

# Measure the Vascular Flow Volume rather than Vascular Stenosis and Pressure Gradient



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We aimed to investigate the extent to which measurements of flow volume (FV) with colour flow duplex ultrasonography (CDU) could predict tissue perfusion. A 68 year-old male patient was admitted to our clinic complaining of intermittent claudication in the right leg. Digital subtraction angiography showed total occlusion of the right femoral artery. The right popliteal artery (PA) was filling by collaterals. CDU showed that the FV in the right PA was higher than in the left. Arterial-venous FV measurement with CDU should be performed rather than the detection of arterial stenosis to assess whether intervention is necessary.

## Keywords

Peripheral arterial disease • Colour flow duplex ultrasonography • Lower extremities • Angiography • Ischaemia

## Introduction

Peripheral arterial disease (PAD) is characterised by flow-limiting stenosis or occlusion in the vessels supplying the lower limbs [1]. A non-invasive technique capable of measuring tissue perfusion would be of great clinical value for assessing the severity of the disease and monitoring the response to therapeutic interventions [2]. We assessed the extent to which measurement of flow volume (FV) with colour flow duplex ultrasonography (CDU) can be used to predict tissue perfusion in a patient with PAD. We then compared these results with those found using lower extremity digital subtraction angiography (DSA).

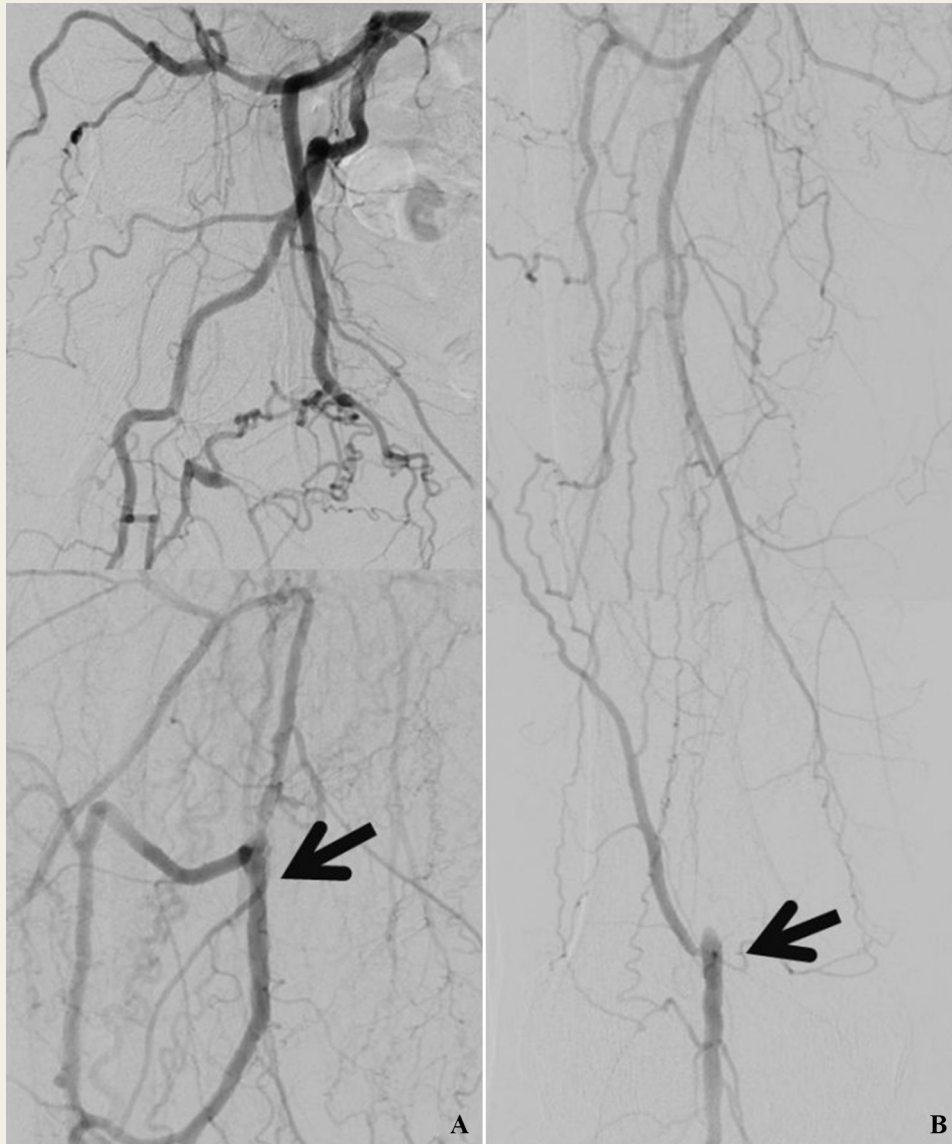
## Case Report

A 68 year-old male patient was admitted to our clinic complaining of intermittent claudication in the right leg. The

ankle brachial pressure index of his right leg was 0.6. DSA was performed for the lower extremity arterial system. CDU was then performed with an Aplio XG (Toshiba Corporation, Japan) using a 7–12 MHz linear array transducer. Analysis of the flow was carried out after 10 min of rest to allow the muscles to reach a resting state. Arterial and venous CDU was obtained in the supine position with the foot elevated 15 cm to neutralise the central venous pressure. The vessel diameter, blood flow velocity and FV in the arteries and veins of the lower extremities were calculated without compression. The common femoral artery (CFA) and popliteal artery (PA) were examined 1 cm above the bifurcation, and the common femoral vein (CFV) and popliteal vein (PV) were examined 1 cm above the saphenofemoral and saphenopopliteal junction. The anterior tibial artery (ATA), posterior tibial artery (PTA), anterior tibial vein (ATV), and posterior tibial vein (PTV) were examined 2 cm proximal to the ankle.

DSA illustrated total occlusion of the right femoral artery (FA). The right PA was filling by collateral vessels from the

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**Figure 1** A, B. Full occlusion of the right femoral artery from the origin to the distal third (\*). Flow in the right popliteal artery (arrow) supplied by collateral vessels from the deep femoral artery is demonstrated.

deep FA (Figure 1). There was a 70% luminal stenosis by an atheroma in the distal part of the left FA (Figure 2). The left PA, ATA and PTA were not demonstrated.

The CDU confirmed DSA findings showing several collaterals around the distal FA. FV was 230 ml/min (mean FV for PA, 100 ml/min) [3] in the right PA and 40 ml/min in the popliteal vein. The FV of the right PA, which was filling by collateral vessels from the deep femoral artery, was higher than the FV of the left PA. FV was 30 ml/min (mean FV for ATA-PTA, 15 ml/min) [3] in the right ATA, 0 ml/min in the ATV and 10 ml/min in the PTA-PTV. The mean flow rates, diameters and flow volume values for the CFA, CFV, PA, PV, ATA, ATV, PTA, and PTV in our patient are summarised in Table 1.

Femoropopliteal bypass grafting was recommended for the patient based on the DSA report; an ilio-popliteal bypass graft was performed on his right leg in the department of cardiovascular surgery in another medical centre.

## Discussion

In spite of total occlusion in CFA, capillary perfusion of cruris can be reconstituted by collateral vessels. We found normal PA, ATA and PTA flow values in the distal areas after occluded arterial segment. We suggest using this type of Doppler flow study for the evaluation of tissue ischaemia. This technique can be useful for cardiovascular surgeons to

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