High resolution steady state imaging of peripheral arteries with a blood pool agent compared with standard first pass imaging and DSA: assessing the clinical benefit

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Purpose

To prospectively evaluate lower extremity arteries using high-resolution steady state MR angiography with Gadofosveset Trisodium as compared to standard resolution first pass arterial phase MR angiography and DSA.

Introduction

Contrast-enhanced MRA of peripheral vessels is routinely used in the diagnostic workup of patients with peripheral arterial occlusive disease[1]. However, with extracellular Gadolinium-based contrast agents, the acquisition window is limited to arterial bolus passage in order to acquire arterial-only images[2], limiting scan time and thus, spatial resolution. The introduction of an intravascular contrast agent allows for image acquisition in a steady state with higher T1-relaxitivity increasing the acquisition window and for the first time offering the opportunity to acquire very high resolution images of peripheral arteries[3,4]. This study was carried out to evaluate the clinical usefulness of high spatial resolution steady state (SS) imaging of peripheral arteries as compared to standard-resolution arterial phase imaging using DSA as the standard of reference.

Methods

22 patients (12 male, 10 female; mean age: 63.0±15.0 [range: 26-87 years]) with suspected or known peripheral arterial occlusive disease were examined with Gadofosveset Trisodium (Vasovist, Schering, Berlin, Germany; 0.03 mmol/kg body weight at a flow rate of 1.2ml/sec.) on a 1.5 T whole body MRI (Achieva, Philips Medical Systems, Best, NL). First pass (FP) images were acquired with effective voxel sizes of 0.88x0.88x1.5mm³ (upper legs) and 0.88x0.88x1.1mm³ (lower legs) respectively. Steady state (SS) images were acquired with effective voxel sizes of 0.88x0.88x0.99mm³ (upper legs) and 0.52x0.52x0.49mm³ (lower legs) respectively. The maximum grade of stenosis was evaluated by two radiologists in consensus in FP and re-evaluated after reviewing SS images. In a second step, the grade of stenosis was evaluated on DSA by an independent radiologist who was blinded for the MRA results.

Results

A total of 221 segments were available for intraindividual comparison of FP, SS and DSA in the 22 patients. All together, 112/221 segments were diseased. In 18/22 patients (82%) the grade of stenosis of at least one of the diseased vessels was modified after reviewing the high resolution SS images. In total, the grade of stenosis was judged higher in SS than in FP in 27/112 (24%) diseased segments and lower in 18/112 (16%) diseased segments. The grade of stenosis as judged after revision of the SS images was confirmed by DSA in 112/112 (100%) diseased segments.

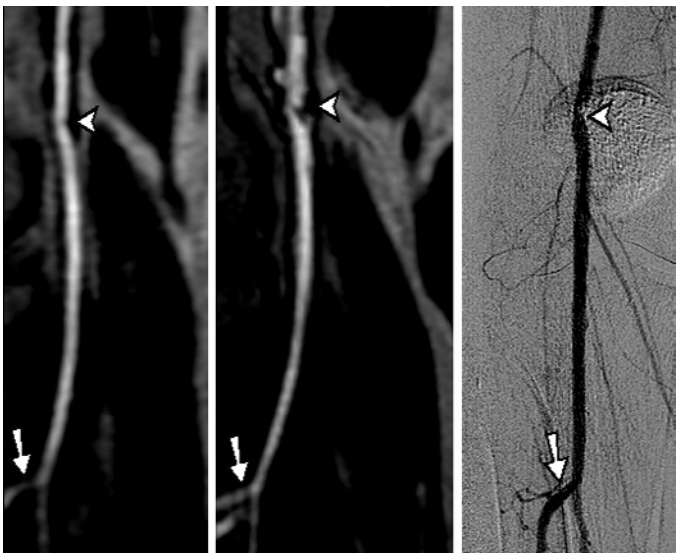

Fig. 1: Curved multiplanar refomats of standard-resolution first-pass MRA (A) and high-resolution steady state MRA (B) as compared to DSA as the standard of reference (C). Please note the underestimation of the stenosis of the popliteal artery (P2-Segment (arrow heads) and the overestimation of a stenosis of the anterior tibial artery in FP as compared to SS and DSA (arrows).

Conclusion

High resolution steady state imaging of the upper and lower legs with Gadofosveset Trisodium allows for a more accurate classification of steno-occlusive disease as compared to standard-resolution first pass arterial phase imaging using DSA as the standard of reference.

References

1 Lenhart M, Finkenzeller T, Paetzel C, Strotzer M, Mann S, Djavidani B, Nitz WR, Link J, Feuerbach S, Kasprzak P. [Contrast-enhanced MR angiography in the routine work-up of the lower extremity arteries] Rofo. 2002 Oct;174(10): 1289-1295.

2 Schoenberg SO, Londy FJ, Licato P, Williams DM, Wakefield T, Chenevert TL. Multiphase-multistep gadolinium-enhanced MR angiography of the abdominal aorta and runoff vessels.Invest Radiol. 2001 May;36(5): 283-291.

3 Grist TM, Korosec FR, Peters DC, Witte S, Walovitch RC, Dolan RP, Bridson WE, Yucel EK, Mistretta CA. Steady-state and dynamic MR angiography with MS-325: initial experience in humans. Radiology. 1998 May;207(2): 539-544.

4 Rapp JH, Wolff SD, Quinn SF, Soto JA, Meranze SG, Muluk S, Blebea J, Johnson SP, Rofsky NM, Duerinckx A, Foster GS, Kent KC, Moneta G, Middlebrook MR, Narra VR, Toombs BD, Pollak J, Yucel EK, Shamsi K, Weisskoff RM. Aortoiliac occlusive disease in patients with known or suspected peripheral vascular disease: safety and efficacy of gadofosveset-enhanced MR angiography--multicenter comparative phase III study. Radiology. 2005 Jul;236(1): 71-78.