

# **Incidental Venous Thrombosis as Detected by Magnetic Resonance Thrombus Imaging in 245 Patients with Suspected Peripheral Arterial Disease Using a Blood Pool Contrast Agent**

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## **Aim of the study**

To prospectively determine the prevalence of incidental venous thrombosis as detected by magnetic resonance thrombus imaging with a blood pool contrast agent in patients who were referred for imaging because of suspected or known peripheral arterial occlusive disease.

## **Introduction**

It is recognized that the use of high-spatial resolution images acquired during the equilibrium phase of contrast-enhancement with a blood pool contrast agent (BPCA) increases the diagnostic accuracy of magnetic resonance angiography (MRA) in patients with peripheral arterial occlusive disease (PAOD) (1-3). In contrast to standard first pass MRA, when imaging is performed during this equilibrium phase of vascular enhancement, not only the arterial vessels are visualized with high vessel-to-background contrast but also the veins with the potential for direct thrombus imaging (4,5). This enables venous imaging as an adjunct to arterial imaging without the need of a separate contrast injection or a second data acquisition. At the same time, thrombus detection has been proven feasible using magnetic resonance direct thrombus imaging with the BPCA Gadofosveset (6).

## **Methods**

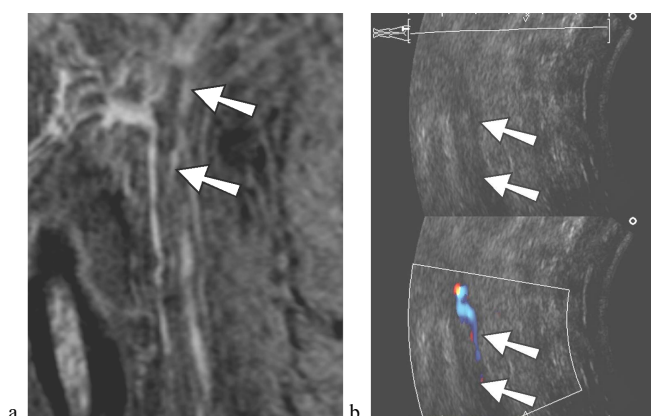
BPCA-MRA with the contrast agent Gadofosveset was performed in 245 consecutive patients (age range, 36-92 years; 161 men with a mean age of 64.3 years; 84 women with a mean age of 66.9 years) with suspected PAOD, yielding a total of 4102 assessable arterial and venous vessel segments. Fourteen patients received two separate examinations at different time points resulting in a total of 259 BPCA-MRA examinations. MR-examinations were performed on a 1.5 T whole body scanner (Achieva; Philips Healthcare, Best, the Netherlands). A commercially available flexible 4-channel phased array surface coil (SynBody, Philips Healthcare, Best, the Netherlands) was used for imaging of the lower legs. Images of the upper legs and the pelvic regions were acquired with the integrated quadrature body coil (1). First pass CE-MRA (FPMRA) acquisitions were initiated when the contrast medium had reached the common iliac arteries as determined by fluoroscopic triggering. Steady state contrast-enhanced-MRA (SSMRA) acquisitions were started 4 minutes after initiation of FPMRA. Acquisition parameters for coronal T1-weighted gradient-echo sequences for contrast-enhanced MRA during the first pass and steady state were identical to those published in reference (1). Findings of incidental venous thrombosis were correlated with duplex ultrasound (DUS) and non-affected contralateral veins served as internal controls.

## **Results**

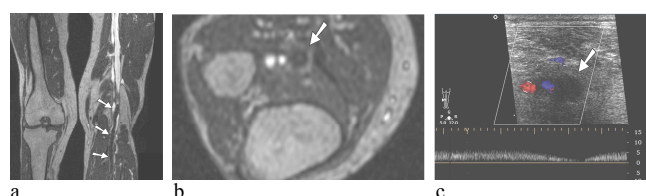
BPCA-MRA revealed <50% luminal stenosis in 78% (3199/4102), ≥50% in 8% (317/4102) and occlusion in 14% (586/4102) arterial segments. BPCA-MRA thrombus imaging identified incidental venous thrombosis in 10% (patients/segments: acute, 10/26; chronic, 17/35) of patients with DUS confirmation. Neither thrombus imaging nor DUS detected thrombosis in any of the control veins (contralateral legs 26 patients/172 segments).

## **Conclusion**

Incidental venous thrombosis as detected by BPCA-MRA thrombus imaging was prevalent in 10% of patients who underwent peripheral MRA for suspected PAOD. BPCA-MRA has a potential role in the simultaneous assessment of arteries and veins. In patients at risk for PAOD, BPCA-MRA can detect concomitant venous disease, not detectable on standard first pass imaging techniques, which may affect therapeutic management.



**Fig. 1: Deep venous thrombosis in the right common femoral vein in an 81-year-old patient. (a) Visualization of the distal end of the thrombus in the right common femoral vein in coronal SSMRA (arrows). (b) Demonstration of the distal end of the thrombus in cranio-caudal B-mode- and color-coded duplex sonography (arrows).**



**Fig. 2: 43 year old male patient with suspected PAOD. (a) Curved coronal and (b) axial multiplanar reformat of SSMRA visualize a thrombosis of the left popliteal vein (dilation, non-enhancement; arrows). (c) The popliteal thrombus and missing flow signal are accordingly shown in DUS (arrow), whereas a normal venous flow spectrum is derived in a non-thrombosed concomitant vein.**

## **References**

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