Diagnosis of Vertebral Artery Dissection by Basi-parallel Anatomical Scanning (BPAS) MRI

H. TAKADA, T. HYOGO, T. KATAOKA, K. HAYASE, H. NAKAMURA

Department of Neurosurgery, Nakamura Memorial Hospital, Sapporo, Japan

Key words: vertebral artery dissection, MRI-BPAS

Summary

To diagnose VA dissection, MRA or cerebral angiography, which provides information regarding intra-vascular space, has been performed. We report the acquisition of various information about VA dissection using MRI-BPAS, which is a new diagnostic method.

Introduction

Symptoms of vertebral artery (VA) dissection involving subarachnoid haemorrhage, cerebral infarction or headache, neck pain, and colorful visual images are known. It is considered that the frequency has increased recently with progress in the diagnostic apparatus available and elucidation of the pathology of VA dissection. However, on neuroradiological study, it is difficult to demonstrate findings reflecting a colorful condition, and diagnose VA dissection. On cerebral angiography, double lumen and dissecting intimal flap on direct view, and pearl and string sign are considered highly specific. Fusiform dilatation on cerebral angiography is useful for diagnosis of VA dissection at the entry only. Moreover, the differential diagnosis in the presence of arteriosclerosis, which shows stenosis or occlusion or other non-specific findings is difficult in many cases.

In this paper, we report the diagnosis, and natural course of vertebro-basilar artery dissec-

tion by observing the outer appearance of the intracranial vertebro-basilar artery in Basi-parallel-Anatomical-Scanning (BPAS)¹ which is an imaging method using MRI, while simultaneously observing the internal space by MRA or cerebral angiography.

Magnetic Resonance Images

All patients underwent imaging with the same 1.5-tesla MR unit (MAGNETOM Symphony; Enlargen, Germany). Two-cm-thick heavily T2-weighted coronal imaging using the fast spin-echo sequence with gray-scale reversal in post-processing were obtained (6000/1050/2 (TR/TE/average), Turbo-factor 256, FOV 216*216, matrix 256*256, interpolation 512*512, scan time 12 sec).

Representative Case

Case 1

A 48-year-old female had Wallenberg syndrome. MRI showed a high intensity area in the outer area of the left medulla oblongata, while MRA showed dilatation of the left VA. Left vertebral angiogram (VAG) demonstrated pearl and string sign (figure 1a). We diagnosed brain stem infarction with left VA dissection. On MRI-BPAS, the whole portion considered to be the beginning of a lesion on cerebral an-

Figure 1 A) left vertebral angiogram (VAG). B) MRI-BPAS. C) follow-up left VAG at one month, the proximal notch was dilated (arrows). D) follow-up MRI-BPAS at one month. E) follow-up MRA at two months. F) follow-up MRI-BPAS at two months.

giography was regarded as a uniform dilatation involving the not only stenotic lesion but also dilative lesion (figure 1B). On follow-up cerebral angiography at one month, the proximal notch was dilated showing aneurysmal change (figure 1C). On follow-up MRI-BPAS, the same portion was dilated but on cerebral angiography, it was slightly changed (figure 1D).

Two months later, follow MRA demonstrated that the peripheral lesion was slightly dilated (figure 1E), it was recognized that the lesion was slightly dilated on MRI-BPAS (figure 1F).

Case 2

A 63-year-old male demonstrated Wallenberg syndrome. MRI (DWI) showed a high in-

Figure 2 A) MRA showed right VA occlusion. B) On right VAG, the right VA was occluded at the extracranial portion. C) On MRI-BPAS, the right VA was wholly dilated.

tensity area in the outer area of right medulla oblongata. MRA showed right VA occlusion (figure 2A). The right VA was occluded at the extracranial portion on right VAG (figure 2B). On MRI-BPAS, the right VA was wholly dilated from the intracranial penetrating part to the VA union (figure 2C). We diagnosed acute VA occlusion by VA dissection.

Case 3

A 67-year-old male was admitted at our hospital for examination of right cerebral infarction. The left VA appeared dilated like a dissecting aneurysm on MRA (figure 3A). On MRI-BPAS, this dilated vascular lesion showed the same appearance as on MRA. Aneurysmal dilatation was recognized as showing a smoother torus on MRI-BPAS and shifted smoothly to normal vessel (figure 3B).

Discussion

MRA, 3D-CTA, cerebral angiography are each methods of examining patients with cerebral vascular disease for cerebral aneurysm or cerebral infarction by visualizing the vascular lumen. A modality that shows the outer vascular appearance is thin slice MRI (sagittal view), but this is a tomographic method

and it is difficult for arterial dissection to be understood by the outer appearance. Moreover, there is not much need to use such a method, and it is not often performed in such patients compared to other methods.

Although MRI-BPAS could not observe a vascular cross section, the outer appearance of the vertebro-basilar artery can be shown over a relatively long distance, providing useful information that was not previously available¹.

The findings of VA dissection on MRI-BPAS is varied on MRA, and cerebral angiography. It is recognized that pearl and string sign on cerebral angiography is highly specific for VA dissection, while uniformly dilative vessels on

Figure 3 A) MRA showed like a dissecting aneurysm. B) MRI-BPAS.

BPAS-MRI include both dilative and stenotic vessels. Lesions recognized as fusiform aneurysm or saccular aneurysm showed a similar outer appearance of vascular dilatation on MRI-BPAS. However, the shift from vessel enlargement to normal portion was smoother, sloping gently rather than displaying internal space. None of the cases showed VA stenosis only. VA occlusion was recognized as showing uniform dilatation on MRI-BPAS. That is, the finding of VA dissection on MRI-BPAS is either uniformly dilatation in the external vessel appearance or a smooth fusiform aneurysm-like form.

Combining information about the internal vessel space by standard MRI or cerebral angiography with the outer vessel appearance on MRI-BPAS, findings of occlusion or stenosis on MRA or cerebral angiography, and dilatation of the outer vessel appearance on MRI-BPAS are highly specific. Dilative change is not usually apparent in atherosclerotic occlusion or stenosis. It is a new finding that pearl and string sign on cerebral angiography is demonstrated as diffuse vessel dilatation on MRI-BPAS. The cases showing fusiform aneurysm or saccular aneurysm appear similarly dilated on MRI-BPAS, and the specificity of the finding is low. However, smooth shift from vessel dilatation to a normal appearance may be a specific indication of VA dissection.

Dilatation of the outer vessel appearance on MRI-BPAS may more exactly indicate the pathological position and length than the findings on MRA or cerebral angiography.

In cases showing pearl and string sign, we noted changes on angiographical follow-up. In situation showing no remarkable findings on MRI-BPAS, we need to perform surgery to observe changes, especially progressive dilatation of the lesion, even cerebral ischemia. In such cases, the internal vascular change is extensive even though, outer vessel appearance on MRI-BPAS shows minimal change. Combination of angiographical follow-up changes and MRI-

BPAS follow-up changes may facilitate decision-making regarding treatment.

It is impossible to distinguish between atherosclerotic change or dissection in VA occlusion, but minute anamnesis and follow up may facilitate diagnosis. Combination with MRI-BPAS, when the occlusion site shows diffuse dilatation or fusiform dilatation, we could diagnose the as VA dissection with highly specificity.

MRI-BPAS can be obtained in a short time, does not require contrast agent, and does not depend on the ability of the MRI equipment. For these reasons, MRI-BPAS is indicated for patients those with mild symptoms, for example vertigo, headache, neck pain, to severe disease, brain stem infarction, subarachnoid haemorrhage and every patient suspected of VA dissection. Furthermore, MRI-BPAS would be useful for screening.

Conclusions

We described the findings, and diagnosis the VA dissection using MRI-BPAS, which is a new examination showing the outer vessel appearance. We conclude MRI-BPAS is useful for diagnosis of VA dissection. Furthermore, MRI-BPAS is a useful modality for VA dissection screening, follow up, and decision making during treatment.

References

- 1 Nagahata M, Hosoya T et Al: Basi-parallel Anatomical Scanning (BPAS) MRI. *Nippon Acta Radiologica* 63: 582-584, 2003.

H. Takada, M.D.
Department of Neurosurgery
Nakamura Memorial Hospital
Sapporo, Japan