Intraindividual comparison of high-spatial resolution abdominal MRA at 1.5T and 3.0T

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Background

Clinical high-field scanners have become increasingly available. Due to the high signal-to-noise ratio (SNR) of 3.0T scanners and due to the improved background suppression 3T-imaging seems very suitable for fast contrast-enhanced (CE) MRA which has been proved in initial feasibility studies[1]. However, to date no study has compared the image quality of CE-MRA intraindividually. The aim of this study was therefore to compare state-of-the art abdominal MRA at 1.5T and at 3.0T intraindividually.

Material and Methods

After IRB approval, 14 healthy volunteers (15 men, 26-36 years) underwent two abdominal CE-MRA exams: one exam at 1.5T on a 32-channel whole-body scanner (Avanto, Siemens Medical Solutions) and one on a 3.0T 32-channel whole-body scanner (Tim Trio, Siemens Medical Solutions). Three-plane localizers were obtained first to allow proper positioning of the MRA sequence. A fast 3D-GRE sequence was used for MRA, the exact sequence parameters at both field strengths can be found in table 1. Independent of the body weight and field strength, a 15ml bolus of Gd-BOPTA (Multihance, Bracco) was automatically injected through an antecubital vein at a flow rate of 2 (1.5T) and 3 (3.0T) ml/s. A testbolus technique was used for timing. Image quality was rated by two radiologists in consensus on a 4 point ordinal scale (4-very good, 3 good, 2 moderate, 1 poor). The criteria included vessel conspicuity, visible noise, and presence of artifacts. Contrast-to-noise ratio (CNR) was measured. T-tests were used for statistical analysis.

Results

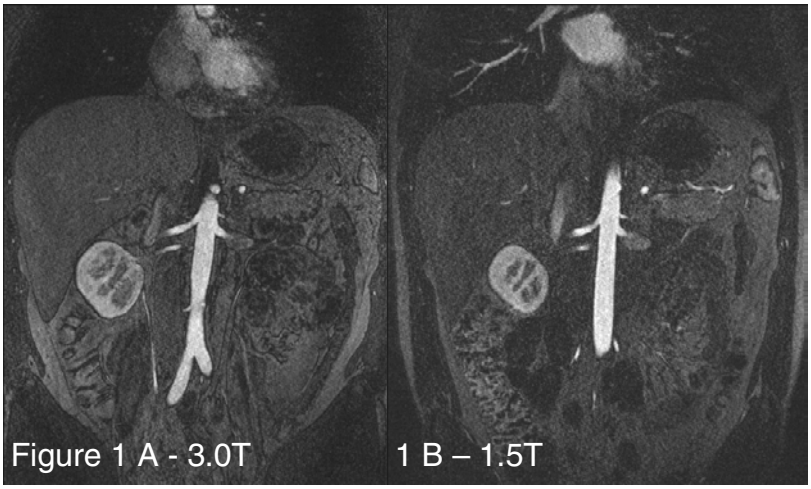
All MRA measurements were diagnostic. The median score for 3T-MRA and 1.5T MRA was 4. The number of visible small vessels was equal to 1.5T but the vessel conspicuity was better at 3T. The image noise was much more perceivable, and artifacts more visible at 1.5T. This was particularly true for the source data (figure 1), the MIP views concealed the increased noise (figure 2). The CNR was significantly ($p < 0.001$) higher at 3T (43,2) than at 1.5T (31,8).

Conclusion

In this intraindividual abdominal MRA study, 3T MRA proved to have a better vessel conspicuity and CNR than 1.5T-MRA. However, the technique we used for 3T-MRA allowed slightly faster sampling, a higher spatial resolution and a broader anatomic coverage. Therefore it seems that the high SNR at 3T can be translated into an improved abdominal MRA protocol. Further studies in patients are warranted to demonstrate the clinical utility of this technique.

References

1. **Michaely HJ, Nael K, et al. *Rofo*. 2005**



	1.5T MRA	3.0T MRA
TR / TE [ms]	3.77 / 1.39	3.14 / 1.1
Flip angle [°]	25	23
Bandwidth [Hz/Px]	350	510
Matrix	512 x 80%	512 x 80%
FOV [mm²]	400 x 87%	400 x 81%
Phase Oversampling [%]	0	8
Voxel size [mm³]	0.8	0.65
Spatial resolution [mm³]	1 x 0.8 x 1	0.9 x 0.8 x 0.9
Scan time [s]	19	18
Partitions	80	96
Parallel imaging	GRAPPA factor 3	GRAPPA factor 3

Table 1 – Overview of the relevant sequence parameters for the MRA sequences at 1.5T and 3.0T (Siemens Avanto and Siemens Tim Trio)