The Achilles Tendon Vascular Flow is Achilles' True Weakness

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Abstract: The Achilles tendon is the strongest and thickest tendon in the human body. Its vascular supply is shared by the posterior tibialis and peroneal arteries. This case report illustrates how frozen biopsies of a benign lesion located on the tendinous segment of the Achilles tendon led to a deep non-healing ulceration with exposure of the mid tendon. This case report intends to review the Achilles tendon different sources of blood flow to its three portions: proximal musculotendinous junction; middle tendinous segment; and the distal osteotendinous junction to the calcaneum. The mid-portion of the tendon is the one least vascularized and more prone to non-healing arterial ulcerations.

VASCULAR DISEASE MANAGEMENT 2020;17(6):E117-E120.
Key words: Peripheral arterial disease, Achille's tendon, vascular ulceration

Case Report

We present an 82-year-old woman with a history of hypertension who presented as a referral to our center for a non-healing ulcer of the left Achilles area. Two months prior to the onset of the wound, the patient underwent two separate dermatological frozen biopsies proximal to the lesion and of the lesion itself. Initial evaluations found the patient to have chronic venous stasis and treatment with compression stockings and dressings were attempted without resolution. She underwent further treatment of the lesion with antibiotics; however, with no improvement.

The patient was referred to our center after the wound progressed to exposure of the tendinous segment of the Achilles tendon (**Figure 1**). Ulcer etiology was hypothesized to be due to the disruption of the arterial bed to the tendon by the dermatologic frozen biopsies. Arterial Doppler ultrasound depicted normal triphasic flow in the femoropopliteal artery and in all three tibial vessels. To further evaluate arterial flow to the ulcer, we advised an arteriogram of the left lower extremity with run-off to the foot. Digital subtraction arteriogram of the left lower extremity was remarkable for practical absence of vascularity to the ulceration site despite patent popliteal, posterior tibialis, peroneal, and anterior tibialis arteries (**Figure 2**).

The patient has undergone intensive wound therapy including OxyBand (OxyBand™ Technologies) dressing and various levels of immobilization of the Achilles tendon and of left ankle range of motion for several months. This strategy has led to substantial success in wound healing (**Figure 3**).

Discussion

The Achilles tendon is the thickest and strongest tendon in the human body. It is composed of the adjoining terminal ends of the gastrocnemius, soleus, and the plantaris muscles.[1] The tendon is unique in its anatomical arterial flow, drawing from distinct vascular beds for its vascular supply. The proximal musculotendinous junction and the distal osteotendinous junction of the tendon draw their arterial blood supply from branches of the posterior tibialis artery, whereas the middle tendinous portion of the Achilles is supplied by the fibular/peroneal artery. The mid-portion of the tendon has been reported to have relatively poor vascularization (**Figure 4**).[2,3] The distal branches of the peroneal artery, which provide blood flow to the mid tendon, are of smaller diameter than the posterior tibialis artery trunk which supplies the arterial flow to the proximal and distal portions of the tendon.

Wound healing is the interplay between vascular supply and delivery of building blocks for hemostasis, inflammation, proliferation, and wound remodeling/repair.[4,5] This interplay is especially delicate if the wound has multiple vascular beds suppling vital factors for healing. Uniquely, in our case report, the patient's dermatological freezing served as the noxious insult for local microvascular injury. Peroneal artery microvascular network injury led to severe hypoxemia of the tendinous portion of the Achilles and the development of a deep ulceration which healed after several months of intensive wound care.

Figure 1. Achilles ulceration with exposure of mid-tendinous segment of the tendon.

Figure 2. Peripheral angiogram with digital subtraction depicting a paucity of vascular supply from the peroneal artery to the ulceration site despite patent popliteal, posterior tibialis, peroneal, and anterior tibialis arteries.

In summary, this case illustrates several clinically relevant points:

1. The different sources of blood flow to the Achilles tendon. The mid-portion or tendinous segment of the tendon is particularly vulnerable to ischemic injury.
2. The need for careful angiographic evaluation of the Achilles ulcers in the presence of a "normal" noninvasive evaluation. Digital subtraction angiography is required to evaluate the quality of vascular supply to the three portions of the tendon.
3. Patients with benign skin lesions should be informed of the risk of developing slow or nonhealing wounds with proposed deep cauterization or frozen biopsies, with avoidance of intervention if possible. ■

Disclosure: The authors report no financial relationships or conflicts of interest regarding the content herein.

Manuscript submitted April 25, 2020, final version accepted April 28, 2020.

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Figure 3. Oxyband dressing in place (A) and progressive growth of granulation over exposed tendon (B, C) with eventual epithelialization (D) over 7 months.

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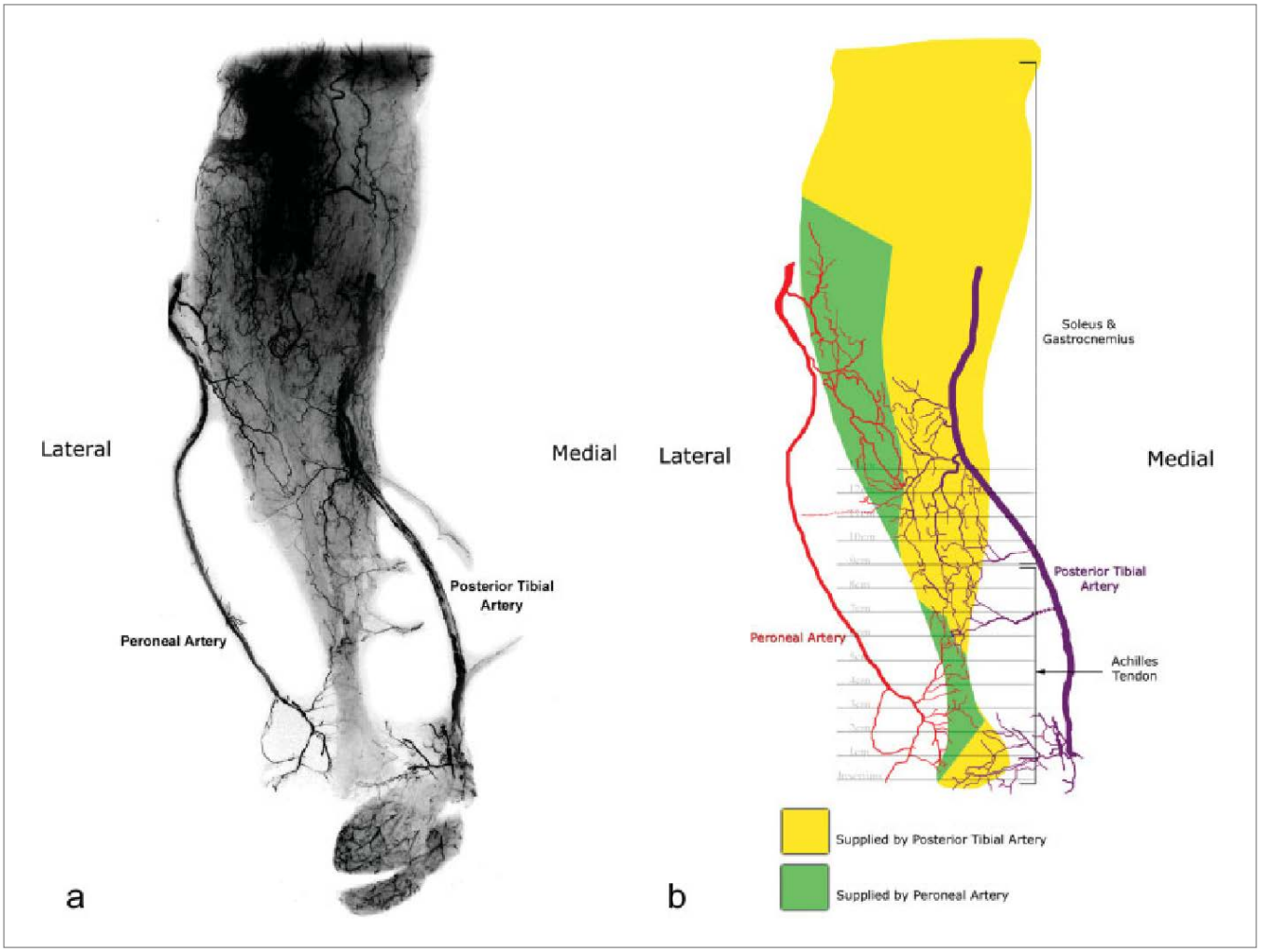

Figure 4. The vascular supply to the Achilles heel demonstrating the different sources of blood flow to its three portions.[6]