

Clinico-anatomical considerations of unilateral bipartite abductor digiti minimi muscle of the foot: a case report

Ashish Nayyar, Vandana Mehta, Vanita Gupta, Rajesh Kumar Suri, Gayatri Rath

Department of Anatomy, Vardhaman Mahavir Medical College & Safdarjung Hospital, New Delhi, India

Abstract

Wound surgery of the heel may prove to be a difficult and time consuming procedure. This is owing to the weight bearing function of the heel. Defects in this region may be reliably covered by myocutaneous flaps. We present an interesting observation of an accessory belly of abductor digiti minimi (ADM) in the right foot of an adult male cadaver. The two bellies of ADM were placed in two planes - superficial and deep. The lateral belly was superficial and lateral in comparison to the medial belly which was deep and more medially displaced. Additionally, the morphology of the two bellies varied with the lateral belly being musculotendinous while the medial belly was tendinous predominantly. The clinical and surgical importance of the additional belly of the ADM is discussed specially in surgical procedures of plantar aspect of the foot. A preoperative radiological assessment of the foot to be operated upon may provide the necessary information and may detect these muscular anomalies. Utilizing these variations to their benefit during operation will shorten the procedure time and may reduce postoperative risks and complications. This anomaly here presented seldom cited in literature may be used to alert the foot surgeons and radiologists so that they may plan their procedures accordingly.

Key words: abductor digiti minimi; accessory; belly; anatomic variations

Anatomy 2010; 4: 72-75, © 2010 TSACA

Introduction

The abductor digiti minimi pedis, as the name suggests, causes abduction of the fifth toe and braces the lateral longitudinal arch. The muscle takes origin from the medial and lateral processes of the calcaneal tuberosity, the plantar aponeurosis and the intermuscular septum, and inserts at the lateral surface of the base of proximal phalanx of the fifth toe.¹ It derives the innervation from the lateral plantar nerve.

The sole ulceration is an ominous complication of leprosy, resulting from the neurovascular malfunctions relating to the disease. A sound working knowledge of

anatomy regarding the muscle and neurovascular bundle is vital in order to perform reconstructive operations on the foot. The importance of using abductor digiti minimi myocutaneous flap is paramount and is being widely used in covering defects such as lepromatous ulcers.²

A combination of abductor digiti minimi (ADM) flap along with lateral calcaneal artery skin flap has been successfully utilized to cover plantar heel defects in case of osteomyelitis of calcaneus.³ The present study is an attempt to report this rare anomaly of an accessory belly of ADM and to share the clinical and surgical relevance of the same.

Case Report

The abductor digiti minimi muscle variant was found in the right foot of a 50-year-old male cadaver during the course of gross anatomical class. The muscle was seen to have two bellies - lateral and medial (**Figure 1**). Both the bellies had a common origin from the lateral process of calcaneal tuberosity and measured 5.2 cm in length. The two bellies had similar linear measurements ascertained with the help of a digital vernier caliper. The lateral belly was superficial as compared to the medial belly and became musculotendinous in the middle of the foot. The muscular part of the lateral belly measured 8.7 cm in

length while its musculotendinous part was 6 cm long. The medial belly was not only deep but was shown to be predominantly tendinous traversing the same length as its lateral counterpart. Subsequently, both the bellies became tendinous and progressed towards their insertion. The two tendinous parts of the ADM were also seen to be interconnected by muscular bands. They joined together and were inserted into the base of the proximal phalanx. The nerve supply of these bellies of the ADM was derived from the lateral plantar nerve. Other muscles in the vicinity displayed normal morphology. No neurovascular variations were observed.

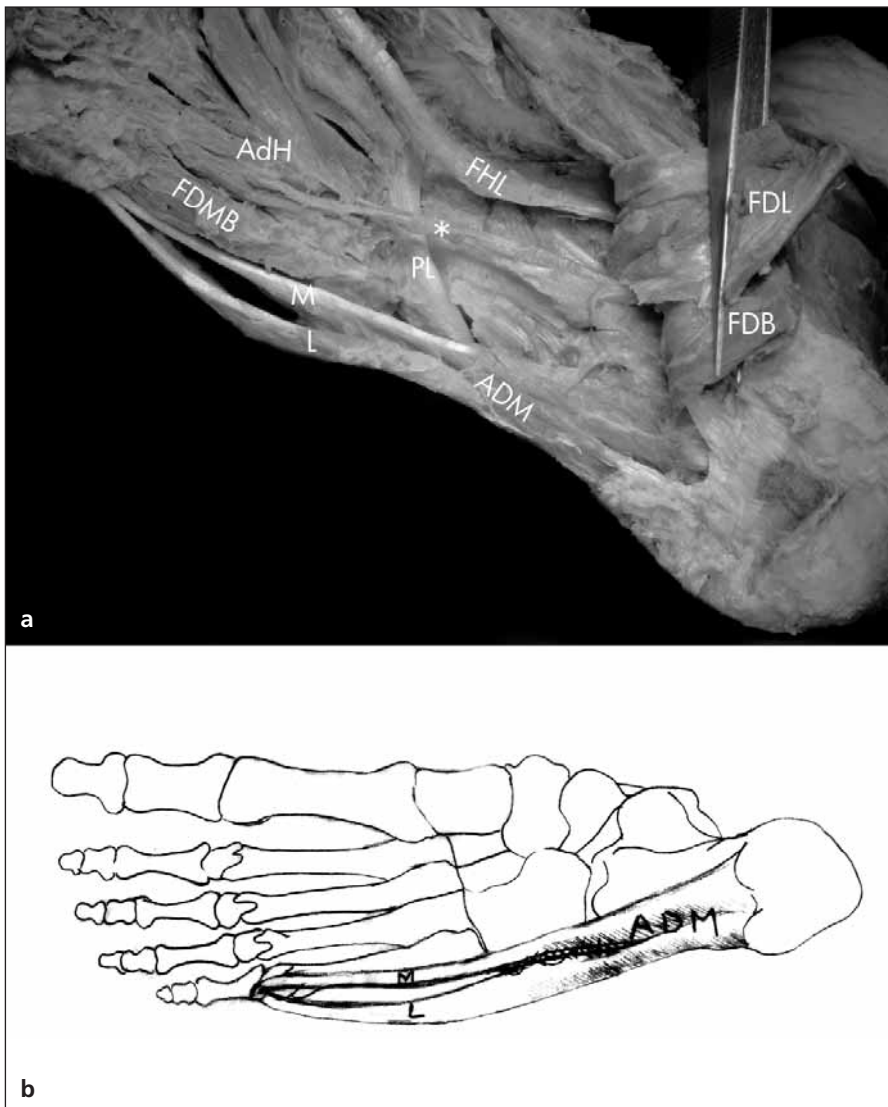


Figure 1. Plantar view of the dissected sole of the right foot (a) and a schematic drawing of the case (b). ADM: abductor digiti minimi; L: lateral belly of ADM; M: medial belly of ADM; FDL: flexor digitorum longus; FHL: tendon of flexor hallucis longus; FDMB: flexor digiti minimi brevis; AdH: adductor hallucis; PL: tendon of peroneus longus; FDB: flexor digitorum brevis; *: lateral plantar nerve.

Discussion

The present study reports an unusual additional belly of ADM muscle of the foot commencing from the same origin as the main belly, but fusing with the latter till its insertion. The nerve supplying the additional belly was the same as the lateral plantar nerve. The present variation is unique as the proximal part of the muscle, which is between the calcaneus and the tuberosity of fifth metatarsal bone, is duplicated.

The duplication of the distal part of the muscle in close vicinity to the proximal phalanx was frequently observed in 40% of cases in an earlier study. This accessory slip from the main belly may be coined as abductor ossis metatarsi quinti. This additional slip may adhere to the abductor of the little toe extending into the middle of the metatarsal bone.⁴

Another similar case described three bellies of ADM of which one was the normal belly and the others were supernumerary fascicles. Both the fascicles took origin from the calcaneus and gained attachment to the fifth metatarsal bone. Another accessory muscular slip was seen to extend between the fifth metatarsal bone and the proximal phalanx.⁵

The most reliable treatment modality in osteomyelitis is debridement and muscle flap coverage. Calcaneal osteomyelitis poses several problems such as difficult reconstruction owing to the weight bearing functions of the heel. Therefore any defect over calcaneus requires a well-padded and durable muscle flap.⁶

A previous study combined the abductor digiti minimi muscle flap along with lateral calcaneal artery skin flap to cover defects of heel in osteomyelitis of calcaneus.³ The abductor digiti minimi in the above procedure helped to obliterate the empty space resulting from debridement and also provide the requisite cushioning over the calcaneus. The combination of these two flaps would definitely fasten the chances of recovery and thereby prevent recurrences. Moreover, the increased vascularity provided by ADM leads to the faster migration of leucocytes and immunological mediators to the wound site. From the biochemical prospective too, the

improved vascularity leads to increased rate of antibodies delivery at the site.

All these salient features suggest the better performance of the flap as compared to the fascio-cutaneous flaps. Identification of ADM in case of flap operation is important as the initial incision is made laterally down to the fascia of this muscle along its entire length. The surgeons have to identify the lateral digital vessels to the fifth toe which lie between the abductor digiti minimi and flexor digiti minimi brevis. The proposition in the present study is that owing to the presence of two heads of ADM the surgeons may get misguided and may recognize the additional head as flexor digiti minimi brevis and may sacrifice these vessels and this was established by an earlier case description.⁶

Moderate sized heel defects may be amply covered by plantar pedicled myocutaneous island flap, as these provide a safe, reliable and mobile flap. The plantar fascia and flexor digitorum brevis are normally used to cover heel defects. We argue and suggest using ADM for these defects. Owing to the presence of the additional belly in the present study the difficulty of thickness of flexor digitorum brevis myocutaneous flap will be overcome. ADM will prove to be sufficient to cover moderate defect and therefore no bony contouring of the calcaneus will be required making the operation time short.

Abductor digiti minimi plantar flap has various merits such as prominent neurovascular bundles, constantly located blood vessels and absence of functional implications. Plantar ulcers arising due to lepromatous leprosy is a troublesome complication of the disease process.²

Usually, these defects/ulcers need to be debrided and subsequently covered by appropriate myocutaneous flaps.

In the present case specimen, the lateral plantar nerve and vessels were recognizable separated from the accessory belly and we attribute this factor for the success of flap procedure. If the surgeons have a good working knowledge of the anatomical variations of the sole, they can reliably identify any variation and also safeguard the neurovascular bundle. Moreover, the lateral plantar neurovascular bundle was clearly seen separated from the accessory belly of ADM. Therefore one can avoid kink-

ing of the vascular pedicle while performing flap transfer operations.

An important aspect of anatomy of ADM is its utility for the motor nerve conduction study of the lateral plantar nerve.⁷ The calcaneal branch of lateral plantar nerve is likely to be implicated and compressed in muscular anomalies of ADM.

The anatomical boundaries of the ADM are important to note while performing the lateral plantar motor nerve conduction techniques. The bulk of the ADM in the present study would definitely exceed that of the normal muscle and could lead to the discrepancy in the evaluation of the tests.

An interesting case of congenital hypertrophy of ADM was reported earlier where a 20-year-old woman presented with soft tissue mass covering the lateral aspect of her left foot.⁸ Maldevelopment of the muscles may lead to the congenital hypertrophy such as the case described above. Radiological procedures such as ultrasound, CT scan and MRI may recognize these soft tissue masses and once recognized they may be removed surgically.

It is difficult to ascertain in the present case, whether the additional belly presented as a soft tissue mass, as the clinical history of the cadaver was unavailable. However, inspection of the foot in the present case report revealed no hypertrophy whatsoever.

Acquaintance with normal and variant anatomy may assist the operating foot surgeon in deciding the approaches to this region.

Conclusion

We hope to affirm through this case report the significance of accessory musculature of the foot. The radiologists and reconstructive surgeons alike should get familiarized to the presence of these accessory muscles for accurate elucidation of CT and MRI scans.

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Correspondence to: Dr. Vandana Mehta, MS

Department of Anatomy,

VMMC & SJH, New Delhi, India

Phone: +91 9910061399

e-mail: drvandanamehta@gmail.com

Conflict of interest statement: No conflicts declared.