Continuous Table Movement for Peripheral MRA with Matrix Coils at 3.0T - comparison to standard step-by-step MRA

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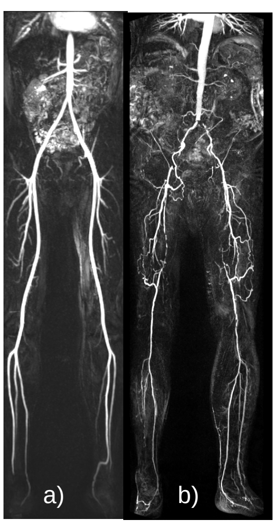
Purpose: Precondition for imaging of the peripheral vasculature is a high spatial resolution in combination with good image quality. The implementation of matrix-coils and parallel imaging (PI) in MRI as well as high field strength offer the possibility to achieve datasets which meet these requirements, without the drawbacks of digital subtraction- or computed tomography angiography (DSA / CTA), e.g. ionizing radiation, invasiveness etc [1]. However, MRA is a complex and time consuming application. The implementation of continuous table movement may help to simplify and shorten the procedure of MRA [2, 3]. The aim of this study was to compare a standard step-by-step (sbs) and a newly developed continuous table movement (ct) technique for peripheral MRA at 3.0 Tesla.

Materials and Methods: We included 14 consecutive patients (mean age 64±10 years, 12m, 2f) referred for peripheral MRA with clinical symptoms of peripheral arterial occlusive disease (Fontaine stage II-IV). All patients underwent both sbs-MRA and ct-MRA in one session (two contrast injections). No patients with impaired renal function (GFR <30ml) were enrolled in the trial, glomerular-filtration-rate was calculated with the Cockroft-Gault formula. All exams were performed on a 3T MR-System. Acquisition of ct-MRA was performed as described by Kruger [2]. Maximal contrast agent (CA) volume was 31.5ml (1.5ml test bolus, 15ml/MRA technique). Spatial resolution of the ct-MRA datasets was technically limited to 1.2mm^3 by reconstruction capabilities of the MR system; step-by-step MRA reached a spatial resolution between 1.4x1.1x1.2mm^3 and 0.9x0.9x0.9mm^3 (**table 1**). Reading of all datasets was done by two radiologists in consensus. First ct-MRA datasets were assessed for presence of stenoses on a segment-by-segment basis on a five point scale grading severity of disease, and findings were thereafter correlated with the step-by-step MRA datasets. Overall image quality, CA timing and occurrence of artefacts and venous contamination were rated on a three point scale.

Results: All ct-MRA datasets were evaluable and about 60% of all ct-MRA cases showed an excellent image quality. 71.4% showed excellent vessel conspicuity; more than 90% of all vessel segments were free of venous enhancement and thus showed an unimpaired diagnostic image quality (**figure1**). In the ct-MRA datasets 47.5% of all vessel segments exhibited arteriosclerotic changes, 5% stenoses (>75%) and 18.3% occlusions compared to 62.5% arteriosclerotic changes, 4.2% stenoses and 17.5% occlusions in the step-by-step MRA datasets. In 13 segments, pathologic changes were underestimated and in only 4 cases overestimated by ct-MRA (**figure 2**).

Conclusion: MRA with continuous table movement is an easy to perform technique which contributes to a substantial reduction in examination time. However, even if performing ct-MRA at 3.0T, the slightly reduced spatial resolution compared to standard step-by-step MRA has to be considered as a drawback, resulting in an under- or overestimation of pathologic changes which may be of therapeutic relevance. A step to overcome this limitation is ct-MRA with variable resolution. Here, spatial resolution is decreased in the abdomen to increase spatial resolution in the more important vessel territories of the lower leg.



	ct-MRA	sbs-MRA I	sbs-MRA II	sbs-MRA III
PI factor	2	3	3	3
acquisition time [s]	64	18	15	21
spat. Resolution [mm3]	1.2x1.2x1.2	1.4 x 1.1 x 1.2	1.1 x 1.1 x 1.1	1 x 1 x 1
FOV [mm]	1280	500	500	500
slices/slab	88	88	80	88

Table 1: Imaging Parameters of ct-MRA and sbs-MRA.

Figure 1: Examples of a ct-MRA dataset without any findings (a) and a dataset with major atherosclerotic changes, e.g. occlusion of the right external iliac artery and the superficial femoral artery on both sides (b).

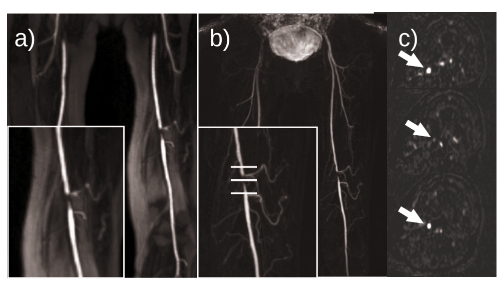


Figure 2: Example of pathologic findings in a) ct-MRA and b) sbs-MRA. c) Axial reformats of sbs-MRA show a high grade stenosis but not occlusion as stated in ct-MRA

1. 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. **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.** Zenge, M.O., et al., High resolution continuously acquired peripheral MR angiography featuring partial parallel imaging GRAPPA. Magn Reson Med, 2006. 56(4): p. 859-65.