [2] reported finding an extra tendon, that traveled parallel to the true EPL on exiting the extensor compartments, and inserted onto the distal phalanx of the thumb. However, this supernumerary tendon exited from the third compartment along with the true EPL. Closer inspection indicated that the anomalous tendon arose from a separate small muscle belly arising from the ulnar border of the true EPL tendon within the third extensor compartment. We choose to classify this as type 1b. Interestingly, while our variant was asymptomatic and discovered during elective surgery for unrelated wrist problems, the variant discussed by Beatty et al. [2] presented with radial-sided wrist pain and clicking, secondary to a lifting injury. This required subsequent exploratory surgery and removal to correct the symptoms.

Again similar to our first case, Sawaizumi [11] quotes Kaplan and Nathan as having reported a supernumerary tendon that exited from the fourth compartment (with the EPL exiting from the third) and ran parallel with the EPL towards the thumb. However in contrast to our case, their tendon attached onto the distal portion of the original EPL tendon. This variant is classified as type 1c.

Abu-Hijleh [1] also reported this initial pattern with his supernumerary tendon exiting from the fourth dorsal

Figure 2 Photograph shows an extensor pollicis et indicis communis tendon emerging from the fourth dorsal compartment. Its thickness was one third that of the EPL.

Table 1 Classification of variations of long extensor tendon to the thumb.

Type 1. Separate tendon variations	1a	Double EPL tendons (different compartment) Case 1
	1b	Double EPL tendons (same compartment)
	1c	Double origin of the EPL tendon (different compartment)
	1d	Extensor pollicis tertius
	1e	Extensor pollicis et indicis communis. Cases 2 and 3
	1f	Extracompartmental two-slip extensor pollicis tendons
Type 2. Interconnections of the extensor tendons	2a	Interconnection between the EPL and the EIP (the extensor pollicis et indicis accessories).
	2b	Interconnection between the EPL and EDC2 (junctura tendinum)
	2c	Interconnection between EPL and the extensor apparatus of the index finger (tendon slip from the third compartment)
	2d	Interconnection between EPL and the extensor apparatus of the index finger (tendon slip extracompartmental)

compartment while the EPL came from the third. However, his variant then followed a different route to the previous examples, with the aberrant tendon crossing the EPL tendon at the metacarpal of the thumb to attach to the

proximal phalanx of the thumb. Found during cadaveric dissection, he also noted that the supernumerary tendon originated just proximal to the origin of the extensor indicis proprius (EIP). This variant is type 1d.

Figure 3 Schematic representation of type 1 EPL and its subclasses.

The variation in our second and third cases also consisted of a supernumerary tendon which exited from the fourth dorsal compartment, while the EPL exited from the third. The variant tendon also initially followed a parallel course to the EPL towards the first web space. However at this point, it split into two branches, with one attaching to the radial side of the extensor hood of the index finger and the other to the distal phalanx of the thumb. When retracted, it extended the distal phalanx of the left thumb and the entire index finger simultaneously. This has been attributed to Wood by Chiu [4] as the extensor pollicis et indicis communis. This is type 1e.

The last of these variants is that described by Sawaizumi et al. [11] and is quite different from the others. In his example, the long extensor to the thumb consisted of two thin tendon slips. The tendon on the radial side passed through an aberrant tunnel between the first and second compartments, while that on the ulnar side did not pass through a compartment instead passing over the extensor retinaculum. In this case, there was no third dorsal compartment and additionally there was no extensor pollicis brevis tendon. We choose to classify this as type 1f. This variant presented with radial wrist pain and limited thumb extension. On surgical exploration for these problems, the tendon on the radial side was found to have developed stenosing tenosynovitis, and following decompression of the tendon sheath, the pain resolved and thumb extension improved.

Interconnections of the EPL and other Extensor Tendons of the Wrist

The first of these interconnections is that described between the EPL and the EIP, termed the ‘extensor pollicis et indicis accessories’ [9]. We classify this as type 2a. Phylogenetically, both the EPL and EIP muscles differentiate from the extensor digitorum profundus (EDP) muscle. Cavdar and Sehirli report that the extensor muscles of the forearm and the hand can be classified into three groups. The first group is brachio-antebrachial group, the second is antebrachio-manual group and the last one is the manual group. The EDP is a member of antebrachio-manual group. The EPL constitutes the lateral component of the EDP while the EIP is the medial component of the EDP [3–5, 9]. Therefore, interconnections between these two tendons should not be surprising. This is also likely to partly explain the formation of the extensor pollicis et indicis communis, type 1f in our classification.

The first of these interconnections is that described between the EPL and the EIP, termed the ‘extensor pollicis et indicis accessories’ [9]. We classify this as type 2a. Phylogenetically, both these muscles differentiate from the EDP muscle; therefore interconnections between these two

tendons should not be surprising. The medial component of EDP becomes EIP and the lateral compartment of EDP becomes EPL [3–5, 9]. This is also likely to partly explain the formation of the extensor pollicis et indicis communis, type 1f in our classification.

Steichen et al. [12] described an interconnection between the EPL and EDC2 tendon. We classify this as type 2b. This variant is morphologically interesting because as discussed earlier, the EPL and EDC arise from separate phylogenetic muscle groups.

Other described interconnections include an accessory slip of the EPL tendon, which emerges from the third compartment and runs to the extensor hood of the index finger [8] and a tendon slip that originates from the EPL tendon and attaches to the extensor hood of the index finger [7]. We classify these as types 2c and 2d, respectively.

As can be gleaned from the above classification, there are several variations of the supernumerary long extensor tendon to the thumb. A clear understanding of these becomes important and this is important. Our classification

Figure 4 Schematic representation of type 2 EPL and its subclasses.

attempts to organize the variations and help avoid confusion (Figs. 3 and 4).

Disclaimer No financial benefits or otherwise have been received by any of the authors for the whole or part of this study. There are also no conflicts of interest.

References

1. Abu-Hijleh MF. Extensor pollicis tertius: an additional extensor muscle to the thumb. *Plast Reconstr Surg*. 1993;92(2):340–3.
2. Beatty JD, Remedios D, McCullough CJ. An accessory extensor tendon of the thumb as a cause of dorsal wrist pain. *J Hand Surg [Br]*. 2000;25(1):110–1.
3. Cavdar S, Sehirli U. The accessory tendon of the extensor indicis muscle. *Okajimas Folia Anat Jpn*. 1996;73(2–3):139–42.
4. Chiu DT. Supernumerary extensor tendon to the thumb: a report on a rare anatomic variation. *Plast Reconstr Surg*. 1981;68(6):937–9.
5. Culver Jr JE. Extensor pollicis and indicis communis tendon: a rare anatomic variation revisited. *J Hand Surg [Am]*. 1980;5(6):548–9.
6. Cohen BE, Haber JL. Supernumerary extensor tendon to the thumb: a case report. *Ann Plast Surg*. 1996;36(1):105–7.
7. Gaulke R (2001) The Extensor Pollicis et Indicis: an accessory or rudimentary deep extensor tendon to the thumb? Variants—frequency—clinical relevance. *Handchir Mikrochir Plast Chir Sep*;33(5):310–320. Review. German
8. Gonzalez MH, Weinzeig N, Kay T, Grindel S. Anatomy of the extensor tendons to the index finger. *J Hand Surg [Am]*. 1996;21(6):988–91.
9. Komiyama M, Nwe TM, Toyota N, Shimada Y. Variations of the extensor indicis muscle and tendon. *J Hand Surg [Br]*. 1999;24(5):575–8.
10. Papaloizos MY. Accessory extensor pollicis longus. *Scand J Plast Reconstr Surg Hand Surg*. 2004;38(5):310–3.
11. Sawaizumi T, Nanno M, Ito H. Supernumerary extensor pollicis longus tendon: a case report. *J Hand Surg [Am]*. 2003;28(6):1014–7.
12. Steichen JB, Petersen DP. Junctura tendinum between extensor digitorum communis and extensor pollicis longus. *J Hand Surg [Am]*. 1984;9(5):674–6.
13. Yoshida Y. Anatomical studies on the extensor pollicis et indicis accessorius muscle and the extensor indicis radialis muscle in Japanese. *Okajimas Folia Anat Jpn*. 1995;71(6):355–63.