



# Variant course of extensor pollicis brevis tendon in the third extensor compartment

Shiro Sugiura<sup>1,2</sup> · Yusuke Matsuura<sup>1</sup> · Takane Suzuki<sup>3</sup> · Satoru Nishikawa<sup>1</sup> · Chisato Mori<sup>3</sup> · Kazuki Kuniyoshi<sup>1</sup>

Received: 27 March 2017 / Accepted: 11 September 2017 / Published online: 14 November 2017  
© Springer-Verlag France SAS 2017

## Abstract

**Introduction** According to the anatomical literature, the extensor pollicis brevis (EPB) tendon passes through the first compartment and enters the base of the proximal phalanx of the thumb. There have been a few reports on the different types of supernumerary EPB tendons; however, an unusual course of the EPB tendon is extremely rare.

**Materials and methods** During routine cadaveric dissection in the Department of Gross Anatomy, we detected an variant EPB muscle in a 96-year-old fresh female cadaver.

**Results** The EPB muscle originated from the posterior surface of the radius and interosseous membrane. However, the EPB tendon passed through the third compartment instead of the first compartment. It ran parallel to the extensor pollicis longus (EPL) tendon and entered the base of the thumb proximal phalanx. The EPL tendon was attached to the base of the first distal phalanx, as normally observed. Both EPB and EPL muscles were innervated by the posterior interosseous nerve.

**Conclusions** We report a case of a variant course of the EPB tendon appearing in the third extensor compartment of the wrist with the EPL tendon. The knowledge of this anatomic variation will be helpful for accurate diagnosis and surgical planning.

**Keywords** Wrist · First extensor compartment · Third extensor compartment · Extensor pollicis brevis · Extensor pollicis longus · Variation course

## Introduction

The existing anatomical literature indicates that there are six compartments for tendons dorsal to the wrist separated by six longitudinal vertical septa. Among them, the extensor pollicis brevis (EPB) tendon passes via the first compartment and enters the base of the proximal phalanx of the thumb [9]. Conversely, the extensor pollicis longus (EPL) passes via the third compartment and enters the base of the first distal phalanx of the thumb [9]. With respect to the anatomical variation and compartments, there have been reports on different types of supernumerary and the absence of EPB tendons [1, 2]. Many studies have reported that the presence

of the septum in the first compartment is observed in cadavers and de Quervain patients [3–6]. Regarding EPL variation outside of the third compartment, Yoshida et al. reported that although most EPL tendons are single tendons, duplicated tendons represented 3.6% of subjects in their cadaver study. However, variation in the third compartment is extremely rare [10]. Furthermore, to the best of our knowledge, the variation of the EPB tendon passing through the third compartment has not been reported. In this study, we describe a case of a variant course of the EPB tendon appearing in the third extensor compartment of the wrist.

## Materials and methods

During routine cadaveric dissection in the Department of Gross Anatomy, we detected an variant EPB muscle on left side of a 96-year-old fresh female cadaver. No upper limbs were damaged by injury or modified by surgery. The extensor and extensor compartments of the hand were dissected, and the EPL, EPB, and abductor pollicis longus (APL)

✉ Yusuke Matsuura  
y-m-1211@khaki.plala.or.jp

<sup>1</sup> Department of Orthopaedic Surgery, Graduate School of Medicine, Chiba University, 1-8-1 Inohana, Chuo-ku, Chiba 260-8670, Japan

<sup>2</sup> Nishikawa Orthopaedic Clinic, Chiba, Japan

<sup>3</sup> Department of Bioenvironmental Medicine, Graduate School of Medicine, Chiba University, Chiba, Japan

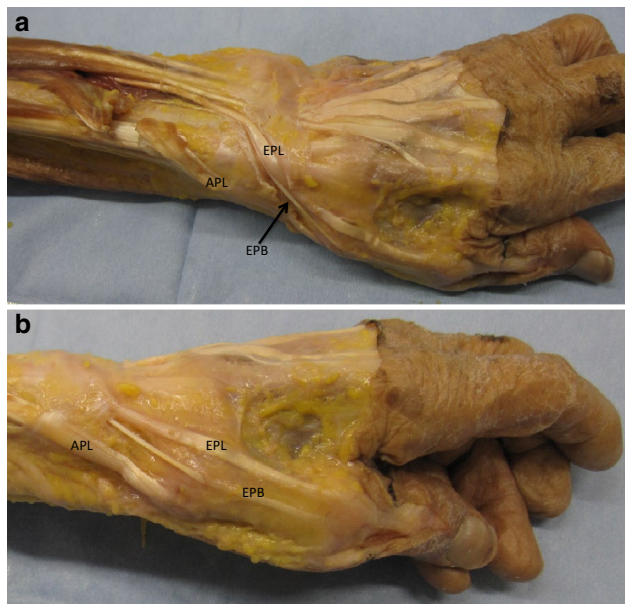
tendons were displayed. The length and diameter of each tendon at distal dorsal compartment were measured.

## Results

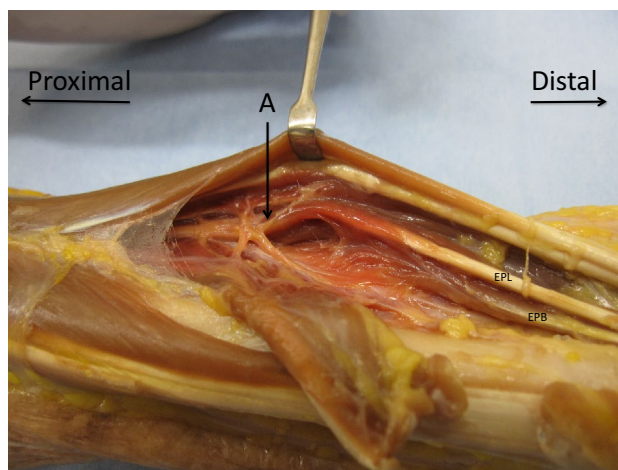
The EPB muscle originated from the posterior surface of the radius and interosseous membrane. However, the EPB tendon passed through the third compartment instead of the first compartment. The EPB remained parallel and radial to the EPL tendon and entered the base of the first proximal phalanx (Fig. 1). The EPL tendon was attached to the base of the first distal phalanx, as observed in the normal cases. Both EPB and EPL muscles were innervated by the posterior interosseous nerve (Fig. 2). The APL was the only tendon with no variation in the first dorsal compartment without septum and entered the base of the first metacarpal, as observed in normal cases.

The lengths of the EPL, EPB, and APL tendons were 128.9, 133.6, and 104.5 mm, respectively. The diameters of the EPL, EPB, and APL at the distal dorsal compartment were 2.9, 1.9, and 6.54 mm, respectively.

This variation was only noted on the left side of the cadaver. No other associated anomalies were observed. In addition, no anomalies were found in the right hand.



**Fig. 1** **a** The dorsal side of the wrist. *EPL* extensor pollicis longus, *EPB* extensor pollicis brevis, *APL* abductor pollicis longus. **b** The radial side of the wrists. *EPL* extensor pollicis longus, *EPB* extensor pollicis brevis, *APL* abductor pollicis longus



**Fig. 2** The dorsal side of the forearm. **A** Posterior interosseous nerve, *EPL* extensor pollicis longus, *EPB* extensor pollicis brevis

## Discussion

The anatomical literature reported that there are six extensor compartments comprising the extensor retinaculum in the dorsal wrist, and each extensor tendon passes through its corresponding compartment, among them, the EPB tendon is one of the thumb extensors in the first extensor compartment of the wrist. The EPB originates from the posterior surface of the radius and interosseous membrane and enters the first proximal phalanx. The EPL tendon is also a thumb extensor in the third extensor compartment of the wrist [9].

Regarding the variants of the EPL and EPB tendons, Yoshida reported that the EPL tendon is the most consistent extensor tendon of the upper limb [10]. Conversely, a number of studies on the EPB have reported on accessory tendons and their insertions [1, 2, 7].

In this study, both EPB and EPL were observed in the third compartment. The EPL tendon entered the base of the first distal phalanx. The EPB tendon entered the first proximal phalanx. Such a variant course exhibited by a single EPB tendon outside the third compartment is extremely rare.

Brunelli GA et al. reported the absence of the EPB in two of 52 examined hands [1]. Therefore, if the EPB tendon is absent in the first compartment during surgery, it may be possible that its route differs from that normally followed and that it may be present in the third compartment. Conversely, if two tendons are present in the third compartment, one may be the EPB tendon. Rousset et al. reported that ultrasonography accurately assesses variations of APL and EPB tendons in the first extensor compartment [8]. Therefore, this method is useful for reviewing each compartment using ultrasonography prior to surgery.

The knowledge of this anatomic variant will be helpful for accurate diagnosis and surgical planning.

**Acknowledgements** The authors are grateful to the brave and generous people who donated their bodies to the medical faculty and to their families and friends. The authors would also like to thank Enago (<http://www.enago.jp>) for the English language review of this manuscript.

### Compliance with ethical standards

**Conflict of interest** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Ethical standards** The study protocol was approved by the Institutional Review Board of our University.

### References

- Brunelli GA, Brunelli GR (1992) Anatomy of the extensor pollicis brevis muscle. *J Hand Surg Br* 17:267–269
- Dawson S, Barton N (1986) Anatomical variations of the extensor pollicis brevis. *J Hand Surg Br* 11:378–381
- Gonzalez MH, Sohlberg R, Brown A, Weinzweig N (1995) The first dorsal extensor compartment: an anatomic study. *J Hand Surg Am* 20:657–660
- Jackson WT, Viegas SF, Coon TM, Stimpson KD, Frogameni AD, Simpson JM (1986) Anatomical variations in the first extensor compartment of the wrist. A clinical and anatomical study. *J Bone Jt Surg Am* 68:923–926
- Leslie BM, Ericson WB Jr, Morehead JR (1990) Incidence of a septum within the first dorsal compartment of the wrist. *J Hand Surg Am* 15:88–91
- Minamikawa Y, Peimer CA, Cox WL, Sherwin FS (1991) De Quervain's syndrome: surgical and anatomical studies of the fibroosseous canal. *Orthopedics* 14:545–549
- Nayak SR, Hussein M, Krishnamurthy A, Mansur DI, Prabhu LV, D'Souza P, Potu BK, Chettiar GK (2009) Variation and clinical significance of extensor pollicis brevis: a study in South Indian cadavers. *Chang Gung Med J* 32:600–604
- Rousset P, Vuillemin-Bodaghi V, Laredo JD, Parlier-Cuau C (2010) Anatomic variations in the first extensor compartment of the wrist: accuracy of US. *Radiology* 257:427–433
- Standing S, Ellis H, Healy J, Johnson D, Williams A, Collins P, Wigley C (2005) Gray's anatomy: the anatomical basis of clinical practice. *Am J Neuroradiol* 26:2703
- Yoshida Y (1990) Anatomical study on the extensor digitorum profundus muscle in the Japanese. *Okajimas Folia Anat Jpn* 66:339–353