

To Find Out the Variations in Composition of Musculature 1st Extensor Compartment of the Wrist

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ABSTRACT

Introduction: Literature suggests that the anatomical variations in the first dorsal compartment of the wrist like supernumerary tendon slips, aberrant compartments or presence of septa, and variation of insertion of tendon slips are encountered to be important causative factors for this problem. The present study is carried to find out the variations in composition of musculature 1st Extensor compartment of the wrist.

Materials and Methods: A total number of 66 (33 Left and 33 Right) disarticulated upper limbs of adult cadavers of Indian individuals of unknown sex from the department of Anatomy of S.M.S. Medical College, Jaipur has been selected for the present study. The dissection started with a transverse Incision distally to the thumb interphalangeal joint. Variations in these tendons and accessory muscles or tendons in this region has been noted. All parameters were tabulated and analyzed. The chi-square test has been using to compare the differences between the right and left limbs and to determine statistically significant differences.

Results: In 97.63 % of cases or in almost all of the cases it was attached to the distal phalanx, in only one hand to the proximal phalanx and in one hand to both right and left hand. Distal phalanges receive 27.27 % of tendons, proximal phalanges receive 54.54 % of tendons and both phalanges

receive 12.12 % of tendons of EPB. In 24.22 % of the cases EPB tendon was attached to distal phalanx, in 66.66 % attached to proximal phalanx and in 12.12 % cases it was attached to both distal and proximal phalanges.

Conclusion: The uniqueness of the present study stems from the ramification of the APL from 2-6 tendons. The APL is important muscle of dexterity. Knowledge about its variations is important in clinical assessment and reconstructive surgery.

Keywords: Abductor Pollicis Longus (APL de Quervain's disease; Extensor Pollicis Brevis.


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INTRODUCTION

Stenosing tenosynovitis of the first dorsal compartment of the wrist or de Quervain's disease is a commonly encountered debilitating condition of the wrist. The common mode of treatment is conservative, but recurrence is seen in 15–20 % of cases in this management. Several factors are responsible for the recurrence.¹ Tendons of Abductor Pollicis Longus & Extensor Pollicis Brevis are main muscular content of 1st dorsal compartment of wrist. Muscular content of 1st dorsal compartment of the wrist has important role in the movement of thumb. Variations in the attachment of two long extensors of thumb (extensor pollicis longus and abductor pollicis Brevis) and the contribution made by various small muscles of thumb in the formation of DDE affects the various movements of the thumb. Multiplicity of tendons of Abductor pollicis Longus & Extensor pollicis Brevis has a significant role in the etiology of De Quervian's Stenosing

Tenosynovitis.^{2,4} De Quervian's tenosynovitis refers to entrapment tendonitis / tenosynovitis of the abductor pollicis longus and extensor pollicis brevis tendons at the styloid process of the radius. It is most often a cumulative movement disorder due to chronic overuse of the wrist and hand. Bilateral or unilateral tenosynovitis may also accompany pregnancy, direct trauma, and systemic diseases such as rheumatoid arthritis and calcium apatite deposition disease.³⁻⁵

De Quervian's tenosynovitis affects two thumb tendons. The abductor pollicis longus (APL) and the extensor pollicis brevis (EPB). These tendons are responsible for extending the thumb backwards and for moving the thumb away from the palm of the hand. These tendons connect their respective muscles in the forearm to the thumb. On their way to the thumb, the APL and EPB traverse side-by-side through a thick fibrous sheath that

forms a tunnel at the radial styloid process. Normally, the APL and EPB glide easily back and forth within this tunnel.²⁻⁵ Literature suggests that the anatomical variations in the first dorsal compartment of the wrist like supernumerary tendon slips, aberrant compartments or presence of septa, and variation of insertion of tendon slips are encountered to be important causative factors for this problem.¹ The present study is carried to find out the variations in composition of musculature 1st Extensor compartment of the wrist.

MATERIALS AND METHODS

A total number of 66 (33 Left and 33 Right) disarticulated upper limbs of adult cadavers of Indian individuals of unknown sex from the department of Anatomy of S.M.S. Medical College, Jaipur has been selected for the present study. 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 motendinous 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 of skin and superficial fascia 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. Extensor retinaculum was defined and the structures on the lateral part of dorsum of hand and thumb were displayed. The extensor retinaculum covering the first extensor compartment was split vertically and the underlying tendons of abductor pollicis longus and extensor pollicis brevis were exposed carefully to note the complete or partial septation of the compartment and the presence of variations of these two tendons. The tendons were traced to their insertion and 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. Variations in these tendons and accessory muscles or tendons in this region has been noted. All parameters have been tabulated and analyzed. The chi-square test has been use to compare the differences between the right and left limbs and to determine statistically significant differences.

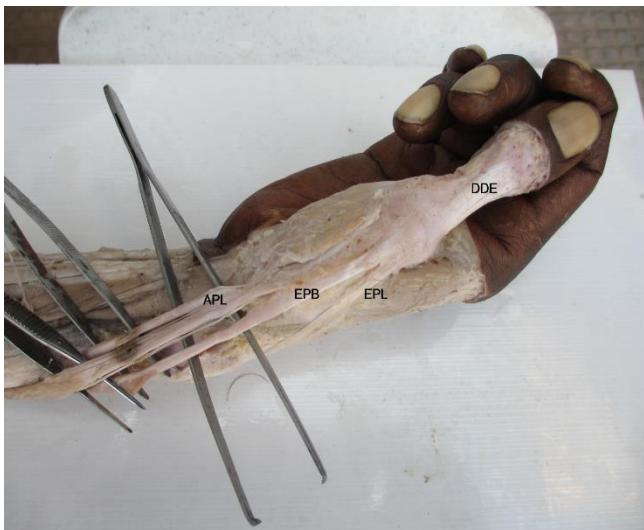


Fig 1: Showing Tendons of EPL, EPB & 2 Tendons of APL A- EPL, B-APB, C-2 Tendons of APL

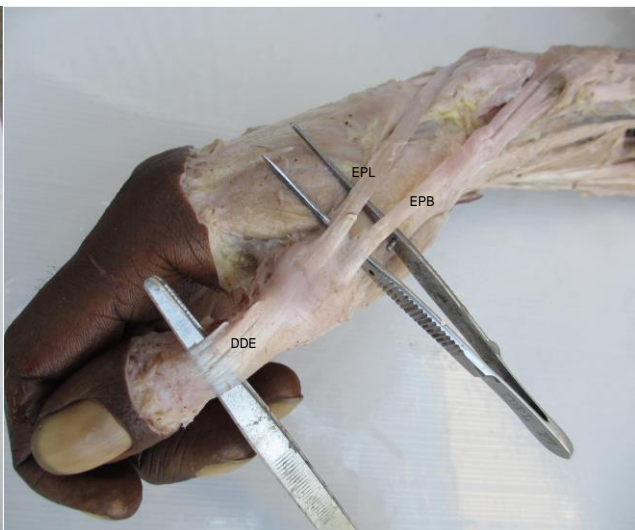


Fig 2: Showing Tendons of EPL & EPB Forming DDE of Right Thumb A-EPL, B-EPB, C-DDE of Thumb



Fig 3: Showing Separate Origin of APL & EPB

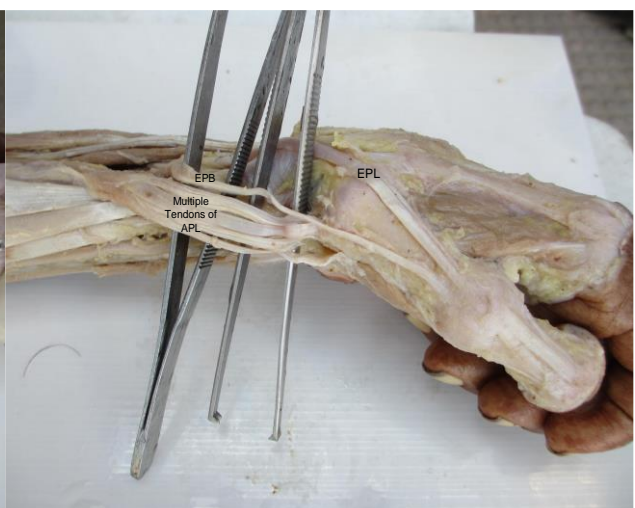


Fig 4: Showing 1 Tendon of EPL, 1 Thin Tendon of EPB & 5 Tendons of APL With attachment of APL to Abductor pollicis Brevis, first metacarpal & trapezium, base of proximal phalanx of thumb.

RESULTS

Table 1 shows percentages of Attachment of tendons of EPL in total no. of 33 Right Thumbs. Findings of above table reveals that the tendon of EPL in right side attached to distal phalanx in 96.9 % of cases, to proximal phalanx in 3.03 % of cases and to both (right and left) in 3.03 % of cases. According to this table almost all the tendons of APL was attached to the distal Phalanx which was 32 out of 33 upper limbs. But to proximal phalanx it is attached in only one thumb, and in only one case it is attached to both distal and proximal phalanx.

Table 2 shows the Attachment of tendons of EPL in Left Thumbs. The tendon of EPL was attached to 33 or all the distal phalanges of left side. But proximal phalanx receives no attachment of EPL tendon on left side. On left thumb both phalanges (distal and proximal) also receives no contribution from the tendon of EPL.

It shows that all the tendons of EPL was attached to the distal phalanges but not a single tendon was attached to the proximal or to both proximal and distal phalanges.

Table 3 shows percentages of the attachment of tendons of EPL in both right and left thumb. Observation of data in this table shows that in 65 upper limbs the tendons of EPL was attached on distal phalanx, in only one hand it was attached to the proximal phalanx and in one hand it was attached to both right and left thumb. In 97.63 % of cases or in almost all of the cases it was attached to the distal phalanx, in only one hand to the proximal phalanx and in one hand to both right and left hand. Data of this table reveals that distal phalanx is the important site of attachment for tendons of the EPL in both right and left hand.

Table 4 shows the Association of Attachment of tendons of EPL on Right and Left thumbs. This table reveals that distal phalanx receives all the tendons of the EPL on both side of upper limb except only in one limb where it is attached to proximal phalanx only. The proximal phalanx of one right limb receives tendon of EPL while in this hand there was no attachment on proximal phalanx of left side, In this hand of left side the tendon of EPL was attached only to the distal phalanx. Only in one right hand the tendon of EPL was attached to both proximal and distal phalanx of hand, but on left side there was no such attachment present.

Table 1: Attachment of tendons of EPL in Right Thumbs (n=33)

Attachment On	n	%
DP	32	96.9
PP	01	3.03
DP + PP	01	3.03

Table 2: Attachment of tendons of EPL in Left Thumbs (n=33)

Attachment On	n	%
DP	33	100
PP	-	0
DP + PP	-	0

Table 3: Attachment of tendons of EPL in *thumbs (n=66)

Attachment On	n	%
DP	65	97.63
PP	01	1.52
DP + PP	01	1.52

*both right and left

Table 4: Association of Attachment of tendons of EPL on Right and Left thumbs

Attachment of EPL on	Right	Left
DP	32	33
PP	01	-
DP + PP	01	-

Table 5: Attachment of tendons of EPB in thumb on Right (n=33)

Attachment On	n	%
DP	09	27.27
PP	18	54.54
DP + PP	04	12.12

Table 6: Attachment of tendons of EPB in thumb on Left (n=33)

Attachment On	n	%
DP	08	24.22
PP	22	66.66
DP + PP	04	12.12

Table 7: Attachment of tendons of EPB in *thumbs (n=66)

Attachment On	n	%
DP	17	25.75
PP	40	60.6
DP + PP	04	12.12

*both right and left

Table 8: Association of Attachment of tendons of EPB on Right and Left thumbs

Attachment of EPB On	Right	Left
DP	09	08
PP	18	22
DP + PP	04	04

Table 9: Association of Attachment of tendons of EPL and EPB on Right thumbs

Attachment On	No. of EPL	No. of EPB
DP	32	09
PP	01	18
DP + PP	01	04

Table 10: Association of Attachment of tendons of EPL and EPB on Left thumbs

Attachment On	No. of EPL	No. of EPB
DP	100	08
PP	-	22
DP + PP	-	04

Table 11: Association of Attachment of tendons of EPL and EPB on *thumbs

Attachment On	No. of EPL	No. of EPB
DP	65	17
PP	01	40
DP + PP	01	08

*both right and left

Table 5 shows the Attachment of tendons of EPB in thumb on Right of 33 upper limbs. This table reveals that the distal phalanx receives 9 tendons of the EPB.

The proximal phalanx of right side receives contribution from the 18 tendons of the EPB. On both distal and proximal phalanges tendon of EPB was attached to only one upper limb.

Table shows that distal phalanges receives 27.27 % of tendons, proximal phalanges receives 54.54 % of tendons and both phalanges receives 12.12 % of tendons of EPB.

Table 6 shows the Attachment of tendons of EPB in thumb on Left in 33 upper limbs.

It reveals the distal phalanx of left thumb of 8 limbs receives contribution from EPB while proximal phalanx receives 22 tendons of EPB.

In only one limb EPB tendon was attached to the both distal and proximal phalanges.

In 24.22 % of the cases EPB tendon was attached to distal phalanx, In 66.66 % attached to proximal phalanx and in 12.12 % cases it was attached to both distal and proximal phalanges.

Table No.7 shows the Attachment of tendons of EPB in both right and left thumbs. The distal phalanx of both right and left side received 17 tendons of EPB which is 25.75 % of the total 66 upper limbs.

Proximal phalanx of both sides received 40 tendons of EPB which is 60.6 % of the total of 66 upper limbs.

The tendon of EPB was attached to both distal and proximal phalanges of the 4 upper limbs which is 12.12 % of the total of 66 upper limbs.

Table 8 shows the Association of Attachment of tendons of EPB on Right and Left thumbs. On the right side 09 EPB tendons was attached to the distal phalanx, 08 EPB tendons was attached to the distal phalanx on left side, 18 EPB tendons was attached to the proximal phalanx on the right side, 22 EPB tendons was attached to the proximal phalanx on the left side, 04 EPB tendons was attached to the both distal and proximal phalanx of right side as well as on the left side.

This table reveals that tendons of EPB attached to the proximal phalanx are more than the tendons attached to the distal phalanx.

Table 9 shows the Association of Attachment of tendons of EPL and EPB on Right thumbs. This table reveals that on the right-side distal phalanx receives attachments of 32 tendons of EPL while it receives only 09 tendons of EPB on right side.

Right side proximal phalanx receives 01 tendons of EPL while it receives 18 tendons of EPB, which is a very big difference between attachments of EPL and EPB on distal phalanx on right side.

The tendon of EPL on both distal and proximal phalanx on right side was attached to only one thumb, while 04 tendons of EPB was attached to these both distal and proximal phalanx.

Table 10 shows the Association of Attachment of tendons of EPL and EPB on Left thumbs. This table reveals that on the left side all the tendons of EPL get attachment on the distal phalanx, while in case of EPB tendons it was attached to only 08 thumbs.

In case of proximal phalanx tendon of EPL has no attachment on the left side, while in case of tendons of EPB it was attached to the 22 thumbs. This is also a very big difference.

In case of the tendons of the EPL on both distal and proximal phalanx there was no attachment to a single thumb but in case of EPB tendons it was attached to 4 thumbs.

Table No. 11 shows the Association of Attachment of tendons of EPL and EPB on *thumbs.

This table reveals that proximal phalanx of thumb on both the sides received 40 tendons of the EPB while it receives only 01 tendon of the EPL. In case of distal phalanx, it received 65 tendons of EPL while only 17 tendons of EPB.

Data of above table reveals that almost all the tendons of EPB get attachment on proximal phalanx whereas most of the tendons of EPL get attachment on distal phalanx.

In case of EPL tendons only 01 tendon get attached to both distal and proximal phalanx, while in case of EPB tendons 08 tendons get attached to both phalanges.

DISCUSSION

Abductor pollicis longus (APL) muscle is known to exhibit numerous variations. Variations in the number of tendons of APL muscle may be asymptomatic and are often incidental findings.⁶

Reports in the literature suggest that variations in the numbers of APL tendons, distal attachment sites of the tendons, and the structure of the APL can have clinical relevance. It has been suggested that variations in the number of APL tendons and corresponding osseo-fibrous canals are involved in the etiology and subsequent surgical decompression of DeQuervains Syndrome.

To confirm the diagnosis Finkelstein test was carried out by McFarland et al,⁷ in which the thumb is passively flexed at the metacarpophalangeal joint and then with the thumb flexed passively forcing the hand into ulnar deviation results in pain at the radial styloid process. The variations of tendons have been reported by many researchers. Still a maximum of 9 tendons of APL have been reported.

We found no cases of absent EPB. In contrast, Fenton and Lapidus observed EPB absence in 9.2% cases. Figure 1-4 shows tendons of EPL, EPB and tendons of APL. EPB reflects that it is a phylogenetically young structure. Aydinlioğlu A et al⁸ suggested that the extensor pollicis brevis muscle and the abductor pollicis longus muscle differentiate from a common muscle. Bade et al,⁹ while describing the fibrous architecture of dorsal aponeurosis of thumb have stated that dorsal connective tissue of thumb forms different layers of collagen lamellae as a peritendinous system around the tendons of extensor pollicis longus (EPL) and extensor pollicis brevis (EPB).

In our study we have found the triangular DDE of thumb on the dorsum of all the thumbs. In our study has been seen that the APL tendon divided into two, three, four, five and six slips of insertion Such supernumerary slips of the APL are of immense clinical relevance. Being an important muscle of dexterity, thorough knowledge of its muscular variations is important in reconstructive surgeries.

Spinner et al¹⁰ and Lamb et al,¹¹ have described that the FPB like APB also joins extensor expansion of thumb. While we have seen that tendons of four muscles; i.e. oblique head of the Adductor Pollicis Longus, transverse head of Adductor Pollicis Longus, Abductor Pollicis Brevis and 1st Palmer Interossei were attached to the extensor expansion of thumb.

CONCLUSION

It's a well-known fact the human thumb plays an important role in prehension, opposition and in performance of intricate skilled and

precision movements of hand. Multiplicity of APL tendons can be viewed as a functional advantage, since injuries in one tendon can be compensated for by the remaining tendons. Precise knowledge of the various APL tendon morphologies is vital for reconstructive procedures to rehabilitate traumatized hands.

The present report describes an unusual pattern of division of the APL tendons. The uniqueness of the present study stems from the ramification of the APL from 2-6 tendons. The APL is important muscle of dexterity. Knowledge about its variations is important in clinical assessment and reconstructive surgery.

REFERENCES

1. Roy AJ, Roy AN, De C, et al. A cadaveric study of the first dorsal compartment of the wrist and its content tendons: anatomical variations in the Indian population. *J Hand Microsurg.* 2012;4(2):55-9.
2. Mehta V, Arora J, Suri RK, Rath G. A rare quadruplicate arrangement of abductor pollicis longus tendons: anatomical and clinical relevance. *Clinics (Sao Paulo)* 2009;64: 153–5.
3. Van Oudenaarde E, Oostendorp R. Significance of the innervation pattern of the human abductor pollicis longus muscle. *J Anat* 1992;181: 155–9.
4. Nayak SR, Krishnamurthy A, Pai MM, Prabhu LV, Ramanathan LA, Ganesh Kumar C, Thomas MM. Multiple variations of the extensor tendons of the forearm. *Rom J Morphol Embryol* 2008; 49: 97–100.
5. Melling M, Reihnsner R, Steindl M, Karimian-Teherani D, Schnallinger M, Behnam M. Biomechanical stability of Abductor pollicis longus muscles with variable numbers of tendinous insertions. *Anat Rec.* 1998;250:475–9.
6. Paul S, Das S. Multiple tendons of abductor pollicis longus muscle: a cadaveric study with clinical implications. *Kathmandu Univ Med J (KUMJ).* 2006 Oct-Dec; 4(4):501-2.
7. McFarland GB. Entrapment syndrome. In: Evart CM, ed. *Surgery of musculoskeletal system*, 2nd ed. New York: Churchill Livingstone, 1983:524-5.
8. Bade H, Krolak C, Koebke J; Fibrous architecture of dorsal aponeurosis of the thumb. *Anatomical Record* 1995; 243 (4) 524-30.
9. Aydinlioğlu A, Tosun N, Keles P, Akpınar F, Diyarbakirli S. *Kaibogaku Zasshi.* Variations of abductor pollicis longus and extensor pollicis brevis muscles: surgical significance. 1998 Feb; 73(1):19-23.
10. Lamb DW, Hooper G and Kuczynski K, *The practice of hand surgery In restoration of thumb.* 2nd Edn. Blackwell scientific publications, 1989: 376-9.
11. Spinner M. *Kaplan's functional and surgical anatomy of hand in thumb.* 3rd Edn. J.B. Lippincott Company, 1984: 124-41.

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