

## CLINICAL APPLICATION OF THE HIGH RESOLUTION MR INTRACRANIAL VESSEL WALL IMAGING

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### Purpose

Compared with conventional MR imaging and MR angiography, high resolution (HR) MR intracranial vessel wall imaging can acquire high quality images that could depict intracranial arterial wall. Although the interpretation of intracranial vessel wall images on HR-MRI could not be based on a comparison between HR-MRI and matched *in vivo* histology, HR-MRI could be interpreted with the similar way as that for carotid or coronary artery image. HR MR intracranial vessel wall imaging could demonstrate the various intracranial conditions such as stable or unstable atherosclerotic stenosis, vasculitis, dissection and perforating artery disease. In this presentation, we will review the basics, protocols and clinical application of the HR contrast enhanced MR intracranial vessel wall imaging.

### Outline of Content

\*\*Basic and protocols of for high resolution contrast enhanced MR intracranial vessel wall imaging

HR 2D T1WI, T2WI, PDWI, 3D black blood T1WI, 3D black blood T1WI with contrast enhancement and 3D FLAIR VISTA

### \*\*Unstable atherosclerotic stenosis

Eccentric intracranial artery stenosis is related to atherosclerotic disease and the enhancement that has been correlated with plaque inflammation and instability may represent unstable plaque. Expansive remodeling was also seen more frequently in patients with unstable plaque.

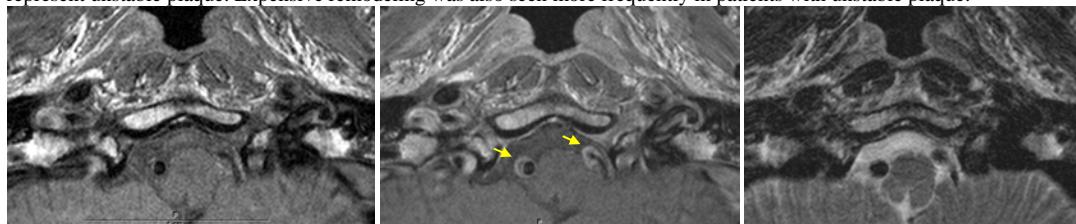


Fig. HR MRI demonstrate eccentric wall thickening with enhancement in both distal vertebral artery. Whereas left distal vertebral artery shows significant atherosclerotic stenosis, right vertebral artery shows atherosclerotic plaque without significant stenosis due to expansive remodeling.

### \*\*Stable atherosclerotic occlusion

Constrictive remodeling was seen more frequently in patients with stable stenosis, whereas expansive remodeling was observed more frequently in patients with unstable vascular disease. Constrictive remodeling, while playing a role in accelerating the narrowing of lumen, was associated with stable features, such as less lipid content, more intraplaque fibrous content, and thick intima.

### \*\*Vasculitis

In contrast to the pattern seen in patients with atherosclerotic stenosis, patient with vasculitis showed a smooth, diffuse, concentric pattern of enhancement.

### \*\*Intracranial artery dissection

Intracranial dissection had a similar pattern to atherosclerosis, including eccentric wall thickening with enhancement. HR MRI could demonstrate dissecting flap and vascular ectasia at the segment of the arterial dissection. Other distinguishing feature is bright wall component on nonenhanced T1 and FLAIR sequences (indicating methemoglobin in the arterial wall), as well as visualization of a false lumen.

### \*\*Normal appearing angiography in patients with brain stem infarction on 3D TOF MRA

Occasionally, we can see the lenticulostriatal or brain stem infarction without any abnormality on TOF MR angiography by virtue of expansive remodeling or too small vessel wall disease. HR MRI could demonstrate wall enhancement or thickening in some patients with these infarctions.

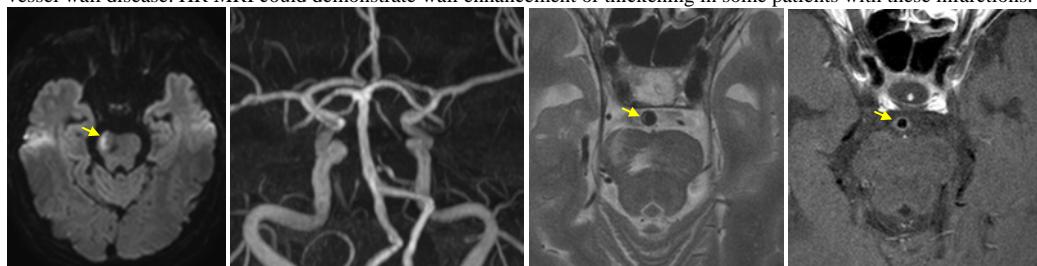


Fig. Diffusion weighted image shows focal acute infarct in the right portion of midbrain without any significant abnormality on TOF MRA. HR MRI shows focal thickening and enhancement at the right side of the upper basilar artery corresponding infarct area.

### \*\*The usefulness of 3D FLAIR VISTA image for intracranial vessel wall imaging.

3D FLAIR VISTA MR imaging that can acquire high quality images is very sensitive for hemorrhage or fluid with high protein contents. On contrast enhanced T1 weighted image, intraluminal flow stasis due to severe stenosis or dissection could be demonstrated as intraluminal high signal intensity that could make misunderstand enhanced active plaque. 3D FLAIR VISTA MR image could be helpful to differentiate intravascular stagnant blood from plaque enhancement. 3D FLAIR VISTA MR image is also helpful to detect intramural hematoma or intraplaque hemorrhage.

### Summary

HR MR intracranial vessel wall image could depict intracranial vessel wall and its pathology in ischemic stroke and TIA patients. High-resolution, multisequences have the potential to characterize the pathology in the intracranial artery and may be a useful modality for evaluating the degree of stenosis. Also, this sequence makes it possible to depict some pathology in the vessel wall without conventional angiographic abnormality.