A Right Fibular Artery Variation: Case Report

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Abstract- The fibular artery originates distal to the popliteus muscle and descends along the inferior tibiofibular syndesmosis. A key feature of this artery is its primary perforating branch. Knowledge of the anatomy and variations of this branch is essential for surgeons to achieve optimal surgical outcomes. Variations in the posterior tibial artery (PTA) and fibular artery (FA) are frequently seen in cadaveric dissections and imaging studies. These variations are important for evaluating arteriograms and performing procedures such as vascular grafting, angioplasty, and embolectomy. Our study found that the fibular artery pierced the interosseous membrane 8 cm proximal to the lateral malleolus, continuing as the dorsalis pedis artery. Recognizing these variants is crucial for assessing peripheral arterial disease and planning revascularization.

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Introduction

The fibular artery, a branch of the posterior tibial artery, originates approximately 2.5 cm distal to the popliteus muscle and extends obliquely towards the fibula. It then descends along the medial crest of the fibula, either within a fibrous canal between the tibialis posterior and the flexor hallucis longus muscles or within the flexor hallucis longus itself. At the level of the inferior tibiofibular syndesmosis, the artery bifurcates into calcaneal branches that supply the lateral and posterior surfaces of the calcaneus. Proximally, the fibular artery is covered by the soleus muscle and the transverse intermuscular septum, while distally, it is covered by the flexor hallucis longus muscle. The artery's size is typically inversely related to the size of other leg arteries, although variations occur in which it can be reduced or enlarged. In some instances, it may join, reinforce, or replace the posterior tibial artery in the distal leg and foot.

The fibular artery gives rise to several branches, including muscular, nutrient, communicating, calcaneal, and perforating branches.

Perforating branches

The primary perforating branch of the fibular artery traverses the interosseous membrane approximately 5 cm proximal to the lateral malleolus to enter the extensor compartment. Here, it anastomoses with the anterior lateral malleolar artery. As it descends anterior to the inferior tibiofibular syndesmosis, it supplies the tarsus and anastomoses with the lateral tarsal artery. This branch can sometimes be enlarged and may serve as a replacement for the dorsalis pedis artery (1,2).

Understanding the anatomy and variations of the main perforating branch of the fibular artery is crucial for surgeons to ensure optimal outcomes in surgical procedures.

Dissection

Posterior approach

In the prone position, a longitudinal incision was made along the posterior midline, extending from the gluteal fold to the calcaneal region. An encircling circumferential incision around the ankle facilitated the

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removal of the skin from the posterior aspect of the leg and the dorsum of the foot.

A vertical cut was made through the crural fascia, from the popliteal fossa to the calcaneal tuberosity, using scissors. The crural fascia was then spread through blunt dissection, exposing the posterior compartment of the leg. A probe was inserted deep into the two heads of the gastrocnemius muscle, just superior to their point of convergence.

Both the medial and lateral heads of the gastrocnemius muscle were transected with precision using scissors, ensuring the branches of the tibial nerve and popliteal artery were preserved. The two heads were then reflected superiorly, and the bulk of the muscle belly was reflected inferiorly to provide a clearer view of the deep muscle layer.

To further enhance visibility, the soleus muscle was reflected by cutting it inferior to its attachments using scissors. Within the transverse intermuscular septum, the posterior tibial artery, vein, and tibial nerve were identified. In the upper posterior region of the leg, the fibular artery was identified between the tibialis posterior muscle and the flexor hallucis longus muscle.

Anterior approach

In the supine position, a vertical incision was made from the patella along the anterior border of the tibia, extending to the dorsum of the foot. A transverse incision was then created across the dorsum of the foot, just proximal to the webs of the toes. The skin was removed from the anterior aspect of the leg and the dorsum of the foot laterally.

Case Report

In this study, the right lower extremity of a male cadaver was dissected during the gross anatomy course at the Department of Anatomy and Neuroscience, Islamic Azad University, Tehran Medical Sciences, Tehran, Iran. The dissection revealed variations in the size and course of the fibular artery. Although the origin and course of the fibular artery were normal, its size was notably thicker than that of the posterior tibial artery.

Tracing the fibular artery distally, it was observed to pierce the interosseous membrane approximately 8 cm proximal to the lateral malleolus, entering the extensor compartment of the leg as the perforating artery and continuing as the dorsalis pedis artery, located between the lateral and medial malleolus on the dorsum of the foot (Figures 1, 2).

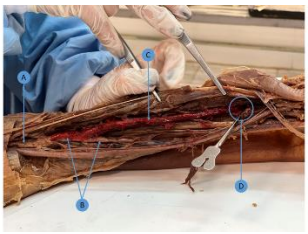

Figure 1. Posterior view of the right leg. A: Popliteal artery, B: Posterior tibial artery. C: Fibular artery, D: Perforation site of the interosseous membrane by the fibular artery

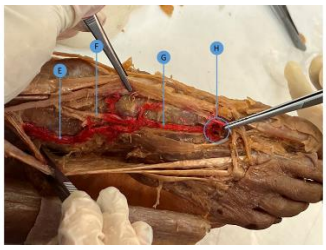

Figure 2. Dorsum of the right foot. E: Continuation of fibular artery as dorsalis pedis artery, F: Extensor Hallucis Longus Tendon, G: First dorsal metatarsal artery, H: Perforation site of …….

Discussion

A comprehensive understanding of the vascular anatomy in the foot and ankle region is crucial for surgical procedures. Variations in the origin and course of the posterior tibial artery (PTA) and the fibular artery (FA) have been described and detected during cadaveric dissections and by arteriograms, Doppler exams, and

duplex scanning in living subjects. Knowledge of these variant patterns is important for evaluating lower limb arteriograms and holds clinical and surgical significance for procedures such as vascular grafts, surgical repairs, transluminal angioplasty, and embolectomy, as well as for diagnosing arterial injuries (3).

Parikh *et al*. emphasize the importance of anatomical knowledge of the communications and branching patterns of the peroneal artery (PA) in the ankle region before performing any operative interventions. This is because the PA serves as the primary arterial supply, providing branches over the ankle, apart from the dorsalis pedis artery (DPA) (4).

Our observation revealed that the fibular artery pierced through the interosseous membrane approximately 8 cm proximal to the lateral malleolus, entering the extensor compartment of the leg. After anastomosing with the anterior tibial artery, it continued as the dorsalis pedis artery. In a similar study conducted in 2020, Rai *et al*., examined 48 cadavers and noted that in two specimens, a thick perforating branch of the peroneal artery pierced the interosseous membrane at 8 cm proximal to the tip of the lateral malleolus. Additionally, in four legs, this artery coursed medially to continue directly as the dorsalis pedis artery (5).

The dorsalis pedis artery is usually considered a continuation of the anterior tibial artery and is exceptionally formed by the perforating branch from the fibular artery (1). The present study revealed that the dorsalis pedis artery was formed by the perforating branch. In a similar study conducted in 2015, Machida et al. examined 18 cadavers and noted that, in three cases, the dorsalis pedis artery arose from the perforating branch of a thick fibular artery (6).

Accurately identifying this variant is crucial for properly assessing peripheral arterial disease burden and planning appropriate revascularization strategies. In cases of trauma or fractures involving the leg or ankle region, this variant arterial supply may be at increased risk of injury, potentially leading to complications such as ischemia or impaired healing. In cases of arterial reconstruction or bypass grafting for peripheral arterial disease, the enlarged perforating branch may serve as an alternative inflow source, especially if the anterior tibial or posterior tibial arteries are compromised. Additionally, perforator-based peroneal flaps are used to repair and restore defects involving both bony and soft-tissue structures (7,8).

Gaining a comprehensive understanding of the intricate vascular network within and surrounding the foot and ankle region is crucial to mitigating potential complications during ankle arthroscopic procedures or surgeries. A thorough mastery of the vascular anatomy in this area is widely regarded as an asset prior to undertaking any operative intervention.

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