

The usefulness of the inflow enhanced inversion recovery fast spin echo (IFIR-FSE) for supraaortic artery imaging

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Target Audience: The scientists, physicians, and technologists who are interested in noncontrast enhanced MR angiography for the evaluation of the cerebrovascular diseases.

Introduction: CT angiography (CTA) and dynamic contrast-enhanced MR angiography (CE-MRA) have been widely used to evaluate supraaortic arteries. However, contrast-enhanced agent cannot be used for CTA or MRA when patients have low renal function or history of adverse reactions to contrast media. 3D time of flight (TOF) technique is used as one of the standard techniques for Non-contrast enhanced (NC) MRA in the brain and is also used for neck arteries. NC MRA with an investigational version of inflow inversion recovery fast spin echo (IFIR-FSE), which is based on inflow effect during inversion time of inversion recovery, is expected to be useful in the assessment of supraaortic arteries.¹ The purpose of the study was to evaluate the visualization of supraaortic arteries and the detection of their stenotic lesions using NC MRA with IFIR-FSE in comparison of NC MRA with 3D TOF and CE-MRA.

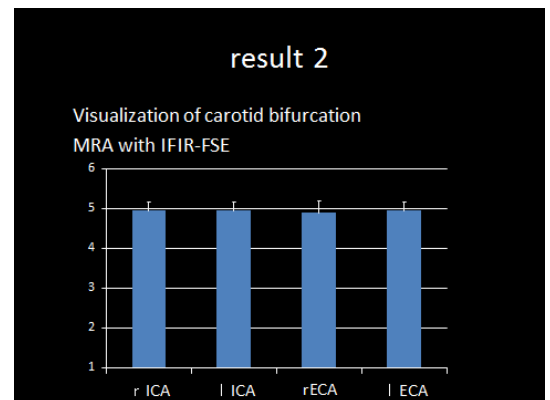
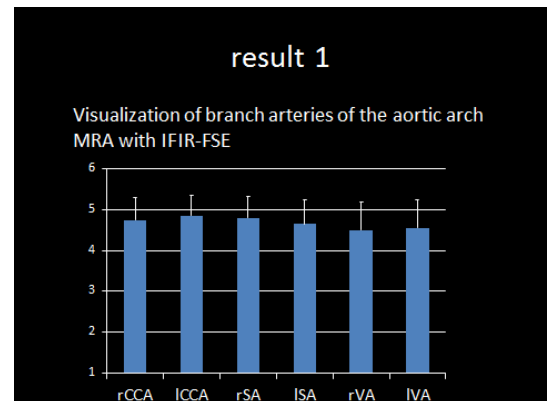
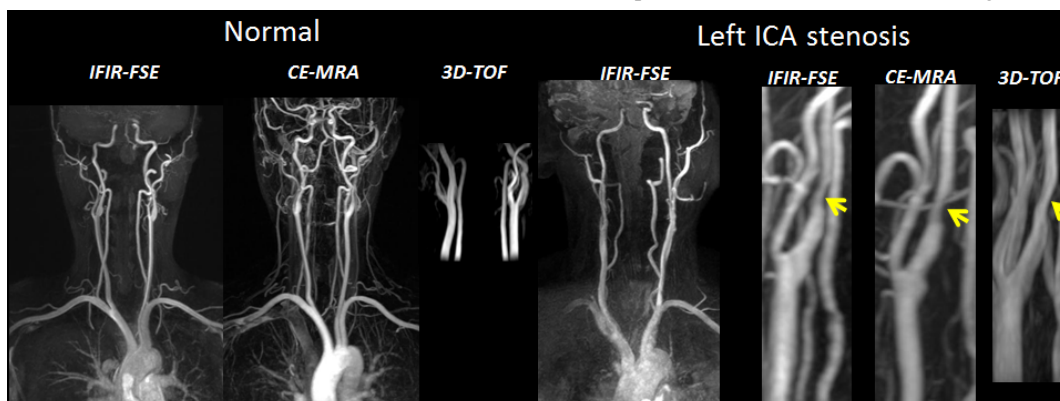
Materials and methods: This study was approved by the institutional review board in our hospital.

Patients: From December 2011 to September 2012, twenty patients who underwent MR imaging on a 3T magnet for the evaluation of the supraaortic arteries were included (12 males, average age = 66.1y, range 17 – 82y). Informed consent was obtained from all the patients. **MR imaging:** A 3T MR magnet (Discovery MR750, GEHC) was used with phased array head and neck coil. All patients underwent head and neck MR imaging including two NC MRAs followed by CE-MRA. MRAs were as follows; 1) NC MRA with IFIR-FSE was performed in a coronal plane covering from the aortic arch to the circle of Willis using peripheral pulse gated 3D FRFSE technique (TR/TE, 3000-4000/30 ms; flip angle, 90°; Slice Thickness = 1.4mm; acquisition time, about 3 minutes). 2) NC MRA with 3D-TOF was performed in an axial plane in the coverage of cervical common carotid artery (CCA) and carotid bifurcation (24/3.1 ms; flip angle 20°; 1.6mm; 2.5 minutes). 3) **CE-MRA:** CE-MRA using EFGRE (GEHC) was acquired in a coronal plane using elliptical centric phase-encoding technique (5.1/1.8 ms; flip angle 25°; 1.4mm; 1.2minutes) with an injection of 2-mL/kg Gd-DTPA followed by 20-mL saline (3 mL/s). **Assessment:** The following points were evaluated; (1) Visualized range of internal carotid artery (ICA) on NC MRA with IFIR-FSE. (2) Visualization at the origin of bilateral CA, vertebral artery (VA), and subclavian artery (SA) (5-point scale) and presence or absence of stenosis (>50%stenosis) compared to CE-MRA. (3) Visualization at carotid bifurcation (5-point scale) and presence or absence of ICA stenosis compared to CE-MRA and NC MRA with 3D-TOF.

Results: (1) ICA was visualized up to C5 for 15 patients, carotid siphon for one, and more for 4 patients. (2) The origin of arch's branches were well visualized (4.7±0.6, overall) (result.1). Stenotic lesions were found in the same 6 patients on both NC MRA with IFIR-FSE and CE-MRA. (3) Carotid bifurcations were visualized well in most of cases (4.9±0.2). In all 8 cases, ICA stenoses were found on NC MRA with IFIR-FSE, NC MRA with 3D-TOF, and CE-MRA. Two false positive cases were found on NC MRA with the IFIR-FSE (Sensitivity/Specificity/positive predictive value (PPV)/negative PV (NPV); 100/93.8/80/100%).

Discussion: NC MRA with IFIR-FSE could visualize large areas of the supraaortic arteries with good image quality and showed high NPV for detection of the vascular stenosis. Thus, NC MRA with IFIR-FSE indicates the potential to be useful as screening technique without use of contrast medium. Stenosis of the arteries might be possibly overestimated on NC MRA with IFIR-FSE, which is problematic in other NC MRA for the other areas due to turbulence flow. When the vascular stenosis is suspected on NC MRA with IFIR-FSE in screening, further study can be performed with high resolution scanning of diseased segment.

Conclusion: NC MRA with IFIR-FSE can be used to evaluate supraaortic arteries with a wide coverage of imaging.



References 1 Takei N, Miyoshi M, Kabasawa H, J Magn. Reson. Imaging 2012;35:957-962