MR angiography of the carotid circulation using two-dimensional parallel imaging on a 32 Channel 3.0T System

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Purpose: To assess the feasibility of combined in-plane and through-plane parallel acquisition for isotropic 3D contrast enhanced MR angiography of the supra-aortic arteries.

Materials and Methods: Six volunteers (three men; median age 52 years) and five patients (2 men; median age 62 years) with suspected cerebro-vascular disease were examined on a 3.0T MR scanner (Magnetom Trio, Siemens Medical Solutions, Malvern, PA) using a 16 element head-neck array. Contrast-enhanced high spatial resolution 3D CE-MRA (TR 3.2 ms, TE 1.2 ms, FA 30°, bandwidth 390 Hz/Pixel) was acquired with generalized autocalibrating partially parallel acquisition (GRAPPA) in both phase- and slice encoding-directions. Images were evaluated independently by two radiologists for image quality, venous overlay, and the presence of artifact. Standard TOF imaging was used as a reference for intra-cranial vessel segments. Signal-to-noise values were calculated using the 3D CE-MRA sequence with and without parallel imaging in phantom measurements. Statistical analysis was performed by unpaired Wilcoxon test, and *k* coefficient for interobserver agreement.

Results: SNR levels of 48.7±10.2 without parallel imaging and 8.7±2.2 with parallel imaging (GRAPPA x6) were measured. Scoring of image quality by observer 1 (observer 2) on a 4-point scale [range 0-3] yielded 2.5±1.0 (2.4±1.0) and 2.1±1.0 (2.0±1.1) for extra-cranial and intra-cranial vessel segments in volunteers and 2.8±0.6 (2.7±0.7) and 2.0±1.2 (2.1±1.1) in patients, respectively. The interobserver agreement was excellent (k=0.82).
Small intra-cranial arteries, i.e. anterior communicating artery, as depicted by standard time-of-flight-angiography were visualized in all cases (Figure 1).

Conclusion: This study shows that contrast-enhanced MRA, applying parallel imaging in both phase- and slice-encoding direction (iPAT^2), is feasible at 3.0T. Coverage of the complete supra-aortal and intra-cranial vasculature was achieved.

Figure 1:

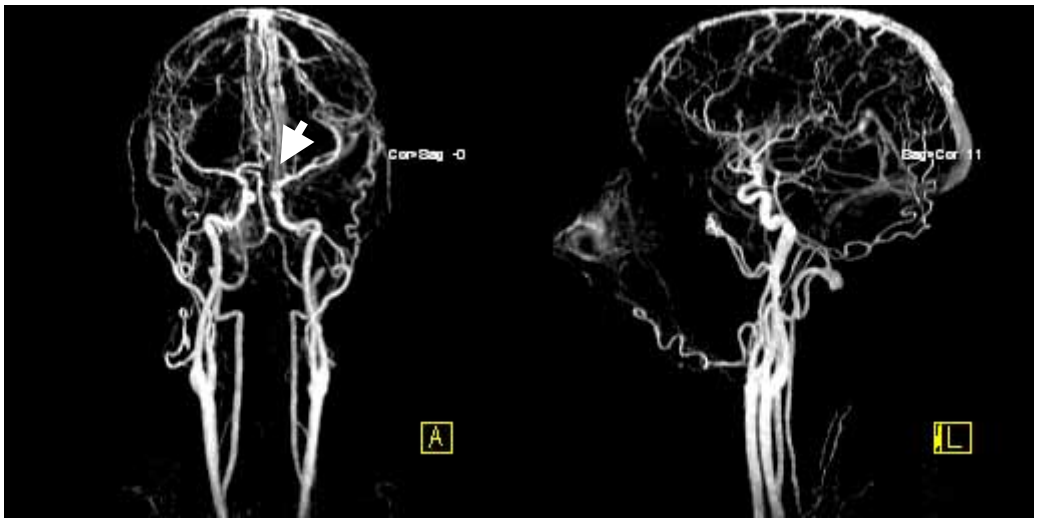

Figure 1: VRT images of a healthy volunteer using the 3D MRA sequence with GRAPPA x6 (TR 3.2 ms, TE 1.2 ms, FA 30°, bandwidth 390 Hz/Pixel, coverage 27x27x16 cm). The images show a hypoplastic A1 segment of the left anterior cerebral artery (white arrow).