Time Resolved TWIST MR Angiography of the Head and Neck:

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Time Resolved TWIST MR Angiography of the Head and Neck: the use of Parallel Imaging with a Higher Acceleration Factor to Increase Temporal Resolution

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Introduction: To evaluate sub-second time-resolved MRA of intracranial vessels with **TWIST (Time-resolved imaging With Interleaved Stochastic Trajectories)** combined with generalized auto-calibrating parallel acquisitions (GRAPPA) algorithm, and to compare image quality of data sets obtained with an acceleration factor of three versus four.

Methods: 7 healthy adult subjects (5M,2F, 25-55 years old) were scanned on a 3.0T MR system (Magnetom **Tim** Trio, Siemens Medical Solutions), using a 12 channel head matrix coil and a 4 channel neck coil (Total Imaging Matrix system). TWIST involves covering k space in 2 segments: a central region A, and a peripheral region B. All k-space points are sorted according to their radial distance k_r from k=(0,0), and azimuthal angle. The key advantage of this technique is that a full range of k-space coverage from k=0 to kmax occurs for every repetition of the basic cycle. Thus, high-frequency information is updated at the same rate as the central region A. The parameters were: TR/TE = 2.7/1.1 ms with sampling BW = 750 Hz/pixel, and in-plane spatial resolution = 1 x 1 mm. 16-20 slices with 5.5mm thickness were choose to cover slab thickness of 8 to 12 cm. Parallel imaging with acceleration factors of three and four were used in all subjects (in a randomized order with other parameters kept constant). Consecutive coronal data sets (typically 13-20 sets) were acquired following a bolus injection of 5 ml Gadodiamide at 4 ml/s. The following supra-aortic arterial branches were evaluated: aortic arch, brachicephalic trunk, subclavian, common carotid, external carotid , internal carotid (four segments: cervical, petrous, cavernous, supra-clinoid), anterior communicating (3 segments: horizontal, sylvian, cortical), vertebral and basilar arteries. Each vascular branch was scored on a 1-4 scale (excellent = 1; good = 2; fair = 3; poor = 4) based on vascular enhancement and image quality for diagnosis.
For quantitative assessment, SNR was measured in 5 regions of interest (aortic arch, bulb of common carotid and cavernous segment of internal carotids) and four regions of interest for background noise, for both acceleration factors in each volunteer. Wilcoxon test was used to detect a significant difference for non-parametric measurements (image quality). In addition, a paired t-test was used to test the SNR difference.
Results: 93% of vascular segments of the cranio-cervical arterial circulation were visualized with excellent or good image quality and definition in the diagnostic range. There was no significant difference in image quality between the two techniques (mean±SD 1.5± 0.6 and 1.4± 0.6 for acceleration factors four and three respectively, P = 0.07). The SNR measurement showed a consistent increase with higher acceleration factor (mean ± SD 102± 46 and 88± 46 for acceleration factor four and three respectively, $p<0.01$).

Conclusion: Contrast enhanced sub-second MR angiography using TWIST sequence for the entire carotid circulation at 3.0T is feasible. Using an acceleration factor of four to improve temporal resolution provided comparable image quality without a compromise in SNR. acceleration factors, the performance of the technique was further improved (about 33% in temporal resolution).

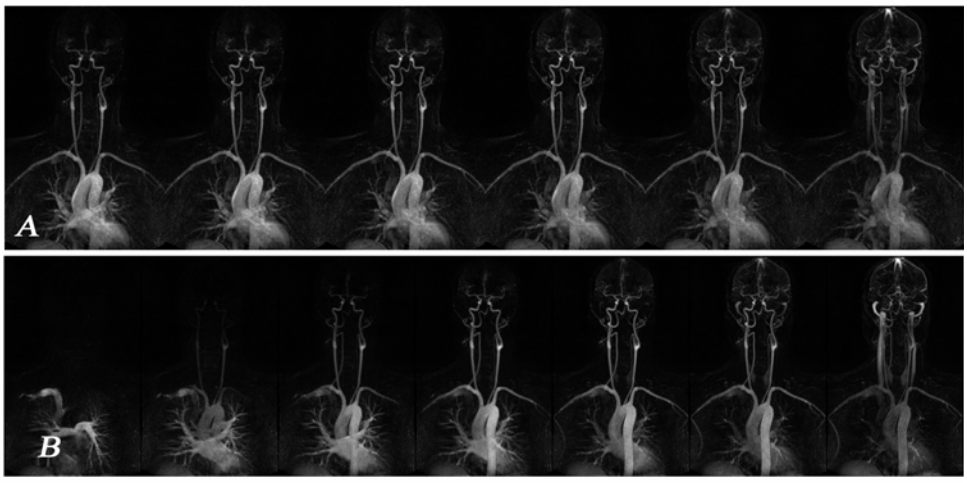

Figure1: Time resolved MRA in a healthy subject with acceleration factor of 4 (A) and 3 (B)