

Meeting abstract

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I58 A contrast dose reduction study for 3D high spatial resolution contrast-enhanced magnetic resonance angiography of supra-aortic arteries at 3.0 Tesla

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Introduction

Recent advances in contrast-enhanced MR angiography (CE-MRA) at 3.0 T support highly accelerated parallel acquisition for improved pulse sequence performance. In clinical practice, CE-MRA of the supra-aortic arteries is performed using 0.1–0.2 mmol/kg of gadolinium. Historically, this has been a very uncontroversial area, in view of the excellent safety record of gadolinium contrast agents and the assumed correlation between image quality and contrast dose. However, recent reports linking gadolinium-based contrast agents with nephrogenic systemic fibrosis (NSF) in renal failure patients has focused attention on the importance of minimizing dose and (by implication) risk in vulnerable patient subgroups.

Currently, no validated approach exists for the selection of minimal or optimal contrast dosing for MR angiography of the head and neck arteries at 3.0 T. Relative to high dose or intermediate dose protocols at 3.0 T, low-dose contrast infusion protocols may result in MR angiograms of diagnostic quality, while diminishing cost and the risk of dose-dependent complications in susceptible populations.

Purpose

To prospectively compare the diagnostic image quality resulting from three dose regimens for high-spatial resolution 3D contrast-enhanced MR angiography of supra-aortic arteries at 3.0 T.

Methods

100 consecutive patients were randomized into three groups (A, n = 40; B, n = 40; C, n = 20) and underwent 3D high-spatial resolution CEMRA of supra-aortic arteries at 3.0 T (Trio, Siemens) using an identical acquisition protocol. A fast spoiled gradient-echo sequence with parallel acquisition (GRAPPA × 4) generated 120 partitions (voxel dimensions 0.7 × 0.7 × 0.8 mm³) in 21 seconds. The contrast injection protocols were 1) 25 mL, 2) 15 mL, 3) 7.5 mL of Magnevist (Berlex Laboratories, Wayne, NJ) at a rate of 0.8, 0.5, and 0.25 mmol/sec, respectively. Supra-aortic arterial territory was divided into 34 segments and assessed for visibility of arterial segments, venous contamination, and severity of stenosis (4-point scales) by two readers. Signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) was also evaluated. Statistical analysis was performed using Wilcoxon, ANOVA, and kappa test.

Results

Reader 1 and 2 identified arterial delineation as sufficient for diagnosis or excellent in group A for 1311 (96.4%) and 1313 (96.6%) segments, in group B for 1321 (97.6%) and 1319 (97.4%) segments, and in group C for 658 (97.5%) and 662 (98.1%) segments, respectively (good inter-observer agreement). Reader 1(2) identified venous contamination in 24 (21), 15 (11), and 11(9) segments, and arterial stenosis in 52(48), 27 (25), and 31(29) segments in groups A, B, and C, respectively (excellent inter-observer agreement). No significant difference existed

between arterial delineation and venous contamination scores for each reader between the three groups ($P > 0.05$). SNR and CNR values were significantly lower in group C compared to groups A and B.

Conclusion

High-spatial resolution CEMRA of the supra-aortic arteries at 3.0 T can be performed with a gadolinium dose as low as 0.05 mmol/kg without compromising image quality. Adoption of low-dose protocols should diminish sensitivity to dose-dependent complications and result in substantial cost savings.

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