

Colour Duplex Ultrasound combined with 3D Tomographic Ultrasound as a potential sole imaging modality prior to lower limb arterial reconstruction

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Introduction

The limitations and complications associated with conventional angiography (CA) and MR Angiography (MRA) prior to lower limb revascularization have led to an increased need for a suitable alternative imaging modality. Colour Duplex Ultrasound (CDU) with 3D Tomographic Ultrasound may be an appropriate alternative modality. In patients with limb ischemia a well-performed CDU offers several advantages over traditionally used imaging modalities. CDU is noninvasive and does not require the use of nephrotoxic agents. It is readily available with

color flow and waveform analysis providing a better estimation of the hemodynamic significance of disease unlike MR angiography which risks overestimation of disease. It allows visualization of the entire artery and not only of the lumen of the vessel, enabling plaque characterization. Unlike conventional Angiography Color flow and power Doppler techniques have the ability to identify patent native arteries subjected to chronic disease with low flow states. CDU with 3D Tomographic Ultrasound performed by a skilled Vascular Physiologist may represent an alternative to conventional angiography for patients with lower limb ischemia.



Figure 1: Catheter angiogram of Anterior Tibial Artery in the calf does not clearly show degree of patency

Case description

65-year-old female presented in December 2018 with rest pain in the left lower limb. Ankle brachial pressures were found to be 0.35 on the right and 0.38 on the left. The patient went on to have a catheter angiogram. The supra-inguinal vessels and common femoral artery were widely patent. The superficial femoral artery was occluded from its origin and reconstituted at the level of the adductor canal. The popliteal artery was thought to be significantly diseased. The anterior tibial artery was diseased (Figure 1) and the posterior tibial

artery was found to be occluded. CDU and Tomographic Ultrasound were used to quantify the disease in the infra-inguinal vessels and identify a suitable target vessel for bypass. The Popliteal artery and the Anterior Tibial artery were found to be widely patent. The Anterior Tibial artery was patent throughout the calf and crossed the ankle (Figure 2).

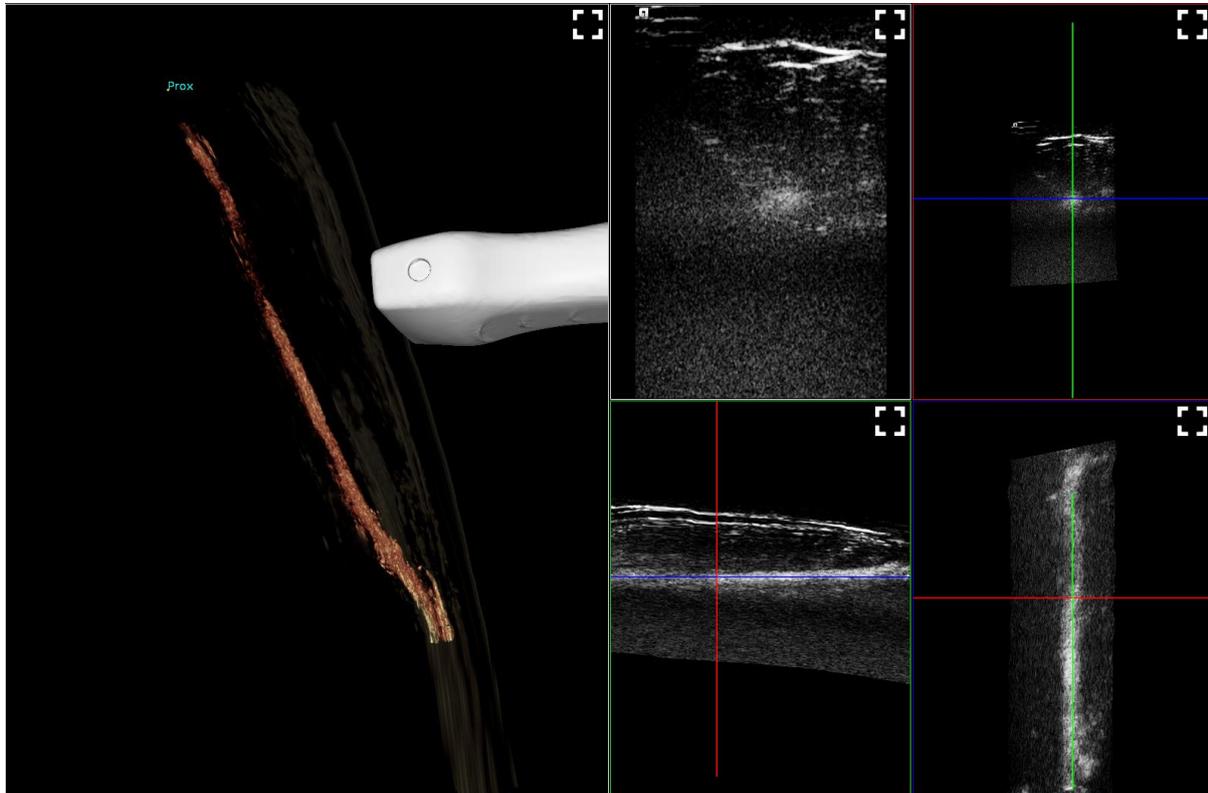


Figure 2: Tomographic ultrasound angiogram of ATA showing widely patent good calibre vessel throughout

The posterior tibial artery was occluded throughout its' length. The Long Saphenous vein and its tributaries was also mapped prior to the surgery using tomographic ultrasound (Figure 3).

The patient underwent left common femoral artery to above knee popliteal bypass surgery using the mapped long saphenous vein as a conduit. Despite the angiography suggesting significant popliteal disease, a decision was made to use the above knee popliteal artery based on the duplex imaging combined with 3D Tomographic Ultrasound.

Post-surgery the graft was found to be widely patent throughout. The patient was discharged free of rest pain.

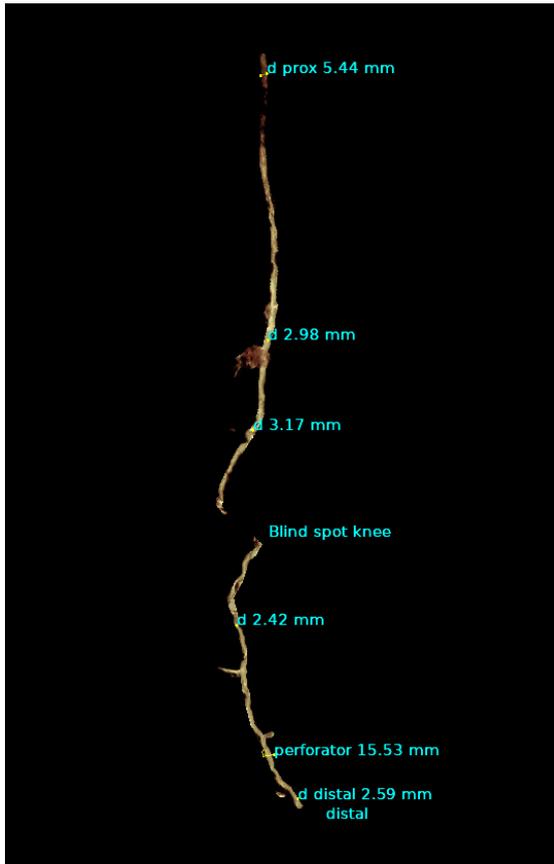


Figure 3: Vein map of long saphenous vein

Discussion

CDU is already considered to be a suitable alternative to conventional angiography in selected cases, the addition of 3D tomographic ultrasound allows for safe high-quality imaging with the advantage of images similar to conventional angiography. CDU along with 3D Tomographic Ultrasound may be an alternative imaging modality prior to lower limb reconstruction and may give additional information over and above that obtained by more traditional forms of angiography, particularly in relation to the flow characteristics in target vessels.