Feasibility of High-resolution MR Imaging for the Diagnosis of Arterial Dissection Involving the Intracranial Vertebrobasilar System

Jin Wook Choi[1], Miran Han[1], Sun Yong Kim[1], and Nae Jung Lim[1]
[1]*Radiology, Ajou University School of Medicine, Suwon, Gyunggido, Korea*

PURPOSE: Arterial dissection is a significant cause of stroke in younger patients[1]. A safe and feasible tool for early diagnosis is needed to prevent neurologic sequelae.[2,3,4] This study aimed to evaluate the feasibility of high resolution (HR) MRI to diagnose arterial dissection involving the intracranial vertebrobasilar system.

METHODS: We retrospectively reviewed 43 patients who underwent HR-MR imaging between March 2012 and March 2013. The intracranial vertebrobasilar system was tentatively diagnosed clinically and radiologically. Two neuroradiologists reviewed the HR-MR images (PDWI; T1WI; T2WI; contrast enhanced(CE) T1WI) for indications of dissection; i.e., mural hematoma or a dissection flap. On T2WI, the outer diameter enlargement of the affected vessel presented as steno-occlusive lesions on angiography and was also recorded as a sign of dissection.

RESULTS: Twenty-six dissecting lesions were diagnosed on HR-MR imaging. A mural hematoma was observed in 12/26 (46%) lesions on PDWI, 12/26 (46%) on T2WI, 20/26 (77%) on T1WI, and 16/22 (73%) on CE-T1WI. A dissection flap was seen in 10/26 (38.5%) lesions on PDWI, 18/26 (69%) on T2WI, 17/26 (65%) on T1WI, and 21/22 (95.5%) on CE-T1WI. Outer diameter enlargement was detected in 17/26 (65%) lesions on T2WI.

DISCUSSION: Although conventional angiography is considered the standard diagnosis tool for arterial dissection, direct signs of dissection (i.e., intimal flap or double lumen) are seen in less than 10% of cases.[3] Also, it is an invasive procedure with complications ranging from a minor groin hematoma to severe neurological deficits. Particularly, in the case of dissection, increased arterial pressure from the contrast injection during conventional angiography may aggravate an existing dissection or cause a new infarction due to migration of the thromboembolism. Therefore, non-invasive studies are highly recommended.[5] In our results, mural hematomas were detected in 77% of dissection lesions on T1WI. In contrast, dissection flaps, the most direct evidence of dissection, were observed in 95.5% of lesions on CE-T1WI. Therefore, we propose that dissection flaps are more reliable for the diagnosis of dissections, and CE-T1WI is a requisite modality for intracranial dissection MR. Most patients with dissections demonstrate a complete clinical recovery; however, there is an approximately 10–12% overall risk of death, recurrent TIAs, or stroke. The risk of recurrent spontaneous dissection is also 2% within the first month.[3] Therefore, follow-up imaging may be needed, especially for dissections showing aneurysmal changes. HR-MRI can be useful not only in the initial diagnosis but also for follow up.

CONCLUSION: This study investigated the efficacy of HR-MRI in the diagnosis of intracranial arterial dissection involving the vertebrobasilar system, including PICA dissections. Dissections were well visualized on HR-MR imaging even in patients who presented with only occlusions or stenosis on angiography. In conclusion, HR-MR imaging is likely a useful and non-invasive diagnostic tool for diagnosis of arterial dissection involving the vertebrobasilar system, including PICA dissections.

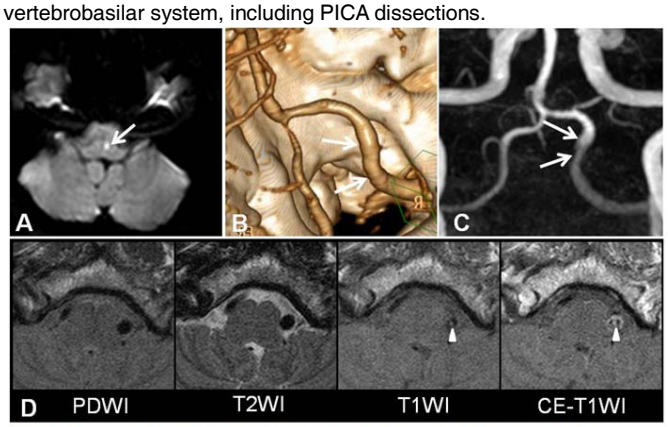

Fig. 1. a 56-year-old male who complained of dizziness, vomiting, and gait disturbance. CTA and MRI was performed 1 day after symptom onset. (A) DWI shows a focal high signal intensity lesion (arrow) at the left paramedian medulla. (B) CTA and (C) TOF-MRA of the left vertebral artery (VA) shows mild stenosis followed by fusiform dilatation (arrows). Among

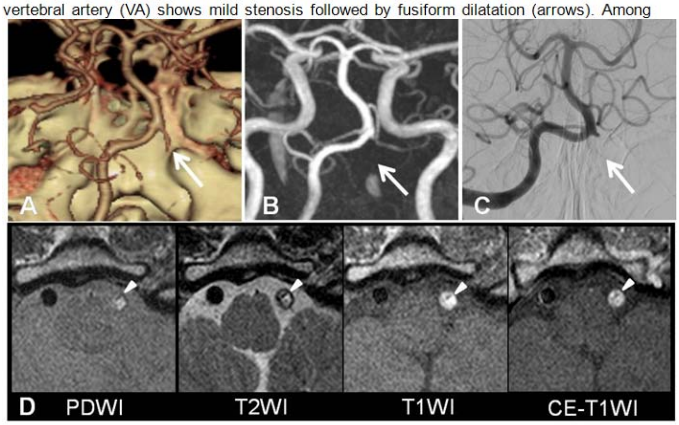

Fig. 2. a 56-year-old male who complained of posterior headache and did not have a brain parenchymal lesion. CTA, DSA, and MRI were obtained 15 days after symptom onset. (A) CTA, (B) TOF-MRA, and (C) DSA show occlusion of the left VA (arrows). At the occluded segment of VA, not only a high signal intensity hematoma but also a dissection flap (arrowheads) is apparent on all HR-MR images (D).

REFERENCES:
1. Schievink WI. Spontaneous dissection of the carotid and vertebral arteries. The New England journal of medicine. 2001;344:898-906
2. Takano K, Yamashita S, Takemoto K, Inoue T, Kuwabara Y, Yoshimitsu K. Mri of the intracranial vertebral artery dissection: Evaluation of intramural haematoma using a black blood, variable-flip-angle 3d turbo spin-echo sequence. Neuroradiology. 2013;55:845-851
3. Mohan IV. Current optimal assessment and management of carotid and vertebral spontaneous and traumatic dissection. Angiology. 2013
4. Provenzale JM, Sarikaya B. Comparison of test performance characteristics of mri, mr angiography, and ct angiography in the diagnosis of carotid and vertebral artery dissection: A review of the medical literature. AJR. American journal of roentgenology. 2009;193:1167-1174
5. Engelter ST, Brandt T, Debette S, Caso V, Lichy C, Pezzini A, et al. Antiplatelets versus anticoagulation in cervical artery dissection. Stroke; a journal of cerebral circulation. 2007;38:2605-2611

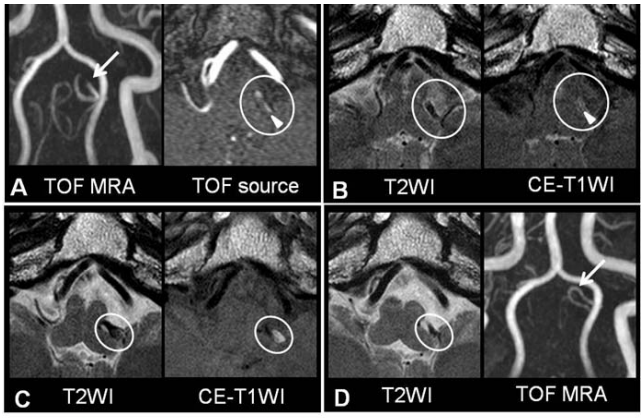

Fig. 3 a 33-year-old male who complained of headache and sensory changes. Initial MRA and MRI were obtained 2 days after symptom onset. (A) TOF-MRA shows stenosis and dilatation (arrow) of the left PICA. An intimal flap was seen on the source image of TOF-MRA (arrowhead). (B) Dissection affecting the lateral medullary segment of the left PICA was confirmed on HR-MR imaging (lesion inside the white circles, dissection flap-arrowheads). (C) In the follow-up study 4 months later, aneurysmal dilatation of the previous dissecting lesion was detected. All HR-MRI sequences, PDWI, T2WI, T1WI, and contrast-enhanced (CE) T1WI show luminal dilatation and an intraluminal high-signal-intensity hematoma (lesion inside the white ellipses). (D) In the most recent follow-up images 7 months after the initial diagnosis, the aneurysmal dilatation was normal on HR-MR images and TOF-MRA (lesion inside the white ellipses).