Continuous Table Movement for Peripheral MRA with Matrix Coils at 3.0T

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Purpose: To compare a standard step-by-step and a newly developed continuous table movement (ctm) technique with variable resolution in the acquired filed of view (FOV) for peripheral MRA at a 3.0 Tesla MR System equipped with a matrix coil system.

Materials and Methods: Peripheral MRA with continuous table movement acquires one large FoV with up to 130cm in patient z-axis. Before acquiring the contrast enhanced dataset vessel scout images as well as a non contrast enhanced dataset for later subtraction are acquired [1, 2]. We included 20 consecutive patients referred for peripheral MRA with clinical symptoms of peripheral arterial occlusive disease (PAOD) Fontaines stage II - IV. All of them underwent both step-by-step MRA and ctm-MRA in one session. Patients with impaired renal function (calculated GFR < 30ml/min) were not included. All exams were performed on a 3.0T MR System (Magnetom Verio). Maximal contrast agent (CA) volume was 31.5ml (1.5ml testbolus, 15ml / MRA technique). For both techniques the same monophasic CA injection protocol was used, 15ml of standard 0.5 molar CA were injected at a flow rate of 1ml/s directly followed 25ml of saline also at 1ml/s. Spatial resolution of the ctm-MRA datasets is technically limited to a reconstructed voxel size of 1.0 x 1.0 x 1.3mm^3 for the entire FoV. Acquired voxel sizes differ throughout the FoV between 1.2 x 1.0 x 2.1mm^3 and 1.0 x 1.0 x 1.6mm^3 due to a technique called “variable resolution” helping to increase resolution in the most distal part of the FoV. Step-by-step MRA reached a spatial resolution between 1.4 x 1.1 x 1.2mm^3 and 0.9 x 0.9 x 0.9mm^3 in the most distal calf station [3]. First ctm-MRA datasets were read and findings thereafter correlated with the step-by-step MRA datasets. Examination times of the different techniques were recorded.

Results: All datasets could be evaluated. Due to the absence of multiple localizers and subtraction masks examination time was considerably shorter when using the ctm-MRA technique. Relevant findings detected by step-by-step MRA were also detected by ctm-MRA. 25.3% of all ctm-MRA vessel segments showed no findings compared to 23.2% in the sbs-MRA datasets. 45.8% and 9.1% showed atherosclerotic changes and hemodynamically significant stenosis in the ctm MRA compared to 53.5% and 7.4% respectively. Only 4.1% of the vessel segments in ctm-MRA were not accessible due to impaired image quality compared to 2.1% in the sbs-MRA. Different results between step-by-step MRA and ctm-MRA occurred in the differentiation between no vessel-wall changes / slight atherosclerotic changes and high grade stenosis / occlusion respectively.

Conclusion: MRA with continuous table movement is an easy applicable technique for imaging peripheral vessels without the need for planning different steps and FOV positioning, thus examination time can be reduced considerably. However, the reduced spatial resolution compared to standard step-by-step MRA is a drawback especially in the most distal calf vessels which leads to under- or overestimation of findings.

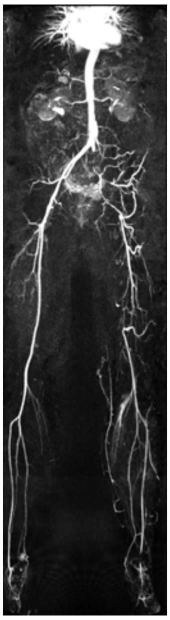

figure 1: Example of a ctm-MRA dataset with occlusion of the left iliac arteries and collateral flow to the thigh arteries. Note the excellent delination of even small vessels in the periphery.

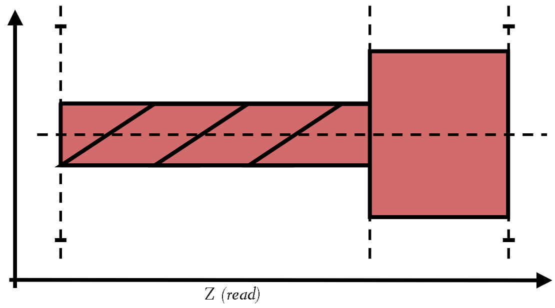

figure 2: Readout scheme for ctm-MRA with variable resolution. To increase spatial resolution in the periphery, at the end of the FOV peripheral parts of k-space are sampled in a higher density.

TR [ms]	2.8
TE [ms]	1.1
FOV [mm]	1280x384
slab thickness [mm]	115
spat. res. I [mm3]	1.2 x 1.0 x 2.1
spat. res. II [mm3]	1.0 x 1.0 x 1.6
spat. res. rec. [mm3]	1.0 x 1.0 x 1.3
PI factor	3
acqu. time [sec]	77

table 1: Acquisition parameters for ctm-MRA. Note the different spatial resolution for different parts of the FOV.

1. Kramer, H., et al., *Peripheral magnetic resonance angiography (MRA) with continuous table movement at 3.0 T: initial experience compared with step-by-step MRA.* Invest Radiol, 2008. 43(9): p. 627-34. 2. Kruger, D.G., et al., *Continuously moving table data acquisition method for long FOV contrast-enhanced MRA and whole-body MRI.* Magn Reson Med, 2002. 47(2): p. 224-31. 3. Kramer, H., et al., *High-resolution magnetic resonance angiography of the lower extremities with a dedicated 36-element matrix coil at 3 Tesla.* Invest Radiol, 2007. 42(6): p. 477-83.