Initial Evaluation of Patients with Suspected Intracranial Aneurysms: Comparison of 3.0 Tesla Contrast-Enhanced MR Angiography and Multi-Slice CT Angiography

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Purpose: To prospectively evaluate a high spatial resolution contrast-enhanced MR angiography protocol at 3.0Tesla for detection and characterization of intracranial aneurysms, and to compare the results with multi-slice CT angiography.

Materials and Methods: Forty one patients (15M, 26F, 22-64 y/o) with suspected intracranial aneurysm underwent high spatial resolution 3D contrast-enhanced MR angiography (CE-MRA) and CT angiography (CTA). CE-MR angiography was performed on a 3.0T MR system (Magnetom Trio, Siemens). A combination of 16 elements array coil [(head n=12), neck (n=4)] was used for signal reception. After intravenous injection of 0.15mmol/kg of Gd-DTPA (Magnevist, Schering) at 1.2ml/s, high-spatial resolution 3D CE-MR angiography of the entire supra-aortic arteries was performed in coronal plane using a fast 3D GRE sequence (TR/TE: 3/1.2 ms, FA: 20º, BW: 720 Hz/pixel, field of view: 360 x 240 mm, image matrix: 576 x 324, 120 partitions with slice thickness of 0.8mm). By applying generalized autocalibrating partially parallel acquisitions (GRAPPA) algorithm **(1)** with an acceleration factor of 4 in phase encoding direction, CE-MRA images were acquired over 20 seconds, achieving a spatial-resolution of 0.7 x 0.7 x 0.8 mm³. CTA images were acquired with spatial resolution of 0.35 x 0.35 x 0.8mm³ on a 16-slice CT scanner (Somatom Sensation 16, Siemens) in 17 seconds. Both CE-MRA and CTA images were evaluated independently by 2 neuroradiologists for image quality, presence of aneurysm, and aneurysm characterization. The aneurysm dimensions were measured independently at both modalities. Interobserver and intermodality agreement was evaluated by kappa and Spearman rank coefficient. For quantitative analysis, Bland-Altman plots were prepared, and the correlation coefficient (*r*) and 95% confidence interval were calculated.

Results: A total of 25 aneurysms (in 18 patients) were identified by both CE-MRA and CTA. A comparative analysis of aneurysm detection and depiction showed excellent interobserver agreement for both CE-MRA (κ =0.81) and CTA (κ =0.91) images. There was a good intermodality agreement between CE-MRA and CTA for qualitative assessment of aneurysm depiction (κ =0.78), with significant correlation (Rs =0.92; 95% CI: 0.88, 0.95). There was no statistically significant difference between CE-MRA and CTA for quantitative measurements of aneurysm size (p=0.52). Bland-Altman plot shows differences of no more than 1 mm between aneurysmal dimension measurements on CE-MRA and measurements on CTA **(diagram)**. There was significant correlation for the dimensional measurements of neck and all three orthogonal diameters of sac between CTA and CE-MRA (r= 0.94, 95% CI: 0.92 to 0.97) **(diagram)**.

Conclusion: CE-MRA at 3.0T can reliably be used for the evaluation and characterization of intracranial aneurysms, with comparable results to multi-slice CTA and without the known drawbacks of radiation exposure, potential nephrotoxicity from intravenous iodine contrast agents.

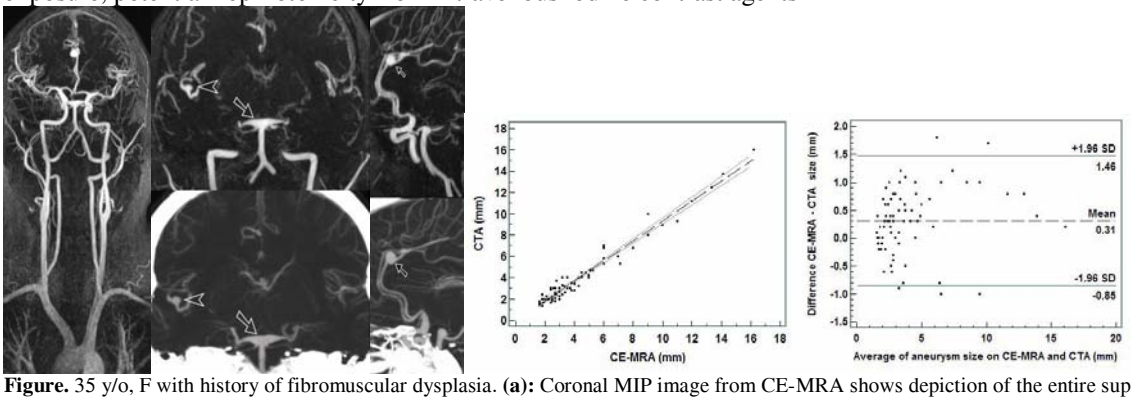

Figure. 35 y/o, F with history of fibromuscular dysplasia. **(a):** Coronal MIP image from CE-MRA shows depiction of the entire supra-aortic arteries. **(b):** Coronal and sagittal MIP images from CE-MRA **(upper row)** and CTA **(lower row)** show three aneurysms including one saccular aneurysm at distal right middle cerebral artery (M2 segment) (arrowheads), one saccular aneurysm at the left anterior cerebral artery (A2 segment) (black arrows) and one fusiform aneurysm at basilar artery tip (white arrows). CTA was acquired with 0.35 x 0.35 x 0.8 mm³ voxels in 17s and MRA was acquired with 0.7 x 0.7 x 0.8 mm³ voxels in 20s.

References:

1. Griswold, M.A., P.M. Jakob, R.M. Heidemann, et al., *Generalized autocalibrating partially parallel acquisitions (GRAPPA).* Magn Reson Med, 2002. 47(6): p. 1202-10.