The Feasibility of Angiosome-Targeted Endovascular Treatment in Patients with Critical Limb Ischemia and Foot Ulcer

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Background: To determine wound location according to the angiosome concept and to investigate the feasibility and success of angiosome-based revascularization in below-the-knee (BTK) arteries.

Methods: This was a retrospective study of 161 patients (67.5 ± 25.5 years, 66.5% diabetics) with critical limb ischemia and a foot ulcer, stage Rutherford 5–6, who underwent percutaneous transluminal angioplasty on BTK arteries in 2012. We evaluated feasibility of angiosome-targeted revascularization and the number of angiosomes affected by a wound in each patient. Patients were divided into 3 groups depending on how many BTK vessels were suitable for revascularization. The feasibility was analyzed in each group and in relation to number of affected angiosomes.

Results: The wound(s) interfered with one angiosome in only 39 (24.0%) cases. Direct flow into affected angiosome was successfully achieved in 98 (60.9%) cases. If ulceration was limited in one angiosome, the targeted revascularisation was possible in 27 cases (69.2%), if ulceration was extended over 2 angiosomes it was possible in 65 cases (86.7%), if 3 angiosomes were affected it was possible in 36 cases (85.7%), when 4 angiosomes were affected the rate dropped to 25.0% and ulceration extended over 5 angiosomes had no possibility of revascularization.

Conclusions: In critical limb ischemia, the tissue lesion affects several angiosomes in majority of the cases. In thus far published literature, there is existence of more approaches of angiosome-targeted revascularization when more than one angiosome is clinically involved and therefore consensus needs to be achieved for the accurate definition.

INTRODUCTION

The most severe stage of critical lower limb ischemia (CLI) is tissue lesion, and patients who developed such stage have a severe risk of major amputation. Percutaneous transluminal angioplasty (PTA) is increasingly being used as the first-line revascularization procedure in CLI. Despite the increasing endovascular interventions in below-the-knee (BTK) arteries, nonhealing ulcers remain common and very often require additional ulcer surgery to prevent amputation.

Multiple studies about wound healing have been published over the last decade in vascular literature, supporting the primary idea that, without pulsatile flow into the correct foot region, the wound will fail to heal. In 1987, Ian Taylor et al.[1] presented the angiosome principle in their landmark anatomy study by dividing the body into 3-dimensional anatomic blocks of tissue supplied by a specific artery, the arteriosome.

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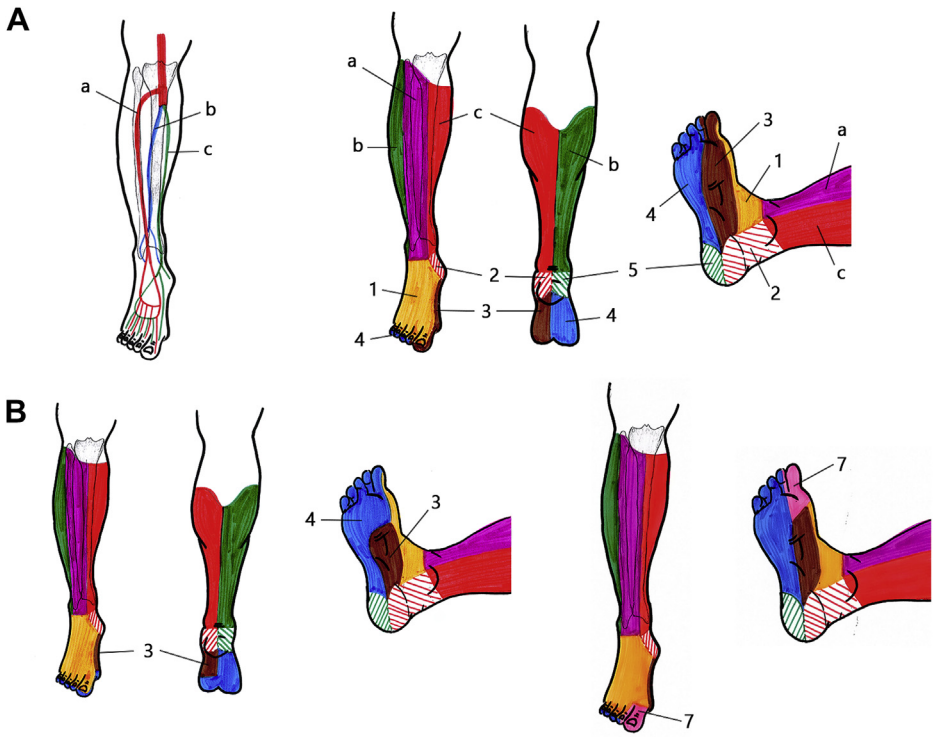

Fig. 1. (A) Angiosomal distribution used in present study. **(B)** Variations of angiosomal distribution. a: Anterior tibial artery and its angiosome; b: peroneal artery and its angiosome; and c: posterior tibial artery and its angiosome. 1: Dorsal angiosome, source a = ADP; 2: dorsomedial and plantar angiosome, source a = calcanear branch of ATP; 3: medial plantar instep and forefoot angiosome, source a = medial plantar artery; 4: lateral plantar foot and forefoot angiosome, source a = lateral plantar artery; 5: dorsolateral and plantar angiosome, source a = calcanear branch of fibular artery; 6: lateral malleolar angiosome, source a = anterior perforating artery (part of the fibular artery angiosome); and 7: the hallux and medial side of the second toe angiosome, source artery = dorsal metatarsal artery (78%), plantar metatarsal artery (22%).

In 2006 Attinger et al.[2] studied the angiosome distribution in foot and concluded that foot contains 6 angiosome regions, each of which supplied by 1 of the 3 main crural arteries and their branches (Fig. 1). This knowledge has brought a new view on revascularization in patients with critical limb ischemia and so called angiosome-targeted revascularization, meaning selective revascularization of the specific artery feeding the angiosome affected by ulcer, has been studied.[3–7] Several retrospective studies comparing angiosome-targeted and angiosome-nontargeted approach in endovascular revascularization have been carried out, showing promising results in regard to wound healing and limb salvage in favor of the angiosome-targeted approach, especially in the diabetic foot.[3–5,8–11]

The purpose of this retrospective study was to evaluate the feasibility of the angiosome theory. We aimed to answer the questions of (1) how often the wound is located in more than just 1 angiosome, and (2) how often angiosome-targeted endovascular revascularization is possible.

MATERIAL AND METHODS

This study was a retrospective analysis of prospectively collected data from a maintained vascular database (HUSVasc). It included all patients with CLI, classification Rutherford 5–6 (ischemic ulcer or gangrene and dry or humid), who underwent PTA of the arteries BTK during 2012. The angiograms of 182 consecutive endovascular procedures for CLI and tissue lesion were carefully analyzed before and after PTA and comparison was made between the anatomy of PTA and the wound location. Overall, 22 procedures were excluded because they either were re-PTA procedures to the same leg during the same year or the wound location was not clear. In the end, 161 procedures in 160 patients were included. One patient underwent procedure to the both legs.