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Research Article

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"Hoodie Unearthed": Anatomy of Extensor Expansion of Thumb, its Variations and Surgical Advantages

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ABSTRACT

Introduction: Review of literature or current anatomy textbooks provides scanty description of the extensor apparatus of thumb. Existing studies on extensor tendons of hand revolve around their application in surgical repairs of ruptured tendons or in reconstructive surgeries involving re-routing of flexor tendons to extensor tendons in radial n palsy. The knowledge about the prevalence of variations in the structure and formation of the extensor expansion of thumb would help surgeons in planning new reconstructive techniques for better functional output. **Aim**: To study the variations in the formation and structure of dorsal digital expansion of thumb in cadavers and statistically analyze the prevalence of its variations in males and females. **Method**: By cadaveric dissection of 11 right and 11 left thumbs, the formative tendons of extensor expansion of thumb (EET) were observed; namely extensor pollicis longus(EPL) and extensor pollicis brevis(EPB), and presence of contributing tendons of extensor expansion of thumb (EET) namely Abductor pollicis brevis(ABP), adductor pollicis(ADP)and palmar interossei (PI) were noted. **Results**: In all the 22 thumbs a triangular shaped extensor expansion existed over the dorsal aspect of base of proximal phalanx.9 out of 22 thumbs had tendinous extension of EPB extending with EPL upto the distal phalanx. ABP, ADP and PI were contributing to EET in 2, 1, and 9 thumbs respectively. **Conclusion**: Extensor expansion of thumb, hitherto not mentioned in standard textbooks of Anatomy was dissected and its formation, design and variations displayed.

Key Words: *Extensor Expansion of Thumb, Extensor Pollicis Longus, Extensor Pollicis Brevis, Dorsal Digital Expansion, Tendon injuries of Thumb, Tendon transfer in Radial Nerve Palsy.*

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INTRODUCTION:

An opposable thumb is exclusively a human trait that makes prehension possible and this requires powerful flexors and extensors in action. Thumb has great stability and power contributed by the muscles acting on the first carpometacarpal joint, and metacarpophalangeal (**MCP**) joints. Synergistic contraction of the extensors and long flexors of thumb make efficient grip of thumb possible. Owing to the superficial location on the dorsum of the hand extensor tendon injuries are very common. Radial nerve injuries are also common and it affects the extensor compartment of hand. But several variations exist in these tendons which are mostly developmental [1]. Existing studies on extensor tendons of hand describes the formation of an Extensor Expansion of Digits (**EED**) by extensor digitorum and a similar extensor apparatus in thumb by the Extensor Pollicis Longus (**EPL**). Current anatomy textbooks provide scanty description of the Extensor Expansion of Thumb (**EET**). Variation in the site of insertion of an extensor tendon of thumb, could provide greater stability at MCP joint of the thumb which further facilitates extension at Interphalangeal joint.

OBJECTIVES:

To study the structure of dorsal digital expansion of thumb in cadavers and analyze the variation in the muscles that contribute to its formation.

METHOD:

During cadaveric dissection of upper limbs, the dorsal aspect of 16 right and 16 left thumbs were studied. The tendons on the dorsal aspect were observed for their source and structure and traced till the insertion. The EPL, Extensor Pollicis Brevis (**EPB**), Abductor Pollicis Brevis(**APB**), first Palmar Interosseus (**PI**) and the Adductor Pollicis(**ADP**) muscles were traced in each hand. The tendons of those muscles that extend along the midline on the dorsum of the proximal phalanx of thumb were designated as formative tendons of the EET. A tendon that joined the EET on either side was designated as a contributing tendon.

RESULTS:

All the thumbs had a fibrous structure formed by aponeurotic expansion of one or more tendons on dorsal aspect of the proximal phalanx extending from the MCP joint to the base of distal phalanx. This is either a small wing shaped structure or broad & band-like if more than one tendon is forming its central axis. The EPL tendon forms its median axis in all thumbs (Fig.1).

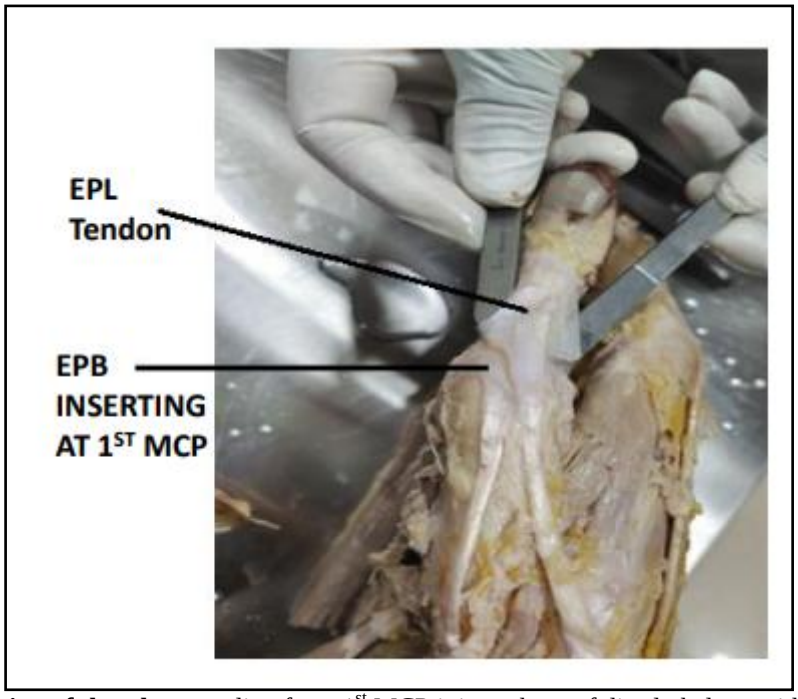


Fig.1: **Extensor expansion of thumb:** extending from 1st MCP joint to base of distal phalanx with EPL tendon in central axis.

In 41% cases the EET was thicker due to presence of fibers from EPB tendon in addition to EPL as the tendon extended beyond its normal insertion at the base of proximal phalanx and along lateral aspect of EPL tendon, to get inserted at base of distal phalanx (Fig. 2).

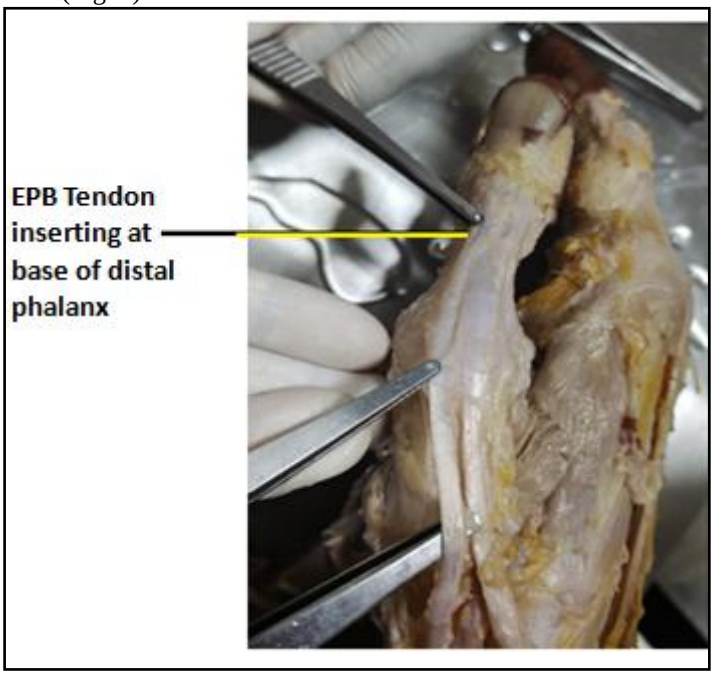
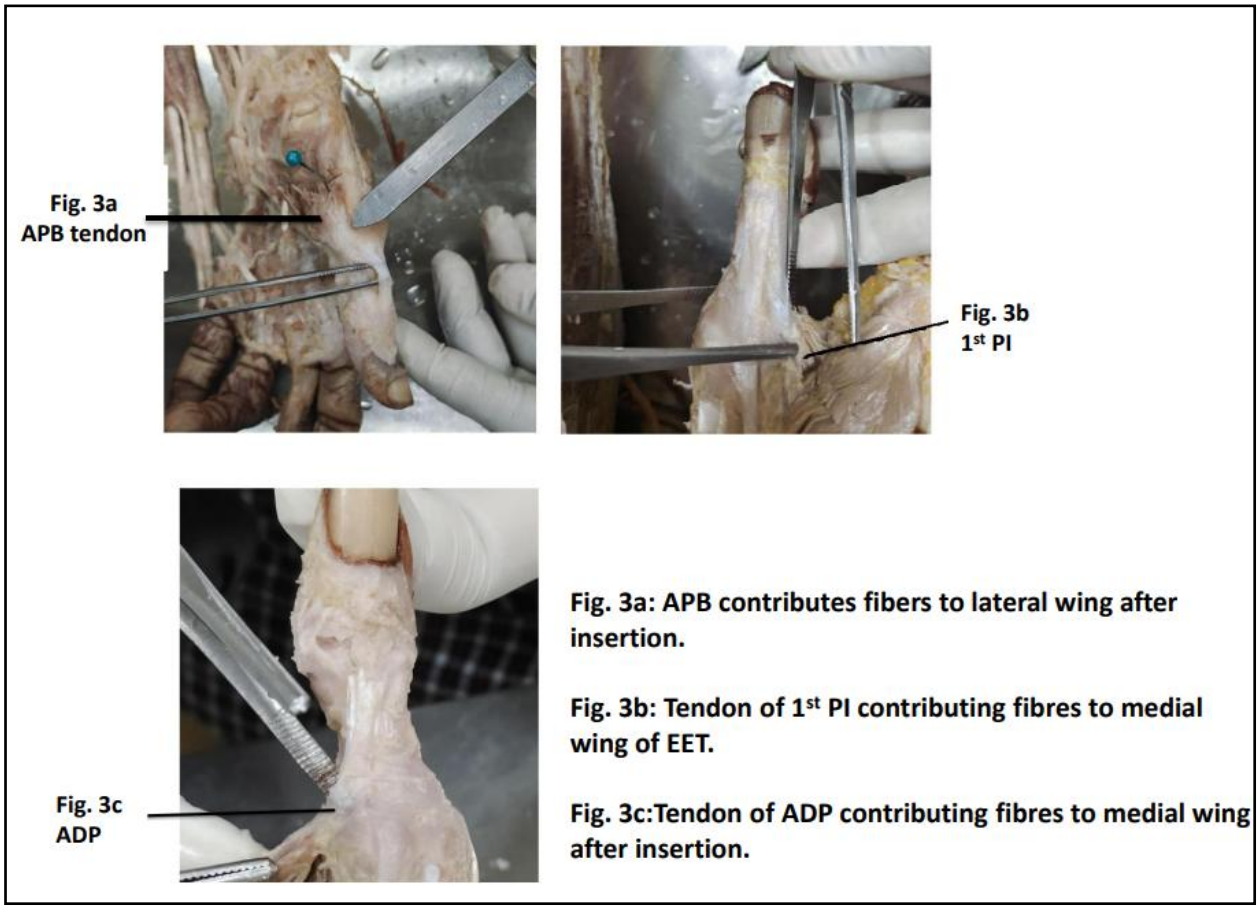


Fig. 2. EPB tendon extending beyond MCP , parallel to EPL tendon along the EET.

Other muscles were seen to contribute to the EET by extension of their tendons along the sides (wings) of the expansion, such as APB in 9% on the lateral wing (Fig.3a) and PI in 41% (Fig.3b) ADP in (5%) along the medial wing of EET (Fig 3c).



Figs. 3a, b, c: Contributing tendons of Extensor expansion of thumb.

DISCUSSION:

Some interesting structural variations in the extensor apparatus of the thumb was observed in our study and varies with observations previously reported by few authors as shown in Table 1 [1,2,3,4].

Table1: Comparing results of similar studies with present study. Abbreviations are the same as shown in text.

Sl No	STUDY	EPB	ABP	ADP	PI
1	G.A. Abdel-Hamid [1]	44.2			
2	Saroj Lata Meena [2]	12.2	74.23	96.96	57.55
3	Joshi SS [3]	27.25	68.2	98.1	62.7
4	Stelin Agnes Michael[4]	48.75	100	100	50
5	Esther Yamuna N [5]	60			
6	Present Study	41	9	5	41

DISCUSSION:

The structure of EET differs from the typical structure of the EED by the absence of lateral slips and absence of attachment to the MCP and IP joint capsules. The muscles inserting to the EED are not the same in EET. This dissimilarity and variations observed in several studies of thumb extensors partially explain the absence of a definitive description of the EET in current anatomy textbooks.

EPL is the major formative tendon of EET and inserts at the base of distal phalanx in all hands included in the present study and also in many other studies. In a study by Esther Yamuna et al. EPL is seen to be attached to base of proximal phalanx of thumb through the EET in 14.3% cases [5]. EPB was attached to the extensor expansion of thumb at the level of base of proximal phalanx, in all cases of our study. It further extended as tendon along its median axis to the base of distal phalanx for insertion in 41% cases in this study, 43% cases in a study by Michael et al [4], and 60% in the study by Esther Yamuna et al [5], whereas Abdel et al [1], reports the attachment of EPB tendon to the base of the EET in 41% cases. Variation in the site of insertion of the EPB and its contribution to the EET stabilizes MCP of the thumb for extension of IP joints. As a result, rupture of the EPL tendon did not have a significant impact on interphalangeal joint thumb extension [6], Extensor pollicis brevis (EPB) is more lateral in position as compared with the EPL so

produces better thumb abduction and extension at MCP by virtue of its radial vector [7]. Routinely in radial nerve palsy as part of triple tendon transfer, rerouting of EPL volarly and transfeing to the Palmaris Longus tendon is the standard procedure to achieve a combined extension and abduction [8], Instead a variant EPB with a tendinous extension onto the EET and insertion to distal phalanx was found to be a better choice [9, 10].

Clinical Relevance:

This strengthened knowledge is applicable in patients with weakness or injury to thumb extensors, where a surgical transfer of flexor tendons with the tendon of the above discussed variant of EPB, instead of the EPL tendon as recipient is preferable and this knowledge would help patients achieve a better functional output.

CONCLUSION:

Extensor expansion of thumb, hitherto not mentioned in standard textbooks of Anatomy, does exist in all thumbs though structurally different from that of other digits, formed by EPL in all with variable contributions from EPB, ADP, PI and APL.

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