

Anomalous attachment of the flexor digiti minimi muscle of the foot: an anatomical study with clinical implications

K.K. Rana and S. Das

Department of Anatomy, Maulana Azad Medical College, New Delhi-110002, India

SUMMARY

In human beings, the muscles of the sole of the foot are known to exhibit variations. During routine cadaveric dissection, an anomalous attachment of the flexor digiti minimi muscle was observed on both sides of a 55 year male cadaver. The flexor digiti minimi muscle had its usual origin from the plantar surface of base of the fifth metatarsal bone and the sheath of the peroneus longus muscle and had its insertion into the abductor digiti minimi muscle, as well as in to the medial and lateral sides of plantar surface of the base of distal phalanx of the fifth metatarsal bone. Some fibres of this muscle were also found to insert into plantar and deep transverse metatarsal ligaments. The attachment of the flexor digiti minimi muscle of the foot to the distal phalanx of the little toe (instead of the usual attachment into the proximal phalanx) is often regarded as a separate muscle i.e. the opponens digiti minimi. Distal attachment of the flexor digiti minimi muscle of the foot may also play a role in the biomechanics of the flexor digiti minimi muscle. The presence of such anomalous muscles may also be of academic and surgical interest in day to day medical practice.

Key Words: Flexor digiti minimi muscle – Variation – Attachment – Opponens digiti minimi

INTRODUCTION

The flexor digiti minimi (FDM) is a muscle of the third layer of the sole of the foot. The muscle is reported to originate from the plantar surface of the fifth metatarsal bone and the sheath of the peroneus longus muscle, while its insertion is into the lateral aspect of the abductor digiti minimi muscle and the proximal phalanx of the fifth toe (Standring, 2005). Few Anatomy textbooks of mention the fact, that the deeper fibers of this muscle may sometimes insert into the lateral aspect of the distal phalanx of the fifth toe, thus existing as a separate muscle, known as the opponens digiti minimi muscle (ODM) (Standring, 2005).

There are fewer reports about the existence of the ODM, which makes the present study more interesting from the academic and clinical points of view. The presence of the distal attachment of the FDM existing as a separate muscle, i.e., ODM may sometimes confuse the surgeons operating on the foot. The biomechanics of the FDM muscle may be altered in cases of its unusual attachment. The present study describes the anomalous ODM muscle and discusses its clinical implications.

CASE REPORT

During routine dissection for undergraduate medical teaching, we detected an anomalous FDM muscle on both sides of a 55 year old male cadaver. The surrounding structures were carefully dissected and the muscles of the third layer of the sole of the foot were displayed. The origin and insertion of the anomalous FDM muscle was studied in detail and appropriate photographs were taken (Fig. 1).

Observations

The anomalous FDM muscle had its origin in the sheath of the peroneus longus muscle ('c' in Fig. 1) and also in the medial plantar surface of the fifth metatarsal bone ('d' in Fig. 1). The insertion of the muscle was into the medial and the lateral plantar surface of the distal phalanx of the fifth toe. Some of the fibers of this muscle were also attached to the plantar ligament and deep transverse metatarsal ligaments of the fourth and the fifth toes. The anomalous FDM muscle traversed a course deep to the transverse head of the adductor hallucis muscle, and was found to lie lateral to the lateral plantar artery ('d' in Fig. 2). The muscle was innervated by the lateral plantar nerve.



Fig. 1.- Photograph of dissected specimen (right side): a: Flexor digiti minimi muscle; b: Abductor digiti minimi muscle; c: Peroneus longus sheath; d: Origin of the flexor digiti minimi muscle from the fifth metatarsal; e: Reflected part of the flexor digitorum brevis muscle; f: Medial plantar nerve; g: Inferior aspect of calcaneum; LT: Little toe.

DISCUSSION

The FDM muscle usually originates from the medial part of the plantar surface of the base of the fifth metatarsal bone and the sheath of the peroneus longus muscle (Standring, 2005). In the present study, we also observed the FDM muscle to originate from the medial surface of the base of the fifth metatarsal bone. According to standard anatomy textbooks, the FDM muscle usually inserts into the lateral aspect of the abductor digiti minimi muscle and the proximal phalanx of the fifth toe (Standring, 2005; Sinnatamby, 2001). However, in the present case it was inserted into the lateral as well as the medial surface of the distal phalanx of the fifth toe, which is a rare finding. The authors regard the distal attachment of the FDM muscle into the distal phalanx to exist as a separate entity, which has been described as the ODM muscle (Standring, 2005). To the best of our knowledge there are very few research reports addressing on the ODM muscle and this too was reported in one single standard textbook on anatomy (Standring, 2005).

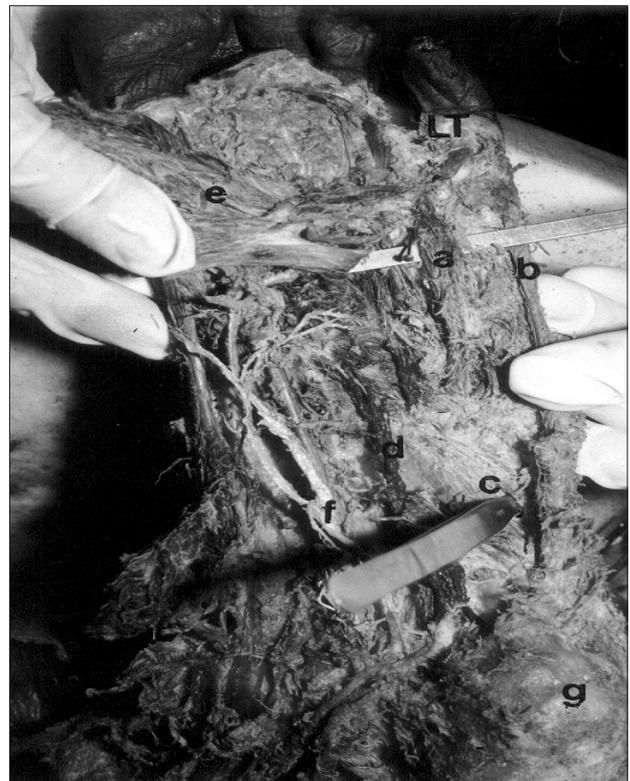


Fig. 2.- Photograph of dissected specimen (left side): a: Flexor digiti minimi muscle (note its course towards medial attachment); b: Abductor digiti minimi muscle; c: Peroneus longus sheath; d: Lateral plantar artery; e: Flexor digitorum brevis (reflected part); f: Medial plantar nerve; LT: Little toe.

The three muscles comprising the third muscle layer of the sole of the foot are the adductor hallucis, the flexor hallucis brevis, and the flexor digiti minimi muscles (Standring, 2005). Reports of anomalies confined to any of these three muscles of the third layer are few in number. An earlier study reported an anomalous abductor digiti minimi muscle of the foot, which had three proximal bellies and a distal belly (Kopuz et al., 1999). Another study also reported the presence of an accessory flexor muscle originating from the tendon of the tibialis posterior and inserting into the middle phalanx of the fifth toe (Asumogha et al., 2005). There are also reports on the accessory flexors of the foot -i.e., the accessory flexor digitorum longus- which are known to cause or are associated with tarsal tunnel syndrome (Peterson et al., 1995). There is a paucity of literature regarding documentation of the ODM muscle.

The presence of anomalous muscles such as the ODM reported here is not usually found in normal individuals and such muscles are often incidental findings. The attachment of these muscles or their peculiar course may sometimes compress the nerves in their vicinity, i.e., the lateral plantar nerve to give rise to the resulting symptoms. There are chances that small twigs of the lateral plantar nerves may sometimes become trapped by the anomalous attachments.

Normally, the lateral-most slip of flexor digitorum longus muscle is inserted into the

distal phalanx of the little toe but an additional attachment of another muscle, i.e. the FDM, as seen in the present case, may definitely alter the biomechanics of the muscle acting on the fifth toe in the sense that more pronounced flexion of the distal phalanx of the little toe may occur.

Radiologists interpreting MRI scans may also be confused by the presence of such anomalous attachments of the muscle. Surgeons operating on the foot should be aware of the abnormal and the normal anatomy of these muscles in order to check any inadvertent injury. In conclusion, the common anatomical knowledge that the FDM muscle is attached to the proximal phalanx of the fifth toe, as seen in the present case may not hold especially while performing grafting operations and reconstructive surgery.

REFERENCES

- ASOMUGHA AL, CHUKWUANUKWU TO, NWAJAGU GI and UKOHA U (2005). An accessory flexor of the fifth toe. *Niger J Clin Pract*, 8: 130-132.
- KOPUZ C, TETIK S and OZBENLI S (1999). A rare anomaly of the abductor digiti minimi muscle of the foot. *Cells Tissues Organs*, 164: 174-176.
- PETERSON DA, STINSON W and LAIRMORE JR (1995). The long accessory flexor muscle: an anatomical study. *Foot Ankle Int*, 16: 637-640.
- SINNATAMBY CS (2001). *Last's Anatomy. Regional and Applied*. Churchill Livingstone, London, pp 148.
- STANDRING S (2005). *Gray's Anatomy. The Anatomical Basis of Clinical Practice*. 39th edition. Elsevier Churchill Livingstone, Philadelphia, pp 1541.