



**Case Report:**

**Variation Branching Pattern of Dorsalis Pedis Artery Accompanied with Anomalous Presence of Extensor Hallucis Brevis Muscle**

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**Abstract:** During routine dissection, we came across multiple variations in the dorsum of the right foot. Dorsalis pedis artery (DPA) presented with an unusual branching pattern. The arcuate artery was completely absent, and hence three tarsal branches arose from lateral side of DPA. The first branch continued as first dorsal metatarsal artery, the second branch continued as the second dorsal metatarsal artery, and the third branch continued as third dorsal metatarsal artery which also provided a small twig to the fourth intermetatarsal space as the fourth dorsal metatarsal artery. We also observed the unique presence of extensor hallucis brevis muscle with the origin from the medial part of superior surface of the calcaneus and inserted to proximal phalanx of great toe. Since the DPA was just beneath this muscle, anomalous presence of the muscle may lead to compression of DPA. Awareness regarding such variations is critical for angiographers, vascular surgeons, reconstructive and plastic surgeons.

**Key Words:** Dorsalis pedis artery, extensor hallucis brevis, extensor digitorum brevis, dorsum of foot

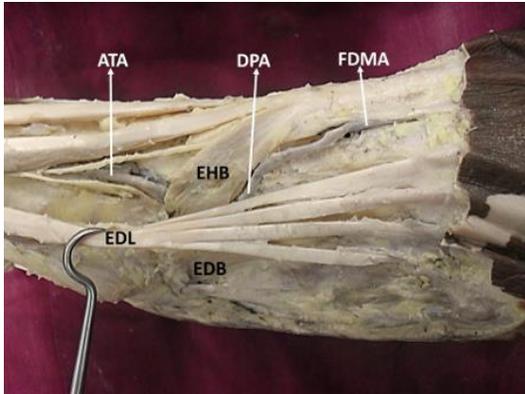
**Introduction:**

The foot is more susceptible to injuries like diabetic foot, peripheral arterial disease, industrial hazards, etc., where a need may arise for a vascular surgery for amputation. Hence, detailed knowledge about the vessels of the foot and their variations is needed in such situations. The arterial supply for the foot is derived from dorsalis pedis artery (DPA) and its branches on the dorsal aspect, and by the medial and lateral plantar arteries and their branches on the plantar aspect. The anterior tibial artery which is the chief artery of the anterior compartment of the leg passes beneath the extensor retinaculum, enters the dorsum of the foot and continues as the dorsalis pedis artery. The DPA gives off tarsal, arcuate and first dorsal metatarsal arteries on foot. [1] Variations of the DPA is not uncommon but, sound knowledge about its origin, course and branching pattern is imperative, as it forms the stem

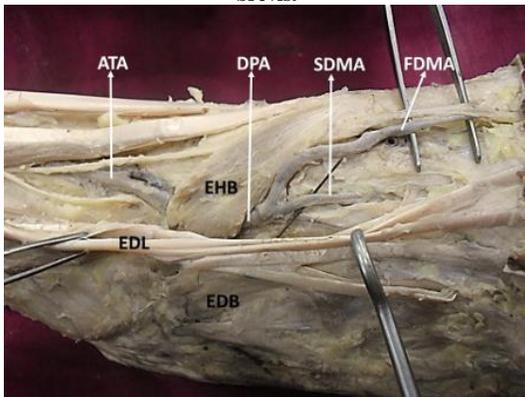
for one of the major myocutaneous flaps, used for ankle surgeries in plastic and reconstructive surgeries. [2] Extensor digitorum brevis (EDB) is the intrinsic muscle of the dorsum of foot found on the lateral side of DPA. It takes its origin from the calcaneus and splits into four tendons for its insertion into medial four toes along with the extensor digitorum longus tendons. The most medial tendon of EDB is the extensor hallucis brevis tendon which gets inserted to the great toe. We report in here an unusual case of anomalous presence of extensor hallucis brevis muscle accompanied by the variant branching pattern of dorsalis pedis artery.

**Case Report**

During routine anatomy dissection, we came across multiple variations in the dorsum of the right foot of an adult male cadaver. DPA in its course on the foot presented with an unusual branching pattern (Figure 1). The arcuate artery was completely absent, and hence three tarsal branches arose from the lateral side of DPA. The first branch continued as first dorsal metatarsal artery, the second branch continued as the second dorsal metatarsal artery, and the third branch continued as third dorsal metatarsal artery which also provided a small twig to the fourth intermetatarsal space which continued as the fourth dorsal metatarsal artery. Associated with this we observed the unique presence of a thick belly of extensor hallucis brevis muscle which took its origin from the medial part of superior surface of the calcaneus and ran superficial to the DPA to get inserted into the base of the proximal phalanx of the great toe. The EHB was totally separated from the EDB at its origin. Thus, extensor digitorum brevis muscle split only into three tendons which attached to the lateral sides of the tendons of the extensor digitorum longus for the second, third, and fourth toes (Figure 2).



**Figure 1:** Dissection of dorsum of the right foot showing the variant branching pattern of dorsalis pedis artery (DPA) and the anomalous presence of extensor hallucis brevis muscle (EHB). ATA: Anterior tibial artery, FDMA: First dorsal metatarsal artery, EDL: Extensor digitorum longus tendon, EDB: Extensor digitorum brevis.



**Figure 2:** Closer view of the variation showing the dorsalis pedis artery (DPA) giving origin to 1<sup>st</sup> dorsal metatarsal artery (FDMA) and 2<sup>nd</sup> dorsal metatarsal artery (SDMA). The figure also shows, DPA running below extensor hallucis brevis muscle (EHB). ATA: Anterior tibial artery, EDL: Extensor digitorum longus tendon, EDB: Extensor digitorum brevis.

### Discussion

Knowledge of any variation in the course and distribution of the DPA is clinically relevant because the DPA is used to record peripheral arterial pulsation. It is often examined, by physicians, when assessing whether a given patient has peripheral vascular disease. There are previous reports on the absence of DPA, [3] the presence of double DPA [4] and variations in its branching pattern. In here, we found the absence of arcuate artery and the origin of metatarsal arteries from DPA. Dilandro et al., from his study postulated that arcuate artery is not the primary branch giving rise to the dorsal metatarsal artery and opines that the lateral tarsal artery provided metatarsal artery more frequently in 47.2% than the arcuate artery. [5] Gabrielli et al., in their study which included fifty feet found that first dorsal metatarsal artery originated from dorsalis pedis artery in 86% of cases. [6] Since DPA gave rise to all the metatarsal arteries, we noticed that the caliber of the dorsal metatarsal artery in the third and fourth spaces was subtle. Hence, the lateral 1/3<sup>rd</sup> of the dorsum of the foot might have poor blood flow. It has been observed that these areas with insufficient blood supply are frequently the sites of non-healing ulcers especially in the diabetic foot and also more prone for gangrene. The grafts done in these

regions may not be successful.<sup>3</sup> Deviation of the usual anatomic pattern of origin, branching of DPA are thus of prime importance in surgical operative techniques as the artery serves as an important landmark on the dorsum of the foot. The DPA is recognized to play a significant role in microvascular surgery of the foot during replantations, reconstruction, and repair. [7]

Another important observation in this reported case is the presence of extensor hallucis brevis (EHB) muscle. This thick muscle belly was present superficial to the DPA, might compress the artery, leading to diminished blood flow to the foot. Knowledge relating to the presence of extra tendons or absence of usual tendons is clinically important in plastic and orthopedic surgeries involving extensor digitorum brevis (EDB) tendon transfer. The EHB tendon transfer was first discussed in hallux varus repair by Skalley and Myerson in 1994.[8] The procedure is recommended for patients with a flexible hallux varus deformity. The absent extensor hallucis brevis (EHB) tendon as observed in here, may misguide foot surgeons performing graft operations and transplant surgeries. Occasionally, the EDB may have two or three distinct heads, and more rarely the whole muscle may be absent. [9] The presence of EHB muscle can be explained concerning the embryonic development of the foot muscles. Each muscle of foot results from the fusion of muscle primordia from different layers. While this fusion is occurring, some of these muscle primordia disappear due to cell death. Persistence of some muscle primordia in the EDB might result in supernumerary heads or accessory fasciculi. The absence of one of the actual heads may be due to the disappearance of some muscle primordia. [10] EHB muscle reported in the present study is also clinically relevant to surgeries for the treatment of crossover toe deformity and painful toe disorders. [11] To avoid confusion, misdiagnosis and ineffective treatment, the clinician must be aware of the anomalous origins of the EHB muscle.

### Conclusion

Variations of DPA gain importance as it serves as an important landmark on the dorsum of the foot. Knowledge of the arterial pattern depicted by an arteriography is essential, before attempting any microvascular surgical procedures like replantation, reconstruction, and repair. As the clinical applications of EDB free flaps are gaining increasing importance, the findings of the present study will be of help to plastic and orthopedic surgeons, to improve diagnostic and treatment procedures.

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