

Bilateral Vertebral Artery Dissecting Aneurysms : A Long Term Follow-up Results of Microsurgical Trapping and Proximal Occlusion

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Regarding the bilateral vertebral artery (VA) dissecting aneurysms, treatment strategy remains controversial because there have not been enough cases to reach a conclusion on the best treatment. We present a patient underwent staged microsurgical trapping and endovascular coiling for each dissecting aneurysm of bilateral VA presenting subarachnoid hemorrhage (SAH). The ruptured side was managed by VA trapping procedure without any neurological deficit. Postoperative cerebral angiography revealed patent right PICA without filling of previous right dissecting aneurysm and spontaneous occlusion of the left dissecting aneurysm one month after trapping procedure. However, follow-up angiography revealed recanalization and growing of the left VA dissecting aneurysm one year after the operation. The patient underwent endovascular embolization using GDC for the proximal occlusion of the left VA and postoperative course was uneventful.

KEY WORDS : Bilateral · Dissecting · Aneurysm · Vertebral artery.

Introduction

Dissecting aneurysms of bilateral vertebral artery (VA) account for 7-17% of all dissecting aneurysms of the vertebral artery^{8,19,20}. Treatment strategy of bilateral VA dissecting aneurysms remains controversial and there have not been enough cases of bilateral VA dissecting aneurysms to reach a conclusion on the best treatment. One of the most important characteristics of bilateral VA dissections, in comparison with unilateral VA dissecting aneurysms, is variability of natural course. Provided ruptured unilateral dissecting aneurysm is treated first, dissecting aneurysm of contralateral side may have unpredictable courses by hemodynamic changes. We report a patient with bilateral VA dissecting aneurysms who underwent staged occlusion of the bilateral VA by combination of microsurgical and neuro-endovascular techniques for the best clinical outcome. The characteristics of bilateral VA dissections for the best surgical options and especially focused for the discussion with a review of literature.

Case Report

A 47-year-old woman was brought to ER with sudden loss of consciousness four years ago. She was semicomatose. Brain CT demonstrated subarachnoid hemorrhage at perimesencephalic cistern and enlarged ventricles with intraventricular hemorrhage (Fig. 1A). Four-vessel cerebral angiography revealed dissecting aneurysms of bilateral vertebral arteries. The right dissecting aneurysm showed large dilatation and extended to just proximal to the origin of the PICA (Fig. 1B). Left VA angiography showed more extended dissection involving the origin of PICA (Fig. 1C, D). Bilateral posterior communicating arteries were prominent and posterior cerebral arteries were visible on the both right and left ICA selections (Fig. 2A, B). It was difficult to identify which dissecting aneurysm had bled. Dissection of left VA was more extensive than right side and extended up to the vertebro-basilar (VB) junction. On the other hands, fusiform dilatation, strongly suggesting lesion of bleeding, was more prominent on the right side. We decided

• Received : November 3, 2006 • Accepted : March 6, 2007

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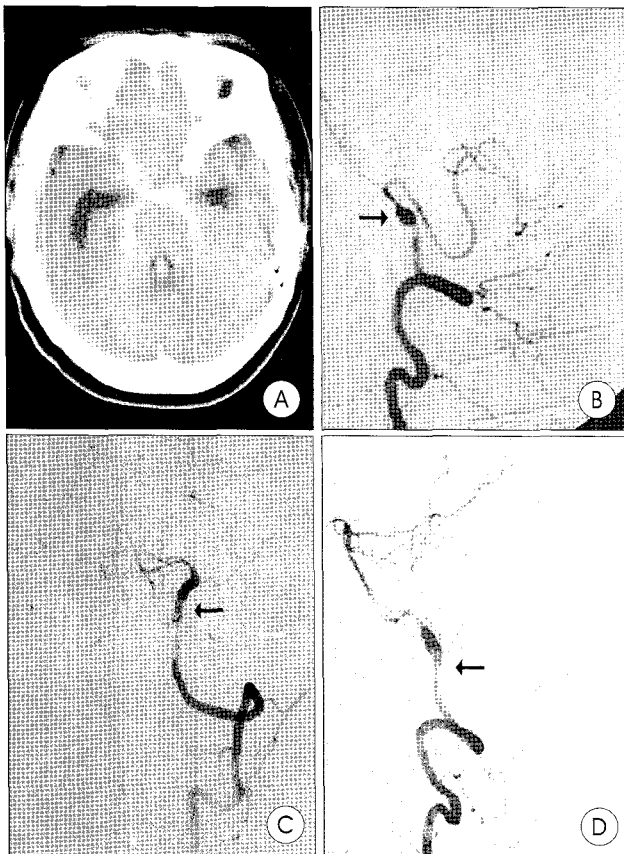


Fig. 1. A : Initial brain computed tomography showing subarachnoid hemorrhage at perimesencephalic cistern and intraventricular hemorrhage. B : Initial right vertebral angiography shows a dissecting aneurysm with large dilatation and stenosis extending to just proximal to the origin of posterior inferior cerebellar artery (arrow). C : AP view of the left vertebral angiography demonstrating a dissection (black arrow) involving the origin of posterior inferior cerebellar artery (white arrow). D : Lateral view of the left vertebral angiography revealing more extended dissecting aneurysm.

to trap the right dissecting aneurysm first based on the morphological characteristics of the aneurysm and the left dissection was supposed to follow-up for the formation of collateral flows. She was managed conservatively and recovered her consciousness to alertness.

On hospital day 17, microsurgical trapping for the right dissecting aneurysm was carried out with two aneurysm clips. Intraoperatively, the dissection was noted to extend to the origin of PICA and a spinal artery arose from just near the PICA. A proximal clip was positioned at 2 cm proximal to the PICA origin. A distal clip was placed just proximal to the PICA origin to save circulation through PICA and spinal artery. A postoperative angiography showed total occlusion of the right VA with good collateral circulation to the right PICA through the basilar artery (Fig. 2D). And, the aneurysm was completely obliterated by 2 clips except a small part of dissected lumen on origin of PICA. Left side dissection revealed no change since initial study. Early postoperative clinical course was uneventful. But urinary incontinence and weakness of lower extremities

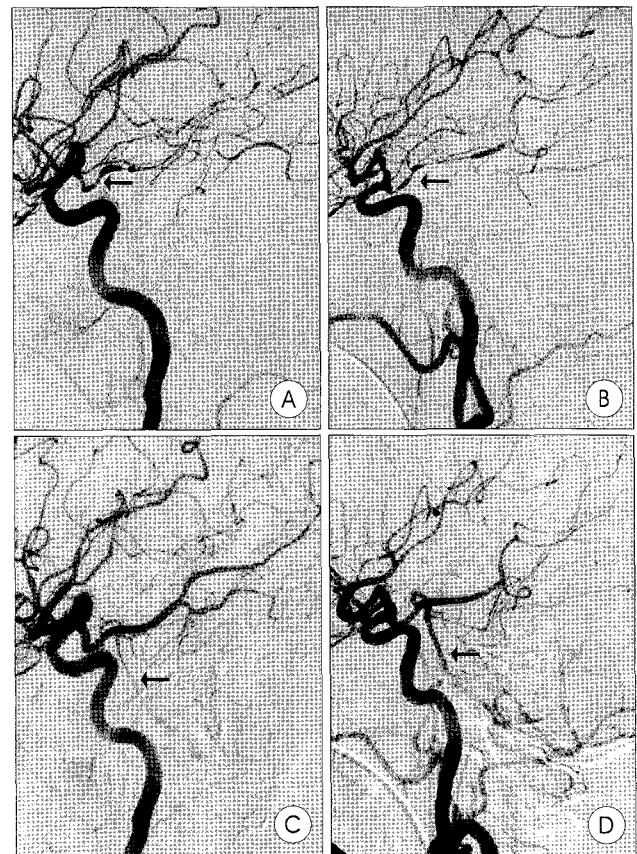


Fig. 2. A(right), B(left) : Bilateral internal cerebral angiography show collateral flow to posterior circulation via posterior communicating arteries (arrow). C : Postoperative right internal cerebral angiography demonstrating sufficient retrograde flows to the posterior circulation. Arrow marked basilar artery. D : Left internal cerebral angiography shows posterior cerebral artery and basilar artery (black arrow). White arrow indicates the right posterior inferior cerebellar artery by retrograde flow via basilar artery.

were noted during the course of time. Follow-up brain CT demonstrated significant enlargement of the ventricle. Ventriculo-peritoneal shunt was done about 2 months after her onset of symptom.

Follow-up angiography was taken for the evaluation of the left VA dissecting aneurysm one month after right VA trapping procedure. The angiogram showed spontaneous obliteration of the left dissecting aneurysm (Fig. 3A). There were retrograde flows to the posterior circulation through both large posterior communicating arteries (P-com A) from anterior circulation (Fig. 2C, D). Afterwards, there was no newly developed neurologic deficit owing to sufficient collateral circulations.

One year later, a follow up angiography revealed recanalization and further enlargement of the left vertebral artery aneurysm. The dissection reached VB junction. The PICA was not visible with growing fusiform dilatation in comparing to the prominent anterior inferior cerebellar artery (AICA) (Fig. 3B). We decided to occlude the left VA to arrest the growth of the lesion and to eliminate the risk of hemorrhage. Hence, proximal occlusion



Fig. 3. A : Follow-up left vertebral angiography 1 month after trapping showing spontaneous obliteration of dissecting aneurysm (arrow). B : Recanalization and regrowing of left vertebral artery dissection are noted on a follow-up angiography one year after the ictus (black arrow). The left posterior inferior cerebellar artery is not visible. However, right posterior inferior cerebellar artery is demonstrated by retrograde flow (white arrow). Arrowhead marked left anterior inferior cerebellar artery and collateral flows. C : Follow-up CT angiography showing good filling of basilar artery, left anterior inferior cerebellar artery (white arrow), right anterior inferior cerebellar artery (arrow head) and right posterior inferior cerebellar artery without further dissection (black arrow). The progression of the left vertebral artery dissection is not noted after proximal occlusion.

of the left vertebral artery was performed by endovascular coil embolization. Her postoperative course was uneventful. A follow up angiography showed non-visualization of left VA and good collateral circulations from anterior circulation. The last follow-up CT angiography showed good filling of basilar, left AICA, and right PICA without further dissection (Fig. 3C). She has had regular follow up check up, for 3 years after the bilateral VA occlusion without newly developed neurologic deficit.

Discussion

Clinical presentation of dissecting aneurysm

The dissecting aneurysm of cerebral artery may be presented with ischemic symptoms or bleeding, directly related to the underlying pathophysiology of the dissection process. Dissection occurring at a subintimal level often results in brainstem ischemia, on the other hand, dissection into the subadventitial space produces subarachnoid hemorrhage^{5,10,12,13}. Diagnosis of dissecting aneurysm has been made based on the angiographic findings such as “string sign”, “rosette sign”, “pearl reaction”, and “double lumen sign”^{6,13,17}.

Natural Course of dissecting aneurysm

Treatment strategy of the VA dissecting aneurysms should be individually based on the clinical characteristics and course. Spontaneous resolution of unilateral dissecting aneurysm is not so rare and natural healing of the bilateral VA dissections has been also reported⁷. Thus, even the question of whether

dissections of the posterior circulation should be treated surgically or nonsurgically remains unresolved. However, several studies have shown that rebleeding is to be expected in 30-70% in vertebrobasilar dissecting aneurysms presenting subarachnoid hemorrhage^{2,11}. Moreover, in the Mizutani's series, rebleeding was associated with higher mortality being 46.7% in comparing to mortality of 8.3% of the patients without subsequent rupture¹¹. We believe that clinical outcome is closely associated with subsequent rupture and early surgical obliteration of the parent artery of dissection may be mandatory.

Treatment of bilateral dissecting aneurysm of vertebral artery

Treatment experiences for bilateral dissecting aneurysms of VA have been rarely reported and there are not enough cases to reach a conclusion on the best treatment option. Regarding the bilateral VA dissecting aneurysms, whether both of dissections should be occluded or occlusion of only symptomatic one would be enough” is unresolved question. Unilateral occlusion of the ruptured lesion often induces hemodynamic stress of the contralateral dissecting aneurysm resulting in enlargement or rupture²². Serial angiographic findings of our patient demonstrated spontaneous occlusion and recanalization of contralateral dissecting aneurysm after trapping of ruptured dissection. The occluded VA dissection recanalizes in 63% of cases after long-term observation and the timing of recanalization is unpredictable^{3,5}. Therefore, it is especially important to estimate the status of the treated vessel and contralateral

vessel by angiography in the treatment of bilateral VA dissection. Contralateral dissecting aneurysm should be under the close observation for the regrowing if the dissection is recanalized because hemodynamic changes following the occlusion of VA may lead to enlargement and subsequent rupture of the contralateral dissection^{14,15,22}. Therefore, staged bilateral proximal VA occlusions should be considered in the case of recurrent VA dissection or progressive aneurysm enlargement^{15,18}. Evaluation of collateral blood flow is necessary before the bilateral occlusion of VA. Tolerance of the patient for the bilateral VA occlusion should be estimated through test balloon occlusion. Tolerance of BA with bilateral VA occlusion is currently defined as both lack of new neurological deficits during balloon occlusion test and angiographic evidence of at least one large P-com A^{4,16}. Ischemic tolerance of bilateral occlusion of the vertebral arteries depends on the collateral blood flow through the P-com A and brainstem perfusion can be maintained when the P-com A is more than 1mm in diameter¹⁶. In the present case, carotid angiography showed the development of collateral flow to basilar artery and the right posterior inferior cerebellar artery through P-com A. Steinberg et al.¹⁶ reported that unilateral proximal clipping of VA dissecting aneurysm produces complete thrombosis in the dissecting aneurysm in 87% of cases with 3% risk of ischemia, but after the bilateral clipping of VA, the ischemic risk was 23%. Suzuyama and his colleagues¹⁸ insisted that staged bilateral proximal occlusions of VA should be considered in the case of recurrent VA dissection or progressive aneurysm enlargement. Treatment modalities for the VA dissecting aneurysms include microsurgical trapping, proximal clipping (or ligation), wrapping and various endovascular techniques^{4,12}. We thought that microsurgical treatment would be safer for the ruptured VA dissecting aneurysm involving the origin of PICA in our patient because direct inspection of the affected segment during surgery provides the surgeon with advantage for decision to sacrifice or save the parent vessel and perforators. Trapping is technically demanding or requires retraction of brainstem if the vertebral dissection is extensive. However trapping should be in consideration to reduce the risk of rebleeding after proximal clipping alone⁹. Endovascular occlusion may be also safe without complications of surgery¹⁷. Endovascular treatment using stents and coils offers advantages including parent vessel preservation and preservation of at least one VA in cases of bilateral VA dissecting aneurysms without development of sufficient collateral flows would be necessary. Regarding the limitations of endovascular treatment, it is technically challenging¹. In addition, dissecting pseudoaneurysm has more friable histological characteristics than saccular aneurysm so that it may be at higher risk associated with the procedure^{1,21}. Wrapping is unable to prevent enlargement of the dissection¹⁵. The indications of reconstructive surgery for PICA have been

not established, but PICA reconstructive surgery should be considered if it has been impossible to preserve PICA while managing VA dissecting aneurysm.

Conclusion

When making a strategy for the individual bilateral VA dissecting aneurysm, it is important to understand hemodynamic changes and various natural courses of contralateral dissecting aneurysm to get the best treatment for the patient. We have treated the bilateral dissecting aneurysms of vertebral arteries by staged microsurgical trapping and endovascular proximal occlusion based on the follow-up angiographic findings and had a good clinical outcome. Finally, it is to keep in mind that the spontaneous occlusion of dissecting aneurysm does not mean the end of the course.

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