**Targeted Multi-contrast Vessel Wall Imaging of Bilateral Peripheral Artery Disease**

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**Introduction:** Peripheral artery disease (PAD) which affects more than a fifth of people over 70 years is associated with high morbidity [1]. Ankle Brachial Index measurement and MR angiography are not sensitive to detect early atherosclerotic changes in the vessel wall [2]. 2D black-blood MRI is highly reproducible for atherosclerotic plaque measurement in the femoral arteries [2]. However current black-blood imaging techniques are time consuming and do not provide adequate coverage of the diffuse disease in PAD [3]. Recent improvements in black-blood imaging provide the opportunity for imaging in planes oblique to the artery and allow for 3D PAD vessel wall imaging [1,3]. Bilateral large coverage of the femoral arteries from the femoral bifurcation to the popliteal artery is required to effectively map the full extent of atherosclerotic disease in PAD. Multi-contrast information is also desirable for adequate plaque component identification. To address the competing demands of large coverage and multi-contrast characterization of atherosclerotic plaque, we propose a time-efficient protocol that allows targeted multi-contrast imaging of arterial segments with large lesion burden and simultaneous lesion burden measurement along the entire length of the superficial femoral artery. **Aims:** 1) To develop and integrate a fast isotropic 3D black blood sequence into a multi-contrast protocol for targeted 2D imaging of the region of maximal disease; 2) To assess the quality of blood suppression and wall delineation in the femoral arteries and veins.

**Materials and Methods: Imaging Protocol:** A 3D motion-sensitized driven equilibrium prepared rapid gradient echo (3D-MERGE) was implemented with MSDE preparation [4,5] and spoiled segmented FLASH (T1-TFE) readout with centric phase encoding. Sequence parameters were adjusted to obtain isotropic resolution of 1.0mm² (zero-interpolated to 0.5mm²) covering bilateral femoral arteries with an axial coverage of 50 cm which was noted to be adequate to cover the distal extent of the superficial femoral artery. The isotropic dataset acquired was examined by interactive multiplanar reformatting to identify the region of interest for centering multicontrast high resolution PDw, T2w and T1w images with MSDE preparation (Table 1). **Image analysis:** Bilateral 3D-MERGE images (12 arteries) were reviewed for image quality (rated on a 3 point scale (Table 2) with 2 and above considered diagnostic) for quality of flow suppression and vessel wall delineation at three locations along the thigh. **Results:** Vessel wall was visualized in all subjects with good flow suppression (fig 1). A lesion of interest was located on 3D-MERGE in two subjects and followed up with multi-contrast imaging. Mild venous wall thickening was noted in one subject while extensive deep vein thrombosis was detected in the second subject (fig 2). Average blood suppression quality on 3D-MERGE was 2.8 for arterial segments and 2.3 for venous segments. Wall definition was rated 2.7 for both arteries and veins. **Discussion:** Image quality in all subjects was of diagnostic quality and enabled fast screening for lesions. Outer wall boundaries of both arteries and veins were well visualized at the bifurcation, midthigh and popliteal regions. Femoral artery blood suppression was rated good in all locations. Venous flow suppression was less optimal particularly in veins of small caliber such as popliteal region. Use of higher MSDE gradients can improve blood suppression. The stronger MSDE gradients used for T1w and T2w helped to distinguish thrombosis vs unsuppressed flow in small veins. **Conclusion:** A fast multi-station multi-contrast peripheral artery vessel wall imaging protocol was developed. Isotropic voxels allowed interactive reformating in arbitrary planes and allowed fast identification of lesions of interest allowing efficient screening of the entire femoral artery from the bifurcation down to the popliteal artery for plaque burden followed by targeting of lesions for high-resolution multi-contrast MRI. Average screening time was 15 minutes and total scan time was 30 minutes for multicontrast imaging.