

# Usefulness of Lower Extremity Arterial Duplex Ultrasound Scanning in the Detection of Anatomical Variations for Critical Limb Ischemia

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## Abstract

**Background:** The existence of anatomical variants, including a high division of popliteal artery branching and hypoplastic branching in the tibial artery, are present in ~10% of infrapopliteal arteries. In Type III variants in particular, one or both of the anterior tibial and posterior tibial arteries are hypoplastic or aplastic, and it is difficult for diagnostic angiography to distinguish usual anatomical patterns in a Type III variant with chronic total occlusion (CTO). Therefore, it is important to be aware of anatomical variations in the infrapopliteal artery prior to revascularization in cases of critical limb ischemia (CLI). The ability to identify the presence of variants using duplex ultrasound scanning (DUS) in advance is expected to be useful for revascularization.

**Purposes:** The present study aimed to investigate ultrasound findings of Type III variants that can be detected by DUS, and the association between Type III variants and CLI.

**Subjects and Methods:** Between January 2016 and October 2017, a total of 603 limbs in 353 patients (238 men and 115 women, mean age 72±11 years) with suspected lower limb ischemia were enrolled in the present study. The patients were divided into two groups according to the presence or absence of CLI. The rate of Type III variants were compared between these groups. Additionally, the patients were divided into two groups according to the presence of the Type III variant or usual anatomical pattern, excluding cases with lower extremity arterial occlusive/stenosis. The ultrasound findings, including the angle of direction of the distal tibial arteries, vessel diameter, and diameter ratio of the tibial arteries were compared between these groups.

**Results:** Of the total 603 limbs in 353 patients, the Type III variant was present in 31 limbs of 26 patients (5.1%), which were classified as Type III-A (2.3%; 14/603), Type III-B (2.4%; 15/603), and Type III-C (0.2%; 2/603). The rate of the Type III variant was significantly higher (10.9% vs. 3.1%,  $p<0.001$ ) in the CLI group. There were significant differences between the Type III and usual pattern in the angles of the distal tibial arteries, vessel diameter, and diameter ratio of the tibial artery.

**Conclusion:** The rate of the Type III variant was higher in patients with CLI as compared with those without CLI. With CTO of the lower limb artery, diagnostic angiography is often difficult to evaluate vessels sufficiently; however, DUS is useful for the distinction between usual anatomical patterns and the Type III variant. Lower extremity arterial DUS is useful for the detection of infrapopliteal variants in CLI.

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