Evaluation of the Arterial Wall in Vertebrobasilar Artery Dissection Using High-Resolution Magnetic Resonance Vessel Wall Imaging

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Background: High-resolution magnetic resonance vessel wall imaging (HRMR-VWI) has been used to explore vascular diseases such as vasculitis and vulnerable plaque of intracranial arteries. Although vessel wall inflammation is suspected as one of the causes of cerebral arterial dissection, there have been few reports regarding the application of HRMR-VWI to arterial dissection. We have therefore evaluated the efficacy of HRMR-VWI in patients with vertebrobasilar artery dissection. *Methods:* HRMR-VWI was performed on 5 patients who had been diagnosed with nonhemorrhagic vertebrobasilar artery dissection. *Result:* Four patients exhibited vessel wall enhancement on HRMR-VWI, the range of which corresponded with the dissection sites identified by cerebral angiogram, magnetic resonance imaging, or magnetic resonance angiography. The enhancements observed in all cases were extensive as compared with the findings of conventional angiography. *Conclusion:* HRMR-VWI is thought to elucidate the condition of the affected vessel wall more in detail as compared with conventional methods. **Key Words:** Cerebral arterial dissection—high-resolution magnetic resonance imaging—vessel inflammation—vessel wall imaging.

Introduction

Vertebrobasilar artery dissection is known to contribute to subarachnoid hemorrhage or cerebral infarction. Multimodal diagnostic approaches such as digital subtraction angiography (DSA), time-of-flight magnetic resonance angiography (TOF MRA), and computed tomography angiography have been used in diagnosis.[1,2] These imaging techniques reveal flow patterns and provide information about the vascular lumen. However, these imaging modalities can only be used to evaluate the vessel configuration, not the vessel wall.

High-resolution magnetic resonance vessel wall imaging (HRMR-VWI) was reported to explore vascular diseases such as vasculitis and intracranial vulnerable plaque. An enhanced lesion on HRMR-VWI is thought to indicate vessel wall inflammation by pathological[3] or clinical verification.[4,5]

Vessel wall inflammation is proposed as one of the causes of arterial dissection, but there have been few reports regarding the application of HRMR-VWI to arterial dissection.[6] In the present study, we have therefore evaluated the efficacy of HRMR-VWI in patients with cerebral arterial dissection.

Patients and Methods

Five patients diagnosed with nonhemorrhagic vertebrobasilar artery dissection at the Nagahama City

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Hospital in Japan were enrolled in the present study. This study was approved by the Ethics Committee in Nagahama City Hospital. Informed consents for this study were obtained from patients or their family. The diagnosis was made by using DSA and conventional magnetic resonance imaging (MRI) sequences (T1WI, T2WI, and MRA). HRMR-VWI was performed on Skyra3.0-T scanner with a 32-channel head coil (Siemens Healthcare, Erlangen, Germany). The HRMR-VWI protocol used in the study is described in the previous study.[7]

The scan included TOF MRA and T1-weighted black blood vessel wall MRI sequencing involving a turbo spin echo acquisition with a field of view = 16 × 16 cm, acquired matrix = 512 × 512, slice thickness = 2 mm, total slab thickness = 48 mm, and repetition time or echo time of 590/10 ms before and after the intravenous administration of gadolinium (constant scan parameters were maintained).

The range of arterial dissection was defined as the range of the intimal flap, arterial stenosis and/or dilatation, fusiform aneurysm, or thrombus on neuroimaging studies other than HRMR-VWI.

Results

Of the 5 patients included in this series, 4 suffered from vertebral artery dissection and the remaining 1 from a basilar artery dissection. All patients were male with a mean age of 50 years (range = 39-71 years). The initial symptoms were neck pain in 3 patients (cases 1, 3, and 5) and cerebral infarction in 2 patients (cases 2 and 4). All patients received medical therapy such as blood pressure control or oral antiplatelet drugs. The patients' clinical profiles are summarized in Table 1.

In HRMR-VWI, 4 patients (cases 1, 2, 3, and 4) exhibited vessel wall enhancement at the dissecting lesions whereas 4 patients (cases 1, 2, 3, and 5) exhibited vessel wall enhancement proximal and/or distal at the dissecting lesions.

As shown below, all cases showed the eccentric enhancement pattern.[8]

In all patients, vessel wall enhancement was not observed in the anterior circulation.

Case Presentations

Case 1

A 41-year-old man experienced sudden onset of neck pain while driving his car. His neck pain spread upward to the occipital area, having him visit our hospital. He did not have any neurological problems. He was diagnosed with left vertebral artery dissection based on DSA and MRA (Fig 1, A). HRMR-VWI revealed vessel wall enhancement not only at the dissecting site but also proximal to it (Fig 1, B,C).

Case 2

A 58-year-old man visited our outpatient clinic because of vertigo lasting for a couple of days. A left cerebellar infarction was found on MRI. Volume rendering MRA revealed near occlusion of left vertebral artery and an irregular vessel wall in the right vertebral artery (Fig 2, A). HRMR-VWI revealed vessel wall enhancement in the bilateral vertebral arteries (Fig 2, B,C).

Case 3

A 45-year-old man referred to our hospital because he suffered from neck pain lasting for 3 weeks. DSA and MRA revealed fusiform dilatation of the left vertebral artery (Fig 3, A), and the patient was therefore diagnosed with a dissecting aneurysm of the left vertebral artery. HRMR-VWI revealed vessel wall enhancement of the proximal parent artery as well as the intra-aneurysmal wall (Fig 3, B,C).

Case 4

A 39-year-old man experienced pain on the left side of the neck and vertigo while driving a car. He visited our outpatient clinic because of the lingering neck pain. MRI and MRA revealed a left vertebral artery dissection with intramural hematoma (Fig 4, A). HRMR-VWI revealed vessel wall enhancement both proximal and distal to the intramural hematoma (Fig 4, B,C).

Table 1. *Clinical profile of 5 patients with vertebrobasilar dissection*

Age/sex	Symptom/diagnosis	Site of dissection	Enhanced site
① 40 years old/M	Neck pain	Left VA	The dissecting site, proximal to dissecting site and contralateral VA
② 56 years old/M	Cerebellar infarction	Left VA	The distal to dissecting site and contralateral VA
③ 45 years old/M	Neck pain	Left VA (dissecting aneurysm)	Aneurysm and proximal to aneurysm
④ 71 years old/M	Pontine infarction	Upper BA	The dissecting site and both VA
⑤ 39 years old/M	Neck pain	Left VA	Proximal and distal to dissecting site

Abbreviations: BA, basilar artery; F, female; M, male; VA, vertebral artery.