High resolution, Non-Contrast-Enhanced MR-Angiography of Pedal Vessels. Comparison with Digital Subtraction Angiography and Contrast-Enhanced MR-Angiography

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Target audience

Clinicans and scientists interested in high resolution, non-contrast MRA of medium and small vessels.

Purpose

The study was conducted in order to compare a high resolution, non-contrast-enhanced MRA-sequence (native SPACE, [1,2]) of the pedal arteries with a digital subtraction angiography (DSA) as the gold standard as well as a contrast-enhanced MRA- (ceMRA-) sequence in patients with peripheral arterial occlusive disease (pAOD). High resolution non-contrast MRA-techniques of the pedal vessels are useful in this patient collective as bypass targets can be identified and renal dysfunction is frequently present.

Methods

The study consists of 11 pAOD patients that underwent DSA, non-enhanced MRA (native SPACE) and ceMRA (TWIST acquisition technique) of the pedal vessels with a high spatial resolution (native SPACE: 1.1 x 1.1 x 1.1, TWIST: 0.7 x 0.7 x 0.7 mm). All patients underwent a percutaneous transluminal angioplasty or stenting and received the MR-Angiographies the following day. Consensus reading of 14 vessel segments regarding visibility, degree of stenosis and diagnostic utility was performed by two interventional radiologists (6, respectively 2 years of experience in IR).

Results

Fig. 1 shows MIP reconstructions of the MRA techniques and the corresponding DSA result of one patient. 154 vessel segments were evaluated. Paired, 2-sided t-tests revealed a significant difference between native SPACE (mean=2.48) and TWIST (mean =2.21 ; p=0.002) and between native SPACE and DSA (mean=2.29 ; p=0.02) regarding vessel visibility (1=excellent, 5=none). The degree of stenosis (0=none, 4=occlusion > 50% of segment) was graded significantly higher using native SPACE (mean=1.72) compared to the TWIST sequence (mean 1.47 ; p=0.004) as well as the DSA (mean=1.45 ; p=0.005). However, no significant differences were found regarding diagnostic utility (1=good, 3=not usable) between native SPACE (mean=1.34) and TWIST (mean=1.25 ; p=0.15) with DSA (mean 1.12) beeing superior to both MRA sequences (DSA vs. native SPACE : p=0.0005, DSA vs. TWIST : p=0.019).

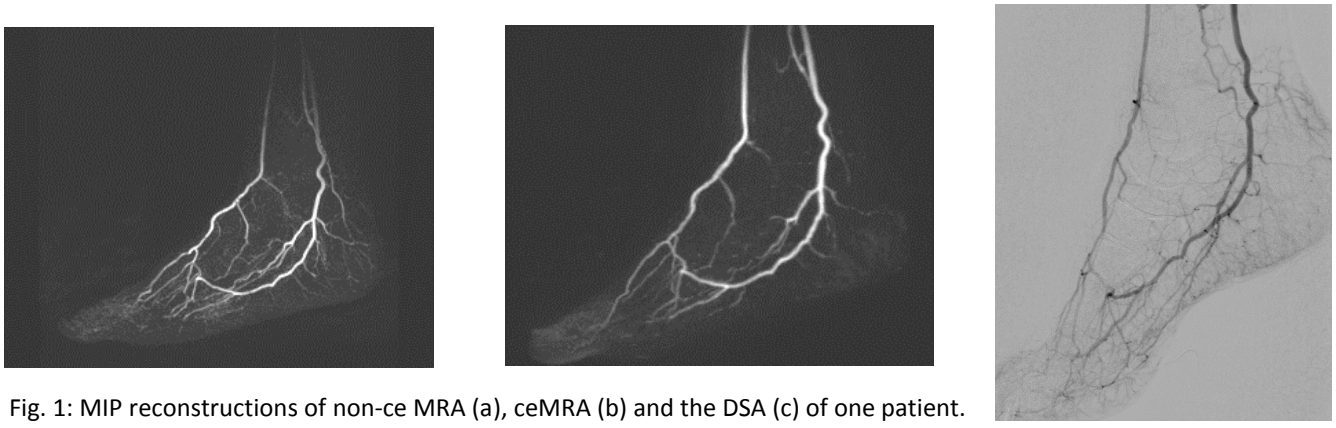

Fig. 1: MIP reconstructions of non-ce MRA (a), ceMRA (b) and the DSA (c) of one patient.

Discussion

The applied non-contrast enhanced MRA-sequence is suitable for the depiction of small pedal vessels. However, as it is composed of two separate cardiac gated acquisitions, movement between the measurements results in heavily compromised image quality. This happened in 1 out of 11 patients in our study. Motion correction algorithms may help to increase image quality in these cases.

Conclusion

Native SPACE is suitable for the depiction of pathologies in even very small, distal pedal vessels.

References

1. Mohrs et al. High-resolution 3D non-contrast-enhanced, ECG-gated, multi-step MR angiography of the lower extremities: comparison with contrast-enhanced MR angiography. Eur Radiol 21:434;2011.
2. Gutzeit et al. ECG-triggered non-contrast-enhanced MR angiography (TRANCE) versus digital subtraction angiography (DSA) in patients with peripheral arterial occlusive disease of the lower extremities. Eur Radiol 21:1979;2011.