Non-contrast-enhanced MR angiography of the carotid arteries and aortic arch using Inherent Enhancement (Inhance) Inflow IR, adopting peripheral-gated partial-Fourier fast spin echo (FSE) or steady-state Free Precession (FIESTA) : A comparison with contrast MRA

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INTRODUCTION: In order to evaluate entire carotid arteries, gadolinium-contrast-enhanced dynamic MR angiography with 3D gradient echo sequence has been one of the most useful and non-irradiated methods in a short period of time. However, non-contrast examinations must be chosen when patients have contraindications to use intravenous contrast agents such as bronchial asthma and severe renal insufficiency. Several approaches have been introduced for neck vessels[1]. To depict a specific blood and separate one-way blood flowing into the slab from undesired blood, currently we used to . an investigational version of the Inherent Enhancement (Inhance) inflow IR pulse sequence[2], in which selective inversion recovery pulse was applied to tag a specific blood and non-selective inversion recovery pulse was applied to suppress background tissues in a non-subtractive fashion. The purpose of our study was to evaluate non-contrast MRA of the carotid arteries and aortic arch with combined assessment of two MR imaging --- 3D Inhance Inflow IR FSE sequence and 3D Inhance Inflow IR FIESTA sequence --- and to compare with contrast-enhanced 3D MRA.

METHODS: Thirty-four patients with cerebrovascular disease (male: 26, female: 8 mean age 65 years-old) including 18 internal carotid artery stenoses were evaluated with non-contrast enhanced 3D MRA using an investigational version of Inhance Inflow IR FSE, FIESTA and contrast-enhanced MRA using an elliptic centric view ordering with fluoroscopic triggering. All studies were performed on 1.5T MRI system (Signa HDe or HDx, GE Healthcare) using HDNV Array coil. The parameters of 3D Inflow IR FSE were as follows; coronal images covered carotid arteries from aortic arch, TR/TE: 2600-4300 / 134-137 msec, Slice thickness: 2 mm, FA: 90 degree, matrix: 256x224, FOV 30x30cm, ASSET (reduction factor 2), with peripheral gating technique. The parameters of 3D Inflow IR FIESTA were as follows; axial images focused on carotid bifurcation, TR / TE: 6.3 / 3.2 msec, Slice thickness: 1.6 mm, FA: 70 degree, matrix: 256x192, FOV: 20x20 cm, ASSET (reduction factor 2), with peripheral gating technique. The parameters of contrast-enhanced 3D MRA were as follows; coronal images covered carotid arteries from aortic arch, TR/TE: 5.2/1.8 msec, Slice thickness: 1.4 mm, FA: 20 degree, matrix: 256x256, FOV 30x30cm, ASSET (reduction factor 2). Fuoro-Triggered contrast-enhanced 3D MRA was performed with elliptic centric view ordering. Contrast material was injected with a power injector at 3 ml/sec, followed by 20ml of a saline solution at a rate of 3ml/sec. All images were evaluated using MIP technique on a cine display. We compared the combination of non-contrast 3D Inhance Inflow IR FSE & FIESTA MRA assessment with contrast-enhanced MRA (CE MRA). The qualitative assessment of overall image quality, visualization of vessels was conducted using a 5-point scale. The visualization of vessels was focused on aortic arch and carotid bifurcation respectively.

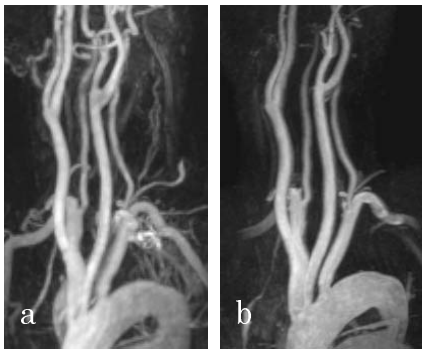

Fig.1 MIP images for 63-year-old man without carotid artery stenosis. Contrast-enhanced MRA (a), and Inhance Inflow IR FSE MRA (b) images show bilateral carotid arteries from aortic arch.

RESULTS: Inhance Inflow IR FSE & FIESTA MRA images had a high score (4.1+-1.0) for overall image quality as well as CE MRA (4.5+-0.6). Inhance Inflow IR FSE & FIESTA MRA images had a high score (4.7+-0.6) for visualization of carotid bifurcation as well as CE MRA (5.0+-0), and had a high score (4.0+-1.0) for visualization of aortic arch as well as CE MRA (4.5+-0.6). All 18 internal carotid artery stenoses were delineated clearly by both Inhance Inflow IR FSE & FIESTA MRA images and CE MRA images.

SUMMARY AND CONCLUSION: The combination of Inhance Inflow IR FSE & FIESTA MRA assessment can provide information identical to that with contrast-enhanced MRA without contrast material.

REFERECCES:: [1] D. Nishimura et al., MRM, 7472 (1988)

[2] N.Takei et al., the proceedings of ISMRM, 3420 (2008)

Fig.2 MIP images for 38-year-old man with rt. internal carotid artery occlusion. Contrast-enhenced MRA (a), and Inhance Inflow IR FSE MRA (b) images show rt. internal carotid artery occlusion clearly.