

Stepping-table gadolinium-enhanced MR angiography for the run-off study of lower extremity arteries: Two-injection techniques using combination of TRICKS for the calf and two-step scanning technique with automated bolus-detection algorithm for the abdomen and thigh.

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ABSTRACT

Purpose

To evaluate the efficacy of stepping-table two-injection gadolinium (Gd)-enhanced MR angiography using combination of time resolved contrast kinetics (TRICKS) for the calf and two-step scanning technique with automated bolus-detection algorithm for the abdomen and thigh in the run-off study of the lower extremity arteries.

Material and methods

This study included 21 patients (14 men and 7 women, 39-90 years old; mean 72 years) who were referred for MR angiography of the abdominal aorta and lower extremity arteries for the evaluation of arterial occlusive disease. MR examination was performed with a 1.5T superconducting MR unit (Signa Excite HD, GE Healthcare) and 4-channel peripheral vascular array coil. First, time-resolved MR angiography of the calf was performed during two minutes after an injection of 10 ml Gd contrast material at a rate of 1 ml/s with TRICKS sequence (TR of 4.4 msec, TE of 1.1 msec, flip angle of 30 degrees, slice thickness of 2.4 mm, slice spacing of 1.2 mm, FOV of 44 cm, and matrix of 320 x 224 and 20 phases). Second, two-step MR angiography of the abdomen and thigh was performed using 3DFT fast SPGR sequence with fat suppression (TR of 4 msec, TE of 0.96 msec, flip angle of 45 degrees, slice thickness of 6 mm, slice spacing of 3 mm, FOV of 44cm, and matrix of 256 x 160 and scan time of 10 sec) with parallel imaging technique (ASSET) and automated bolus-detection algorithm (MR SmartPrep). Scanning of the abdominal aorta was initiated automatically using MR SmartPrep after the injection of Gd contrast material at a rate of 1 ml/s, and immediately followed by scanning of the thigh. Maximum intensity projection (MIP) angiographic images were produced. Subtraction MIP images were obtained for the thigh. Visualization of the arteries and venous overlap on the MIP images were evaluated for the abdomen, thigh, and calves.

Results

On TRICKS images, clear visualization of the calf arteries without venous overlap was obtained in 16 patients (76%), calf arteries were visualized with venous overlap because of arteriovenous fistula in 2 patients (10%), and calf arteries were not clearly visualized because of patients' motion in 3 patients (14%). Abdominal arteries were clearly visualized without venous overlap in 20 patients (95%), while timing of scanning was inappropriate in the remaining one patient (5%). Arteries of the thigh were clearly visualized without venous overlap in 15 patients (71%), while they were visualized with venous overlap in the other 6 patients (29%).

Conclusion

TRICKS is useful for the visualization of the calf arteries without venous overlap. However, incidence of venous overlap on arteries of the thigh is slightly increased with our technique. Improvement of contrast material injection technique is necessary.

