Canadian Journal of Cardiology 35 (2019) 1256.e3–1256.e4 www.onlinecjc.ca

Images in Cardiology

Demonstration of Corkscrew Collaterals in Buerger's Disease by Superb Microvascular Imaging

Sedat Giray Kandemirli, MD,[a] Basak Erdemli Gursel, MD,[a] Atif Yolgosteren, MD,[b] and Omer Fatih Nas, MD[a]

[a] Department of Radiology, Uludag University Faculty of Medicine, Bursa, Turkey

[b] Department of Cardiovascular Surgery, Uludag University Faculty of Medicine, Bursa, Turkey

Buerger's disease (Thromboangiitis obliterans) is an inflammatory vaso-occlusive disease that has a predilection for small- and medium-sized arteries. Unlike atherosclerotic changes, the vessel wall usually retains its normal structure. The affected segment often demonstrates thrombotic occlusion and local collateral formation that has a serpiginous or corkscrew appearance.[1] The combination of colour Doppler ultrasound with characteristic appearance of corkscrew-shaped vessels and clinical assessment are important for diagnosis. Demonstration of corkscrew collaterals and depiction of vascular course by colour Doppler sonography may not always be possible due to relatively low resolution. The advanced dynamic flow (ADF) technique has been shown to be superior in demonstrating corkscrew collaterals in Buerger's disease.[2] Superb microvascular imaging (SMI) is a new flow imaging technique that can demonstrate subtle low-flow components with high detail and resolution. In Doppler ultrasound, there are 2 sources for the signal: blood flow and tissue movement (clutter). However, the clutter signal may superpose with low-flow components. During image processing in conventional Doppler ultrasound, the wall filter cannot distinguish between tissue movement and low-flow components, and it eliminates all clutter signals and low-flow signal is also lost. SMI uses a unique algorithm for isolating and eliminating clutter while preserving the low-flow signals. SMI has higher frame rates and lower pulse repetition frequencies than colour Doppler imaging.[3] We have adapted the SMI technique to map the arterial vasculature with a higher resolution for routine lower extremity Doppler imaging. Herein, we demonstrate the far superior demonstration of corkscrew collaterals in a patient with Buerger's disease by SMI compared with colour Doppler and ADF.

SMI has been used in the assessment of synovial inflammation in rheumatological diseases, characterization of thyroid nodules, breast masses, and hepatic lesions. A vascular application of SMI is the assessment of intraplaque neovascularization and prediction of vulnerable plaques for stroke management.[4] However, because this is a relatively new technology, the standard for normal perfusion patterns on SMI has not been established yet and more data on correlation of SMI with histopathologic findings are required. In addition, obtaining adequate quality images can be hampered by depth of focus and respiratory/patient motion. Thus, SMI has been used so far for superficially located lesions and in patients who can cooperate.

A 66-year-old man presented with worsening of intermittent claudication in his right lower limb. His past medical history was positive for a diagnosis of Buerger's disease, established when he was 27 years old. During the initial diagnosis, he presented with signs of claudication worse at the right side and a 15-pack-year smoking history. Throughout the course, he underwent bilateral surgical sympathectomy. He continued to smoke until 3 years ago.

Digital subtraction angiography (DSA) images (Fig. 1A) showed collateral formation at the distal one third of posterior tibial artery. Color Doppler (Fig. 1B) at the same level is suggestive of corkscrew arteries; however, clear demonstration is not possible due to low resolution. The ADF image (Fig. 1C) demonstrates the course of the vessel better compared with colour Doppler imaging. However, the colour SMI image (Fig. 1D) and the monochrome SMI image (Fig. 1E; Video 1, view video online) delineate the course of the collateral vessels far better.

SMI is a promising new tool that may be particularly useful in clear depiction and identification of the corkscrew collaterals that are characteristic of Buerger's disease.

Disclosures

The authors have no conflicts of interest to disclose.

Received for publication March 7, 2019. Accepted May 3, 2019.

Corresponding author: Dr Sedat Giray Kandemirli, Department of Radiology, Uludag University Faculty of Medicine, Bursa, Turkey. Tel.: +90-5543971851.

E-mail: gskandemirli@yahoo.com

See page 1256.e3 for disclosure information.

https://doi.org/10.1016/j.cjca.2019.05.002

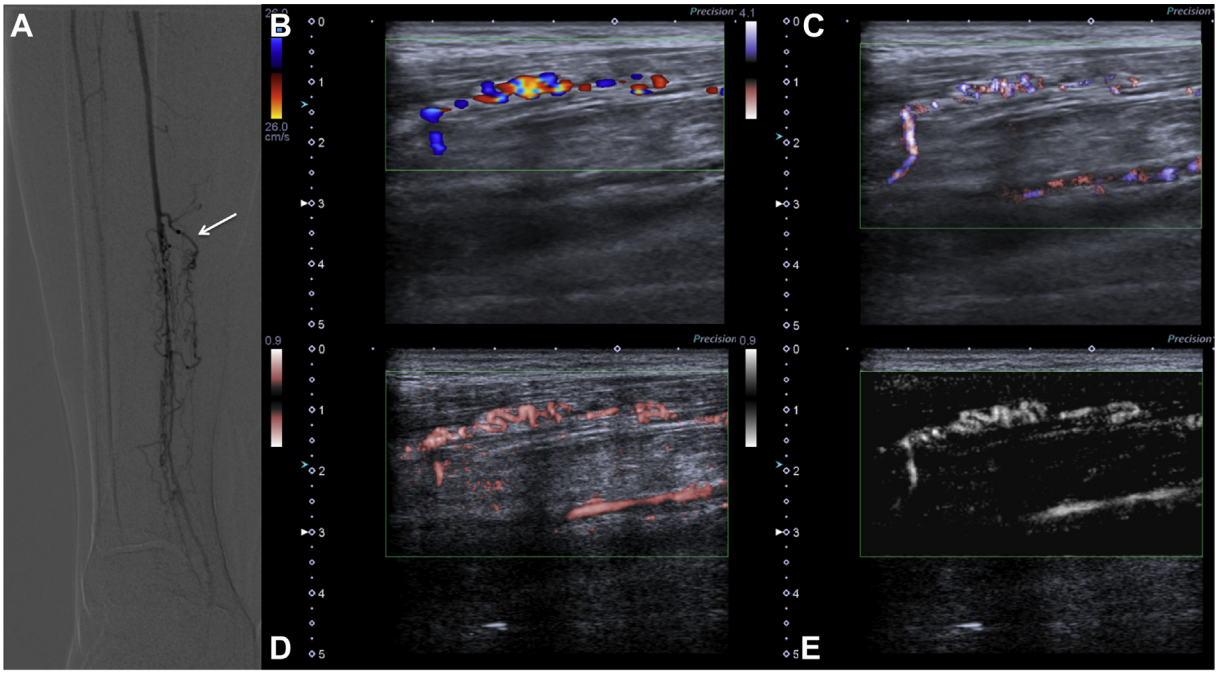

Figure 1. (**A**) Digital subtraction angiography shows corkscrew-like collaterals (**arrow**) originating from the distal one third of posterior tibial artery. (**B-E**) All ultrasound images were acquired with the Toshiba Aplio 500 ultrasound system (Canon Medical Systems, Tokyo, Japan) using the same 10-14 MHz linear transducer. (**B**) Color Doppler imaging (transducer frequency: 14 MHz, 12 frames per second [FPS]) of the same region is suggestive of underlying collateral vessels; however, depiction of the exact course of vessels is not possible due to the exaggerated flow signal. (**C**) Advanced dynamic flow image (transducer frequency: 14 MHz, 7 FPS) demonstrates a more clear delineation of corkscrew vasculature. (**D, E**) Color and monochrome superb microvascular images (transducer frequency: 14 MHz, 27 FPS) are superior in demonstration of corkscrew collaterals with a much better resolution.

References

1. Olin JW. Thromboangiitis obliterans (Buerger's disease). N Engl J Med 2000;343:864-9.

2. Yoshimuta T, Akutsu K, Okajima T, et al. Corkscrew collaterals in Buerger's disease. Can J Cardiol 2009;25:365.

3. Hata J. Seeing the unseen new techniques in vascular imaging superb microvascular imaging. Toshiba Med Rev 2014.

4. Jiang ZZ, Huang YH, Shen HL, et al. Clinical applications of superb microvascular imaging in the liver, breast, thyroid, skeletal muscle, and carotid plaques [Epub ahead of print]. J Ultrasound Med 2019.

Supplementary Material

To access the supplementary material accompanying this article, visit the online version of the *Canadian Journal of Cardiology* at www.onlinecjc.ca and at https://doi.org/10.1016/j.cjca.2019.05.002.