



Case Report

A case of unilateral vertebral artery dissection progressing in a short time period to bilateral vertebral artery dissection

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ABSTRACT

Background: Vertebral artery dissection (VAD) is an important cause of stroke in young and middle-aged people. Bilateral occurrence of VAD is generally considered rare, but the number of reports of bilateral VAD has been increasing in recent years. In this paper, we report a case of *de novo* VAD on the contralateral side presenting with subarachnoid hemorrhage in the acute stage of cerebral infarction due to unilateral VAD.

Case Description: A 52-year-old man developed sudden-onset left occipital headache, dizziness, dysphagia, and right-sided hemiparesis and was admitted to our hospital. Head magnetic resonance imaging on admission showed a left lateral medullary infarction due to the left VAD. At this point, the right vertebral artery was normal. However, on day 9 after onset, he suddenly presented with subarachnoid hemorrhage due to the right VAD. Emergency endovascular treatment was performed for the dissecting aneurysm of the right vertebral artery. The patient's condition improved gradually after the procedure, and he was discharged with a modified Rankin Scale score of 1.

Conclusion: Bilateral occurrence of VAD may be more common than previously believed. Even in cases of unilateral VAD, we need to pay attention to the occurrence of *de novo* VAD on the contralateral side.

Keywords: Bilateral vertebral artery dissection, *de novo* vertebral artery dissection, Stent-assisted coil embolization, Subarachnoid hemorrhage, Vertebral artery dissecting aneurysm

INTRODUCTION

Vertebral artery dissection (VAD; referring to intracranial VAD in this paper) is an important cause of stroke in young and middle-aged people.^[10] VAD occurs more frequently in the Japanese than in the European or American populations,^[18] and, to date, many papers on VAD have been published from Japan.^[7-10,14,16,18] Bilateral occurrence of VAD is generally considered rare, but the number of reports of bilateral VAD has been increasing in recent years.^[2,5,11,17,19] In this paper, we report a case of *de novo* VAD on the contralateral side presenting with subarachnoid hemorrhage (SAH) in the acute stage of cerebral infarction due to unilateral VAD.

CASE DESCRIPTION

A 52-year-old man with no particular medical history developed sudden-onset left occipital headache, dizziness, dysphagia, and right-sided hemiparesis and was transported to another hospital. Head magnetic resonance imaging (MRI) revealed a left lateral medullary infarction due to the left VAD, and he was admitted to that hospital. Conservative treatment was performed, and the patient had an uneventful course, but at his and his family's request, he was transferred to our hospital 4 days after onset.

On admission to our hospital, head MRI was performed again. The MRI findings were the same as those observed at the other hospital; that is, a left lateral medullary infarction due to the left VAD was observed, and there were no abnormal findings in the right vertebral artery [Figure 1a and b]. Antiplatelet or anticoagulant agents were not administered, and conservative treatment with administration of a free radical scavenger and mild volume expansion was performed. Because his blood pressure remained at approximately 130/80 mmHg, antihypertensive agents were not administered. He had an uneventful course with no exacerbation of symptoms.

On day 9 after onset, the patient developed sudden disturbance of consciousness and was found lying on the side of his bed by a nurse. Head computed tomography (CT) showed SAH, mainly in the posterior cranial fossa [Figure 2a]. Three-dimensional CT angiography revealed a dissecting aneurysm with active extravasation of contrast agent in the right vertebral artery distal to the posterior inferior cerebellar artery [Figure 2b]. Under general anesthesia, emergency internal coil trapping was performed for the dissecting aneurysm of the right vertebral artery [Figure 3a and b]. The left vertebral artery angiography after internal trapping showed moderate stenosis of the left vertebral artery corresponding to the dissection site, but the basilar artery was visualized in antegrade with no delay of blood flow, endovascular treatment for this stenotic portion was not performed [Figure 3c]. After the procedure, there were no ischemic symptoms due to vasospasm after SAH. The patient's condition improved gradually, and he was discharged with a modified Rankin Scale score of 1. The stenosis of the left vertebral artery due to dissection had resolved on head magnetic resonance angiography (MRA) performed approximately 1 month after onset [Figure 3d]. Up to the present, approximately 2 years after onset, no new dissections have occurred in the vertebral artery on either side.

DISCUSSION

The cerebral arterial walls consist of four layers: From the inside, the tunica intima, internal elastic lamina, tunica

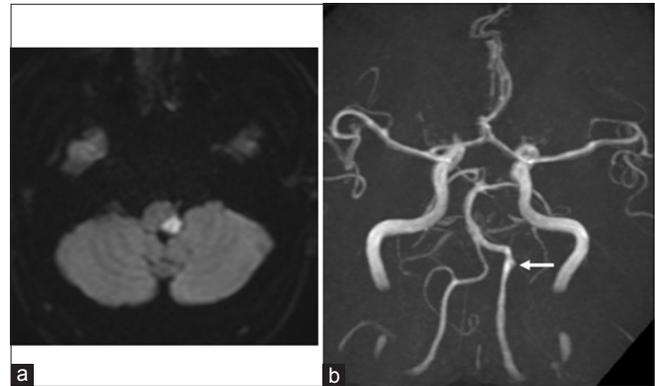


Figure 1: (a) Magnetic resonance diffusion-weighted imaging shows acute cerebral infarction in the left lateral medulla. (b) Magnetic resonance angiography shows irregularities of the vessel wall (arrow) suggestive of dissection in the left vertebral artery. No abnormal findings are observed in the right vertebral artery.

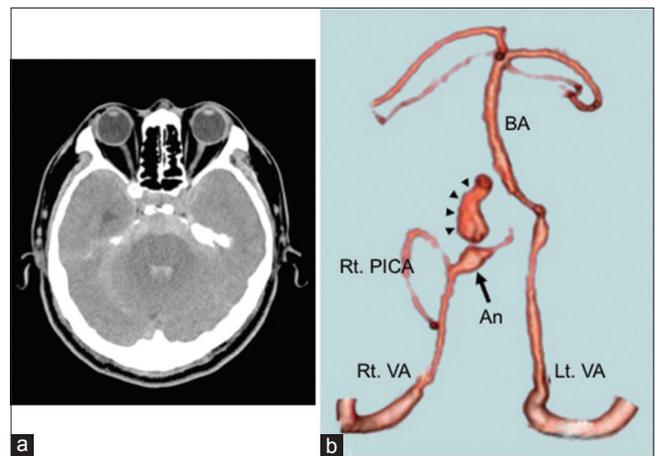


Figure 2: (a) Plain computed tomography (CT) shows diffuse subarachnoid hemorrhage, mainly in the posterior cranial fossa. (b) Three-dimensional CT angiography shows a dissecting aneurysm (arrow) with active extravasation of contrast agent (arrowhead) in the right vertebral artery distal to the posterior inferior cerebellar artery. An: Aneurysm; BA: Basilar artery; Lt. VA: Left vertebral artery; Rt. PICA: Right posterior inferior cerebellar artery; Rt. VA: Right vertebral artery.

media, and tunica adventitia. In cerebral arteries, which are typical muscular arteries, the elastic fibers that determine the strength of the vessel wall are sparse in the tunica media and abundant in the internal elastic lamina.^[9,10] Therefore, the internal elastic lamina is the strongest layer of the cerebral arterial wall.^[8-10] VAD occurs by sudden widespread disruption of the internal elastic lamina,^[8-10,16] and depending on the depth of the dissection plane in the arterial wall, an aneurysm or arterial stenosis may develop.^[9,10] VAD presenting with SAH, which is often associated with a high rebleeding rate,^[7] needs to be treated emergently by direct surgery or endovascular treatment. VAD presenting with

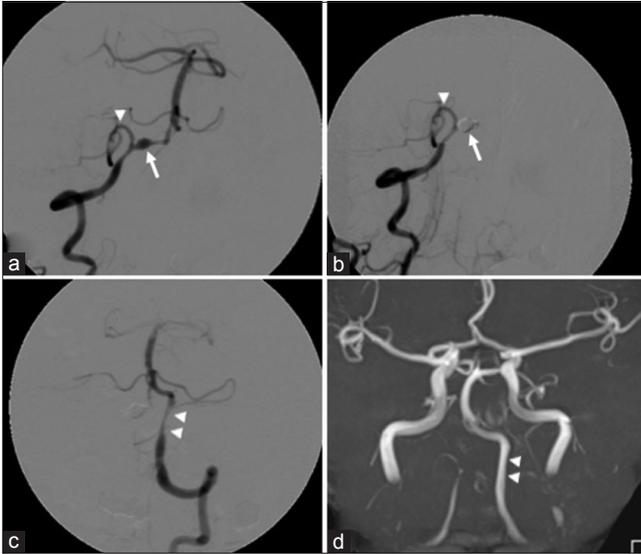


Figure 3: (a) The right anterior oblique view of the right vertebral artery angiography. A dissecting aneurysm (arrow) is observed in the right vertebral artery distal to the posterior inferior cerebellar artery. The arrowhead indicates the right posterior inferior cerebellar artery. (b) The right anterior oblique view of the right vertebral artery angiography after internal trapping. The dissecting aneurysm of the right vertebral artery is completely embolized by coils (arrow), and blood flow of the right posterior inferior cerebellar artery is preserved (arrowhead). (c) Anteroposterior view of the left vertebral artery angiography after internal trapping. The moderate stenosis of the left vertebral artery due to dissection is observed (arrowhead), but the basilar artery is visualized in antegrade with no delay of blood flow. (d) Magnetic resonance angiography approximately 1 month after onset. The stenosis of the left vertebral artery due to dissection has resolved (arrowhead).

cerebral infarction is generally treated conservatively, but administration of antiplatelet or anticoagulant agents is controversial.^[6,14] These agents may be effective in preventing thrombotic occlusion or distal embolization; however, they may extend the dissection plane, leading to exacerbation of cerebral infarction or SAH.

In the present case, *de novo* VAD on the contralateral side occurred in the acute stage of cerebral infarction due to unilateral VAD, and, as a result, the patient presented with SAH. Why did this kind of surprising phenomenon occur? There is an interesting autopsy study that answers this question. Ro *et al.*^[16] performed a detailed pathological investigation of the bilateral vertebral arteries of 58 patients who died of SAH due to VAD. In their study, they found a latent previous dissection, that is, small disruption in the internal elastic lamina covered by intimal thickening, in a different location from the rupture point in 25 of the 58 patients. In addition, they reported that the latent previous dissection had a tendency to occur as bilateral multiple

lesions. Their findings suggest that vertebral arteries of a patient with VAD may be vulnerable on both sides. It is not clear whether the dissecting aneurysm of the right vertebral artery in the present case was formed by the extension of a latent previous dissection or formed by the occurrence of a new dissection; however, in any case, when managing a patient with VAD, we need to carefully monitor not only the unilateral vertebral artery but also the contralateral vertebral artery.

In the diagnosis of VAD, MRA is widely used. However, in some cases, ordinary MRA alone may not be able to detect VAD. Basiparallel anatomic scanning is a method designed to visualize the surface appearance of the vertebrobasilar artery within the cistern. The combination of MRA and basiparallel anatomic scanning enables a more accurate diagnosis of VAD.^[12] Vessel wall imaging using a flow-sensitized three-dimensional fast spin echo technique not only provides information on luminal stenosis or aneurysmal dilatation but also clearly depicts intramural hematoma at the dissection site. This imaging method is recommended as the second-line diagnostic tool in cases in which the diagnosis of VAD is difficult.^[13] In the present case, only ordinary time-of-flight MRA was performed and other methods were not used. Therefore, we cannot exclude the possibility that the initial MRA had missed the presence of the right VAD although it had already existed.

With recent advances in device technologies, endovascular treatment has become the first-line treatment for vertebral artery dissecting aneurysms.^[2,4,17,19] Endovascular treatments of vertebral artery dissecting aneurysms include internal trapping and stent-assisted coil embolization. In the present case, internal trapping was performed for the dissecting aneurysm of the right vertebral artery. However, there are several reports indicating that internal trapping, which leads to an increase in hemodynamic stress, has a risk of developing a new dissection in the contralateral vertebral artery.^[1,3,4,15] Kidani *et al.*^[4] reported a case of contralateral *de novo* VAD developing 3 months after internal trapping of a vertebral artery dissecting aneurysm presenting with SAH. Inui *et al.*^[1] also reported a case of contralateral *de novo* VAD presenting with cerebral infarction 2 weeks after internal trapping of a vertebral artery dissecting aneurysm. Based on these reports, it might have been better, in the present case with bilateral VAD, to preserve blood flow of the parent artery with stent-assisted coil embolization.

CONCLUSION

Bilateral vertebral arteries of a patient with VAD may be vulnerable. Therefore, when managing a patient with VAD, we need to carefully monitor not only the unilateral vertebral artery but also the contralateral vertebral artery. In the treatment of vertebral artery dissecting aneurysms, stent-

assisted coil embolization with preservation of blood flow of parent artery would be the ideal treatment method.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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