Variation and Clinical Significance of Extensor Pollicis Brevis: A Study in South Indian Cadavers

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- **Background:** de Quervain's disease is a condition in which there is pain in the radial styloid process caused by stenosing tenosynovitis of the abductor pollicis longus (APL) or/and extensor pollicis brevis (EPB) tendons in the first extensor compartment of the wrist. In this study we studied variations in the tendons of the EPB in the first extensor compartment and its site of insertion. Methods: One hundred fifty six upper limbs from adult cadavers of south Indian origin were dissected to observe the number of EPB tendons and the presence of an osseo-fibrous septum in the first extensor compartment of the wrist. **Results:** The EPB had a single tendon in 133 limbs, double tendons in 17 limbs and triple tendons in only 6 limbs. The EPB was present in all of the upper limbs in our study. In 34.6% of cases, the tendons of the EPB were separated from the tendons of APL by an osseo-fibrous septum in the first extensor compartment. Conclusion: Variation in the number of EPB tendons and site of insertion should be taken
- **Conclusion:** Variation in the number of EPB tendons and site of insertion should be taken into consideration by clinicians and surgeons when performing surgical decompression of the first extensor compartment of the wrist in de Quervain's syndrome. Surgical failure may occur due to overlooking variations in EPB tendons or septation of the first extensor compartment. (*Chang Gung Med J 2009;32:600-4*)

Key words: first extensor compartment, extensor pollicis brevis, variation, de Quervain's disease, south Indian population

The extensor retinaculum of the wrist forms the roof of six compartments in the dorsum of the hand where the extensor tendons pass. In every compartment, the tendons are protected by a synovial sheath which has the function of reducing friction during tendon excursion through the osteofibrous tunnels. One common anatomical variation in the

first compartment where the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) normally pass, is separated synovial sheaths and compartments, which raises the number of compartments from six to seven.⁽¹⁾ Anatomical variations in the tendons at the first compartment level have been found quite often, because of the interest raised by cumula-

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tive trauma from repetitive strain or inflammatory processes. The most frequent and disabling disease is de Quervain's stenosing tenosynovitis.⁽²⁾ We studied EPB tendon variations in the first extensor compartment. Classically, the EPB muscle is described as originating from the posterior surface of the radius distal to the APL, and from the adjacent interosseous membrane. The tendon is inserted into the base of the proximal phalanx of the thumb, and commonly has an additional attachment to the base of the distal phalanx, usually through a fasciculus which joins the tendon of the extensor pollicis longus (EPL). The EPB may be absent or fused completely with the APL.⁽³⁾ Variations from the standard anatomical description of the EPB are common and must be considered in the treatment of acute and chronic injuries.⁽⁴⁾ The purpose of the present study is to observe the most frequent variations in the tendon number and insertion pattern of the EPB.

METHODS

The present study was conducted in the Department of Anatomy, Kasturba Medical College, Mangalore, India. Adult cadaver upper limbs with the distal forearm, wrist, and hands from 156 men of south Indian origin between 38 and 69 years old were dissected. The upper limbs were fixed in 10% formaldehyde solution. The cadavers were placed on the dissection table in the supine position, with the superior limb placed over an auxiliary wooden board with the forearm midway between pronation and supination. The dissection started with a transverse incision distally to the thumb interphalangeal joint. Another incision was made at the transition of the middle and distal thirds of the forearm, above the miotendinous junction of the dissected muscles. The center of these two transverse incisions was joined by a longitudinal incision that passed the midpoint between Lister's tubercle and the radial styloid process. Two flaps were raised and retracted: one in the ventral direction and the other in the dorsal direction. The sensory branches from the radial nerve and the cephalic artery with its branches were dissected and removed. We started muscle identification by the first osteofibrous tunnel. The EPB, APL and EPL muscles were dissected from the miotendinous junction towards their attachments. Anatomical variations in the EPB, such as accessory tendons, absence of the tendon, and presence of an osseo-fibrous septum in the first extensor compartment were recorded.

RESULTS

During dissection, we found separated (double) synovial sheaths and compartments in 34.6% (54 limbs) of the first extensor compartments (Fig. 1); in the remaining 102 limbs (65.3%) the first extensor compartment had a common synovial sheath for both the APL and EPB tendons, as expected. The EPB had a single tendon in 133 limbs (85.25%) with its distal attachment to the base of the proximal phalanx, double tendons in 17 limbs (10.89%) and triple tendons in only 6 limbs (3.8%) (Fig. 2, 3, 4, respectively). The EPB was present in all of the upper



Fig. 1 Dorso-lateral aspect of the wrist and hand region. (A) canal for the abductor pollicis longus; (B) canal for the extensor pollicis brevis. The arrows show the osseo-fibrous septum, isolating the slips of the abductor pollicis longus tendon from those of extensor pollicis brevis tendon in the first dorsal extensor compartment of the wrist.



Fig. 2 Dorso-lateral aspect of the wrist and hand region. Abbreviations used: APL: abductor pollicis longus tendon; EPB: extensor pollicis brevis tendon; EPL: extensor pollicis longus tendon extensor compartment of the wrist.



Fig. 3 Dorso-lateral aspect of the wrist and hand region. Abbreviations used: APL: abductor pollicis longus tendon; AEPB: accessory extensor pollicis brevis tendon; EPB: extensor pollicis brevis tendon; EPL: extensor pollicis longus. Note the insertion of the AEPB to the base of the distal phalanx of the thumb along with the insertion of the EPL.



Fig. 4 Dorso-lateral aspect of the wrist and hand region. Abbreviations used: APL: abductor pollicis longus tendon; EPL: extensor pollicis longus tendon. The star indicates the extensor hood of the thumb. 3 indicates the tendon of the extensor pollicis brevis; 1 and 2 indicate accessory tendons of the extensor pollicis brevis. Note the insertion of the accessory extensor pollicis brevis tendon 1 to the extensor hood of the thumb.

limbs in our study. In 11 limbs (7%), the accessory tendon insertion was located at the base of the distal phalanx (Fig. 3). In 2 limbs (1.2%) the EBP had its origin from the APL tendon (Fig. 5). In 5 limbs (3.2%) the EPB tendon was attached to the base of the first metacarpal bone (Fig. 6).

DISCUSSION

Phylogenetically, the APL and EPB are differentiated from a common muscle mass. The EPB separates completely from the APL only in humans and gorillas. In a recent dissection of a chimpanzee (Pan), the EPB tendon was found to have double insertions; although the attachment was mainly into



Fig. 5 Dorso-lateral aspect of the wrist and hand region. Abbreviations used: APL: abductor pollicis longus tendon; EPB: extensor pollicis brevis tendon; EPL: extensor pollicis longus tendon. Note the extensor pollicis brevis has its origin from the abductor pollicis longus muscle.



Fig. 6 Dorso-lateral aspect of the wrist and hand region. Abbreviations used: 1, 2, 3: tendons of the abductor pollicis longus; BFM: base of the first metacarpal bone; EPB: extensor pollicis brevis tendon; Tr: trapezium. Note the insertion of the extensor pollicis brevis tendon into the base of the first metacarpal bone.

the lateral aspect of the first metacarpal bone, it was also attached by a very slender tendon to the dorsal surface of the base of the proximal phalanx. Thus a gradation in the extent of differentiation of this common muscle is noted in different species. With this process still in its phylogenetic infancy it is not surprising that anomalies are found in humans. This has great relevance to surgery for de Quervain's disease.⁽⁵⁾ Dawson and Barton reported that the sporadic absence of the muscle belly of the EPB reflects that it is a phylogenetically young structure.⁽⁴⁾ There is a huge difference in the percentage of limbs with an absent EBP tendon in various studies, which is difficult to explain (Table 1).^(2,6-14) We found no cases of absent EPB, similar to the findings of Kulshreshtha et al.⁽⁶⁾ In contrast, Fenton and Lapidus observed EPB absence in 9.2% cases.⁽¹⁴⁾ In the present study, the accessory tendons of the EPB were frequently

| Authors (Year) | No. of upper limbs studied | No. of EPB absent | Percentage |
|----------------------------|-------------------------------|----------------------|------------|
| Present study (2008) | 156 | 0 | 0% |
| Kulshreshtha et al. (2007) | 44 | 0 | 0% |
| Belluci (1989) | 51 | 1 | 1.9% |
| Joshi & Joshi (2002) | 50 | 1 | 2% |
| Brunneli & Brunneli (1992) | 92 | 2 | 2.17% |
| Caetano (1992) | 60 | 2 | 3.3% |
| Leao (1958) | 50 | 2 | 4% |
| Pearson & Robinson (1898) | 126 | 8 | 6.3% |
| Caetano et al. (2004) | 60 | 4 | 6.6% |
| Stein (1951) | 84 | 6 | 7.14% |
| Fenton & Lapidus (1983) | 54 | 5 | 9.2% |

Table 1. Studies Showing Absence of the Extensor Pollicis Brevis

 (EPB) Tendon

found to be attached to the base of the distal phalanx of the thumb, similar to the findings of other authors.^(2,4,6,7,9,13) In our study along with double EPB tendons, we observed triple tendons in 3.8% of limbs. There are few reports of more than two EPB tendons in the literature. We observed the EPB tendon was attached to the base of the first metacarpal bone in 5 limbs. Caetano et al. found in a single case in which the accessory tendon of the EPB was attached to the trapezium.⁽²⁾ In reports, accessory tendons of the EPB were more likely to be attached to the distal phalanx of thumb, the metacarpophalangeal joint level and on the thumb extensor apparatus.^(2,6,9,10,13)

A thorough understanding of common anatomical variations of the first extensor compartment is important for treatment of de Quervain syndrome. The first extensor compartment is divided by a complete or partial septum in about 30%-60% subjects.⁽¹⁵⁻²³⁾ In the present study we observed the first extensor compartment was divided by an osseo-fibrous septum in 34.6% of cases. Kulthanan and Chareonwat similarly described this variation in 37% of cadavers, but in a much larger percentage (58%) of patients with de Quervain syndrome.⁽²³⁾ This indicates that multiple compartments in the first extensor compartment may be associated with a predisposition to de Quervain syndrome.⁽²³⁾ Previous reports,^(24,25) make it clear that separated compartments contribute to the symptomatology, and have a role in the development of this syndrome. Therefore, in surgery for de Quervain syndrome, proper recognition of accessory tendons and in particular the presence or absence of a separate osseo-fibrous compartment, is of great importance. Decompression of the main osseo-fibrous canal may not relieve the symptoms of the disease if an accessory tendon remains unrecognized and is left compressed in its own fibrous canal.⁽²⁾ In our study, we also found that in 1.2% cases, the EPB had an origin from the tendon of the APL. Caetano et al. found this variation in 3.3% cases and they considered that the same as absence of the EPB.⁽²⁾

Conclusions

We found a single tendon of the EPB with its distal attachment to the base of the proximal phalanx in the majority of the cases, with variations in the number of tendons (two and three) and its distal attachments. Information about the number of tendons of the EPB, its attachments (normal and abnormal) and its positioning in the first extensor compartment is essential in proper surgical decompression of the first extensor compartment in de Quervain's disease. These details will help the clinicians and surgeons better understand the first extensor compartment of the wrist.

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