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Anatomy

A BILATERAL ANATOMICAL VARIATION OF FLEXOR HALLUCIS LONGUS: PRESENCE OF AN ACCESSORY SLIP IN THE DEEP GROUP OF CRURAL FLEXORS

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ABSTRACT **Introduction:** The flexor hallucis longus (FHL) is a key muscle of the deep posterior compartment of the leg, playing an essential role in plantar flexion of the great toe, maintenance of the medial longitudinal arch, and propulsion during gait. Main clinical finding: During routine cadaveric dissection conducted in the Department of Rachana Sharir, a rare bilateral accessory slip of the FHL was observed in a 72-year-old male cadaver of Indian origin. On the right side, the accessory slip originated from the medial aspect of the FHL muscle belly along with fibers from the interosseous membrane, whereas on the left side it arose solely from the medial surface of the FHL muscle belly. **Diagnosis:**The variation was bilaterally present, with asymmetry noted in morphometric parameters and origination of fibres. **Outcome:** Accessory slips of the FHL are rare but clinically significant, particularly in tendon transfer procedures, hindfoot endoscopy, in reconstructive foot and ankle procedures and in the etiopathogenesis of tarsal tunnel syndrome. Bilateral occurrence with asymmetrical morphology is infrequently reported and reflects developmental variability. **Conclusion:** The present case highlights a rare bilateral accessory muscular slip of the FHL with asymmetric morphology and origination of fibres, underscoring the importance of recognizing such variations during anatomical study, imaging interpretation, and surgical interventions.

KEYWORDS : Flexor Hallucis Longus, Accessory Flexor Hallucis Longus, Anatomical Variation, Morphometry.

INTRODUCTION:

The deep group of crural flexors, forming the posterior compartment of the leg, includes the tibialis posterior, flexor digitorum longus, and flexor hallucis longus muscles.[1] Among these, the flexor hallucis longus (FHL) plays a crucial role in plantar flexion of the great toe, stabilization of the medial longitudinal arch, and propulsion during the gait cycle.[1,2] It originates from the posterior surface of the fibula and the interosseous membrane and inserts into the base of the distal phalanx of the great toe.[1]

Anatomical variations in the deep posterior compartment of the leg are not uncommon and may involve differences in origin, insertion, tendon formation, or the presence of accessory muscular slips.[3,4] Variations of the flexor hallucis longus, though relatively rare, are of particular clinical importance due to their close anatomical relationship with neurovascular structures of the leg and ankle.[1,3]

The presence of an accessory slip arising from the flexor hallucis longus may have significant implications during surgical procedures around the ankle and foot, tendon transfer surgeries, and in conditions such as tarsal tunnel syndrome or chronic ankle pain.[2,3] Such variations may also alter the normal biomechanical function of the muscle and contribute to diagnostic confusion in radiological imaging.[4]

The present observation reports bilateral accessory slips of the flexor hallucis longus identified during routine cadaveric dissection, emphasizing the importance of awareness of such anatomical variations for anatomists, clinicians, and surgeons.

REVIEW OF THE LITERATURE FOR VARIATIONS FOUND IN RELATION TO FLEXOR HALLUCIS LONGUS:

Anatomical variations of the flexor hallucis longus (FHL) muscle and its tendon are well documented in anatomical, radiological, and surgical literature. These variations are important for clinicians and surgeons due to their implications for surgical planning, interpretation of imaging, and understanding of foot and ankle biomechanics.

1. Tendinous Slips and Interconnections- The most frequently reported variation involves tendinous slips or connections between the FHL and the flexor digitorum longus (FDL).[5]

2. Multiple tendinous slips of FHL continuing to the lateral toes.[6]

3. Musculotendinous Junction Variability[7]

4. Accessory Muscles and Variant Muscle Slips [8]

5. MRI analyses have identified variants such as distal muscle belly extensions and accessory tendons in around 9–10% of examined ankles. [9]

CASE STUDY:

During routine dissection in the Department of Rachana Sharir (Anatomy), an anatomical variation was observed in the deep posterior compartment of the leg in a 72-year-old male cadaver of Indian origin. The cadaver was legally donated to the department under the institutional body donation program and was well preserved with no evidence of gross deformity, trauma, or prior surgical intervention in the lower limbs.

On meticulous dissection of the posterior compartment of the leg, after reflecting the superficial flexor muscles and removing the deep fascia, the deep group of crural flexors—namely tibialis posterior, flexor digitorum longus (FDL), and flexor hallucis longus (FHL)—were exposed. The tibialis posterior and flexor digitorum longus exhibited normal origin, course, and insertion.

However, the flexor hallucis longus muscle showed an accessory muscular slip, arising from the medial aspect of its muscle belly and interosseus membrane in Right leg (Figure:1 & 2) and from medial aspect of muscle belly only in left leg (Figure 3 & 4). This accessory slip coursed distally, remaining distinct from the main tendon of FHL for a variable length before blending with the surrounding deep flexor structures. The main FHL muscle originated normally from the posterior surface of the fibula and interosseous membrane and continued as a well-defined tendon towards its insertion.

The accessory slip was tendinous proximally and muscular distally. It was observed to pass in close relation to the flexor digitorum longus tendon within the deep posterior compartment. The neurovascular structures of the posterior compartment, including the posterior tibial artery and tibial nerve, maintained their normal anatomical relationships and were not compressed by the accessory slip.

The variation was present bilaterally in both the limbs. The difference was only of measurements of accessory bellies of flexor hallucis longus muscle as shown in Table:1.

Table:1 showing measurements of Accessory Flexor Hallucis Longus Muscle

S. No.	Side of Leg	Total Length of Accessory Slip	Length of Tendinous Part	Length of Muscular Part	Width of Muscular Belly (At centre)
1.	Right Side	14 cm	08 cm	06 cm	2.5 cm
2.	Left Side	11 cm	05 cm	06 cm	1.5 cm

Table: 2 showing illustration of figures

Figure 1	Rt. Leg	Illustrates the presence of extra accessory slip of FHL.
Figure 2	Rt. Leg	Illustrates the origin of accessory slip from FHL belly and interosseus membrane.
Figure 3	Lt. Leg	Illustrates the presence of extra accessory slip of FHL.
Figure 4	Lt. Leg	Illustrates the origin of accessory slip from FHL belly only.

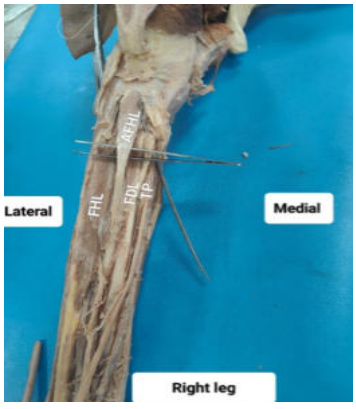

Figure:1

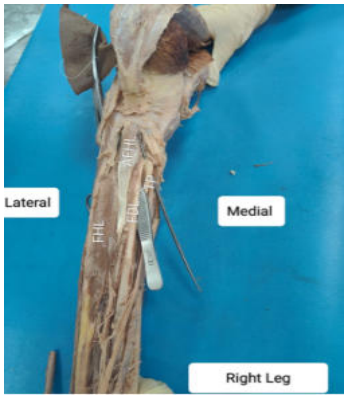

Figure:2

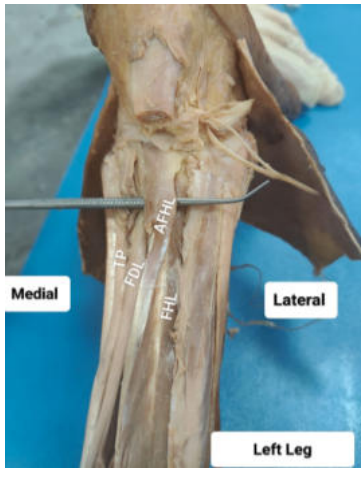

Figure:3

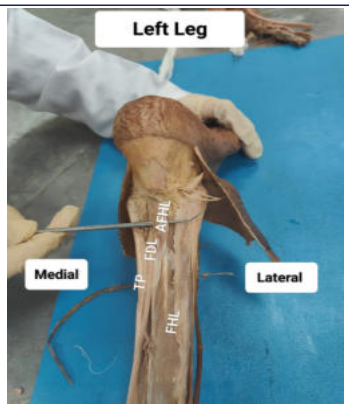

Figure:4

DUSCUSSION:

Accessory muscles and variant muscle slips related to the FHL, such as the flexor digitorum accessorius longus, have been implicated in clinical conditions including tarsal tunnel syndrome, chronic ankle pain, and neurovascular compression. Although no compression of the posterior tibial artery or tibial nerve was observed in the present cadaver, the close proximity of the accessory slips to these structures highlights their potential clinical relevance, particularly in living subjects.

The bilateral presence of accessory slips in the present case is noteworthy, as bilateral symmetry of such variations is less frequently reported in literature. The difference observed only in the measurements of the accessory bellies suggests individual limb-specific growth patterns during embryological development. From a surgical standpoint, awareness of such bilateral but morphometrically different variations is crucial during tendon harvest, reconstructive procedures, and endoscopic interventions around the ankle and hindfoot.

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Overall, the present case adds to the existing body of literature by documenting a bilateral accessory muscular slip of the flexor hallucis longus with asymmetrical dimensions, reinforcing the need for detailed anatomical knowledge of deep posterior compartment variations for anatomists, surgeons, and radiologists.

CONCLUSION:

The present case highlights a rare bilateral anatomical variation of the flexor hallucis longus in the form of an accessory slip identified during cadaveric dissection. Documentation of such variations contributes to existing anatomical knowledge and emphasizes the importance of careful dissection and awareness of muscular anomalies in the deep posterior compartment of the leg.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this publication.

DATA AVAILABILITY STATEMENT

All relevant dissection data generated or analysed during this study are included in the article. Further details or clarifications can be made available from the corresponding author upon reasonable request.

REFERENCES:

1. Standring S, editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42nd ed. London: Elsevier; 2021. p. 1415–1418.
2. Moore KL, Dalley AF, Agur AMR. Clinically Oriented Anatomy. 8th ed. Philadelphia: Wolters Kluwer; 2018. p. 636–639.
3. Tubbs RS, Shoja MM, Loukas M. Bergman's Comprehensive Encyclopedia of Human Anatomic Variation. Hoboken (NJ): Wiley-Blackwell; 2016. p. 789–792.
4. Nathan H, Gloobe H. Variations in the muscles of the posterior compartment of the leg. Acta Anat (Basel). 1970;75(1):22–28.
5. Plaass C, Abuharbid G, Waizy H, Ochs M, Stukenborg-Colsman C, Schmiedl A. Anatomical variations of the flexor hallucis longus and flexor digitorum longus in the chiasma plantare. Foot Ankle Int. 2013 Nov;34(11):1580-7. doi: 10.1177/1071100713494780. Epub 2013 Jun 20. PMID: 23788233.
6. Maddox MB, Mashaw SA, MacDonald EM, Mira AJ, Parker WJ, Fakoya AO. Four Tendinous Slips of Flexor Hallucis Longus Tendon: A Case Report. Cureus. 2024 May 3;16(5):e59601. doi: 10.7759/cureus.59601. PMID: 38716366; PMCID: PMC11076001.
7. Pichler W, Tesch NP, Grechenig W, Tanzer K, Grasslober M. Anatomical variations of the flexor hallucis longus muscle and the consequences for tendon transfer. A cadaver study. Surg Radiol Anat. 2005 Aug;27(3):227-31. doi: 10.1007/s00276-005-0314-y. Epub 2005 Mar 24. PMID: 15789138.
8. Basu, Rituparna1,; Baral, Karabi2; Sarkar, Jayanta3; Ray, Koushik3; Mistry, Bileswar3. Supernumerary muscle of tarsal tunnel: a case report. National Journal of Clinical Anatomy 5(3):p 169-171, Jul–Sep 2016. | DOI: 10.4103/2277-4025.294937
9. Vega J, Redó D, Savín G, Malagelada F, Dalmau-Pastor M. Anatomical variations of flexor hallucis longus tendon increase safety in hindfoot endoscopy. Knee Surg Sports Traumatol Arthrosc. 2017 Jun;25(6):1929-1935. doi: 10.1007/s00167-017-4465-2. Epub 2017 Feb 20. PMID: 28220191.
10. Sammarco GJ, Stephens MM. Supernumerary muscles and tendons of the foot and ankle: a comprehensive review. Foot Ankle Int. 1998;19(12):825–834.