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Case Report

Incomplete occlusion treatment of intracranial vertebral artery dissecting aneurysms - case report

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Abstract: The incidence of intracranial vertebral artery (VA) dissecting aneurysms is 0.001-0.0015% in the general population and intracranial VA dissecting aneurysms are lesions associated with significant morbidity and mortality. Ruptured intracranial vertebral artery dissecting aneurysm is associated with poor functional outcome and high mortality. More immediate treatments are needed due to the high rebleeding rate in this disease condition. Endovascular treatment may be a useful option for ruptured intracranial vertebral artery dissecting aneurysms. The incomplete occlusion of the true lumen and the proximal parent artery by endovascular treatment may present a viable alternative strategy, especially when the VA dissecting aneurysm involving PICA origin and with sufficient compensation of contralateral VA blood flow.

Keywords: Incomplete occlusion, vertebral artery, dissecting aneurysms

Introduction

Ruptured intracranial vertebral artery (VA) dissecting aneurysms are associated with high morbidity and mortality rates, therefore these patients need to be treated urgently. Endovascular surgery of intracranial vertebral artery dissection has been wildly accepted as the treatment of choice, which include procedures such as stent assisted coiling (SAC) occlusion of the dilated segment of the aneurysm, distal or proximal vertebral artery [1-4]. With SAC, the patency of the parent artery is preserved while the dissecting aneurysm is occluded by coils; however, there is a higher rate of recurrence in certain cases, especially the dissection segments in the posterior inferior cerebellar (PICA) origin [3, 4]. Occlusion of dissecting aneurysm and parent artery represents a reliable treatment for preventing recurrence and rebleeding of VA dissecting aneurysms [1, 5]. When the dissection segment involves PICA origin, or collateral blood flow is insufficient to sacrifice the parent vessel, the occlusion of the dissecting aneurysm and parent artery should not be performed [4].

In the present report, 2 cases of ruptured dissecting aneurysms located in VA, involving PICA origin were treated with incomplete occlusion technology, which promoted the self-healing of aneurysm by the altered hemodynamics in the parent arteries and dissecting aneurysms, and avoided thromboembolic complications of acute complete occlusion.

Case 1

Clinical presentation: A 43-year-old female presented with persistent severe headache (World Federation of Neurosurgical Societies grade III) for three days. Computed tomography (CT) revealed subarachnoid hemorrhage (SAH) predominantly in the posterior fossa and basal cistern. CT angiography (CTA) and following digital subtraction angiography (DSA) demonstrated dissecting aneurysm arising from left intracranial VA involving origin of PICA (**Figure 1**). DSA also showed the right vertebral artery adequately supplied the basilar artery and the posterior cerebral arteries (**Figure 2A**).

Intervention: Because the dilated segment of the aneurysm involved PICA origin, the patient was treated with incomplete occlusion of aneurysm and parent artery. A 6 F guiding catheter (Envoy; Cordis Endovascular, Miami Lakes, FL, USA) was introduced into the left VA of the patient under general anesthesia. An Excelsior SL-10 microcatheter (Boston Scientific/Target

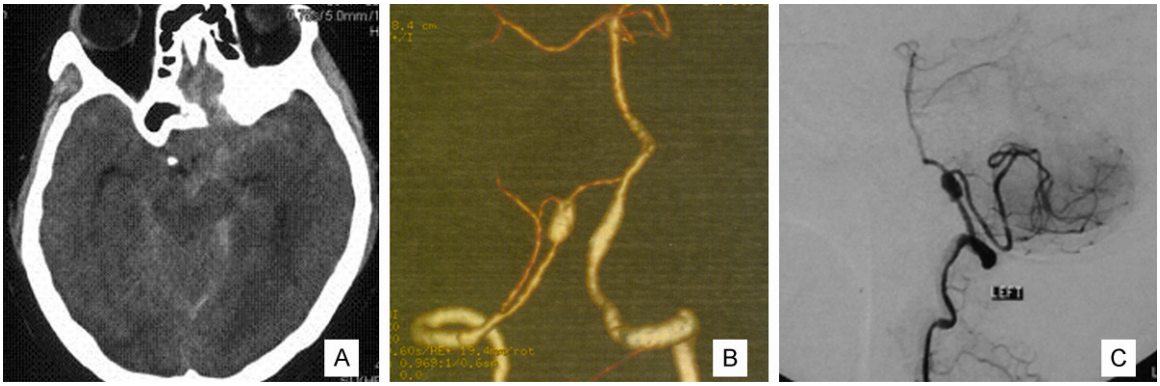

Figure 1. A. CT revealed SAH located predominantly in the posterior fossa and basal cistern. B, C. CTA and DSA revealed dissecting aneurysm arising from left intracranial VA involving origin of PICA.

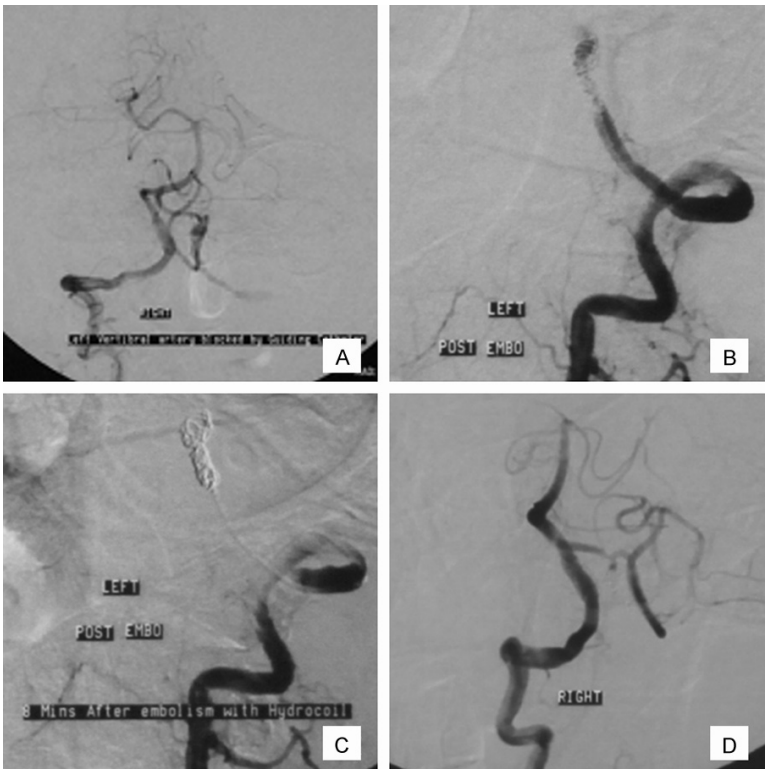

Figure 2. A. The right VA angiography showed right VA adequately supplied the basilar artery and good collateral blood flow to the left VA and PICA. B. Immediate angiography revealed the dissecting aneurysm and parent artery were incompletely occluded. C. The left dissecting aneurysm and affected left VA were completely occluded after eight minutes. D. The right VA angiography revealed contrast medium via the retrograde flow into the apex of the left dissecting aneurysm sac (white arrow) and the left PICA was preserved.

Therapeutics, Fermont, CA, USA) was positioned into the dissecting segment via a guiding catheter in the left vertebral artery in an attempt to occlude the dissection site and parent artery. Four complex and hypersoft coils (Microvention Terumo, Tustin, California, USA) were deployed and resulted incomplete occlusion of the dissecting aneurysm and parent artery on the immediate angiography (**Figure 2B**). Although the left vertebral artery angiogram showed that it appeared to completely occluded the left dissecting aneurysm and the affected left VA after 8 minutes (**Figure 2C**), the angiogram of the right vertebral artery showed contrast medium via the retrograde flow into the apex of dissecting aneurysm sac, whereas the left PICA was preserved (**Figure 2D**).

The treatment effect: 4 months late, the follow-up angiography showed the blood flow was preserved in left PICA, as well as the right vertebral and basilar artery. There is spontaneous resolution of the apex of dissecting aneurysm sac (**Figure 3A**). The proximal left VA was completely occluded (**Figure 3B**). The modified Rankin Scale (mRS) was excellent (mRS=0) at the time of 4 months after treatment.

Case 2

Clinical presentation: A 55-year-old female was admitted to the emergency department, who suffered sudden severe headache, transient unconsciousness, and dyspnea (World Federation of Neurosurgical Societies grade IV). CT

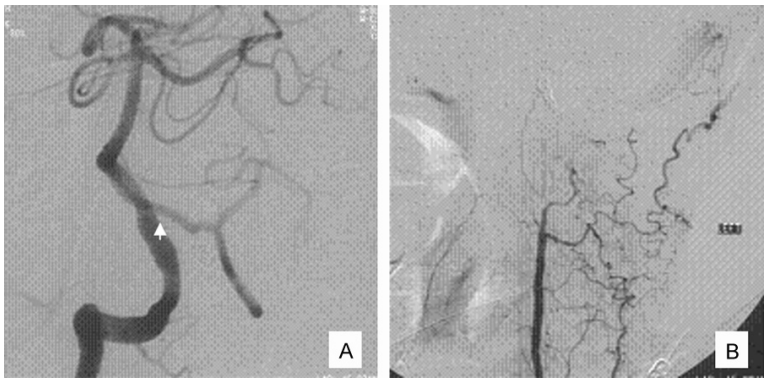

Figure 3. A. The right VA angiography after 4 months revealed a good patency of the left PICA and spontaneous resolution of the apex of dissecting aneurysm sac (white arrow). B. The left VA angiography revealed the dissecting aneurysm and affected left VA were completely occluded.

revealed SAH (**Figure 4A**). The patient's clinical status had improved gradually (World Federation of Neurosurgical Societies grade III) after resuscitation in neurosurgical intensive care unit. Follow-up CTA and DSA demonstrated the dissecting aneurysm of right VA arising distal to the origin of the PICA (**Figure 4B**, **4C**). The left VA angiography revealed good collateral blood flow to the right VA and PICA, which retrograded into the aneurysm (**Figure 5A**).

Intervention: Endovascular treatment under general anesthesia was performed. Through the 6 F guiding catheters, proper shaped Prowler-14 (Cordis Neurovascular, Miami, FL) was navigated into the right dissecting aneurysm over Silverspeed-14 (Micro Therapeutics, Irvine, CA, USA). Five coils (Microvention Terumo, Tustin, California, USA) were deployed. The dissecting aneurysm and affected right vertebral artery were both incompletely occluded with preservation of the right PICA on the immediate angiography (**Figure 5B**, **5C**). The contrast medium was observed via retrograde flowed into the dissecting aneurysm sac and the right PICA (**Figure 5D**).

The treatment effect: The right VA angiography 1 month later revealed the dissecting aneurysm and the affected right VA were completely occluded (**Figure 6A**). Collateral blood flow could be seen from the left VA, and the right PICA was preserved (**Figure 6B**). At the last clinical follow-up, the patient present with a favorable recovery 12 months after initial treatment (mRS=2).

Discussion

Along with the advance of endovascular techniques, stent placement and/or stent assisted coiling become one of the best treatment strategies for the rupture or unruptured VA dissection. These methods preserve the patency of the parent vessel, which obviates the concern for the insufficient collateral blood flow to allow parent vessel sacrifice without neurologic deficit. Some patients with the VA dissections were treated by stenting, with or without coiling, and had favorable clinical outcomes [6, 7]. However, it is still uncertain regarding the safety of these procedures, because radiologic complete occlusion is not always achieved by these methods, and incomplete occlusion involves the additional risk of rebleeding. Due to maintenance of patency of the parent artery, recurrence is a risk factor which influenced the prognosis of patients with intracranial vertebral artery (VA) dissecting aneurysms after SAC [8, 9]. The PICA origin involvement was the only independent risk factor for recurrence based on the follow-up angiography of 97 VA dissecting aneurysms in 89 patients after endovascular treatment [10]. Persistent blood flow through the unprotected remnant dissecting aneurysm toward the PICA was believed to be the reason of recurrence.

Differing from SAC which maintains the blood flow of the parent artery and increases the risk of recurrence, the parent artery occlusion represents a reliable treatment for preventing recurrence and rebleeding of VA dissecting aneurysm if patients can tolerate the sacrifice of the parent vessel. Endovascular parent vessel trapping has some limitations. Complete occlusion may lead to infarction of the medulla oblongata, due to the impaired perforators supplying [11, 12]. In order to decrease risk of undesired occlusion of the perforators and the PICA, the incomplete occlusion technology may be used in these cases.

The incomplete occlusion technology is not the first option for endovascular treatment. The aim of the technology is to avoid neurologic

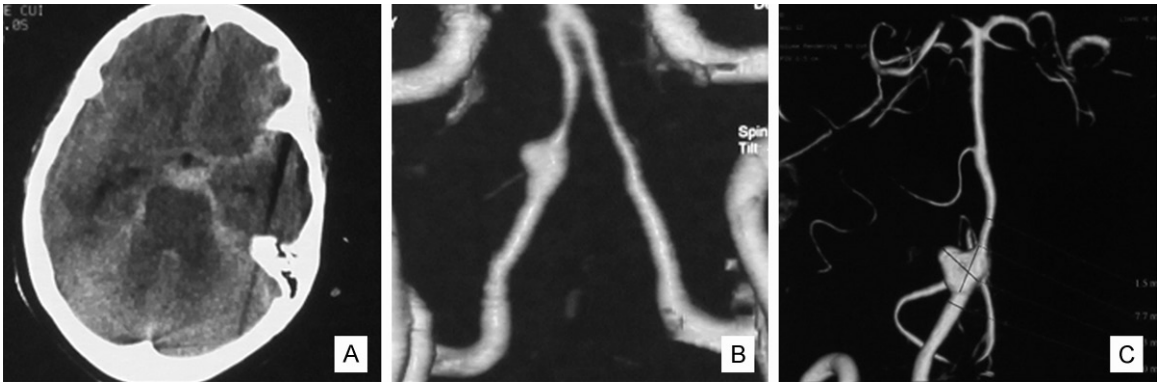

Figure 4. A. CT revealed SAH. B, C. CTA and DSA showed the dissecting aneurysm of right VA arising distal to the origin of the PICA.

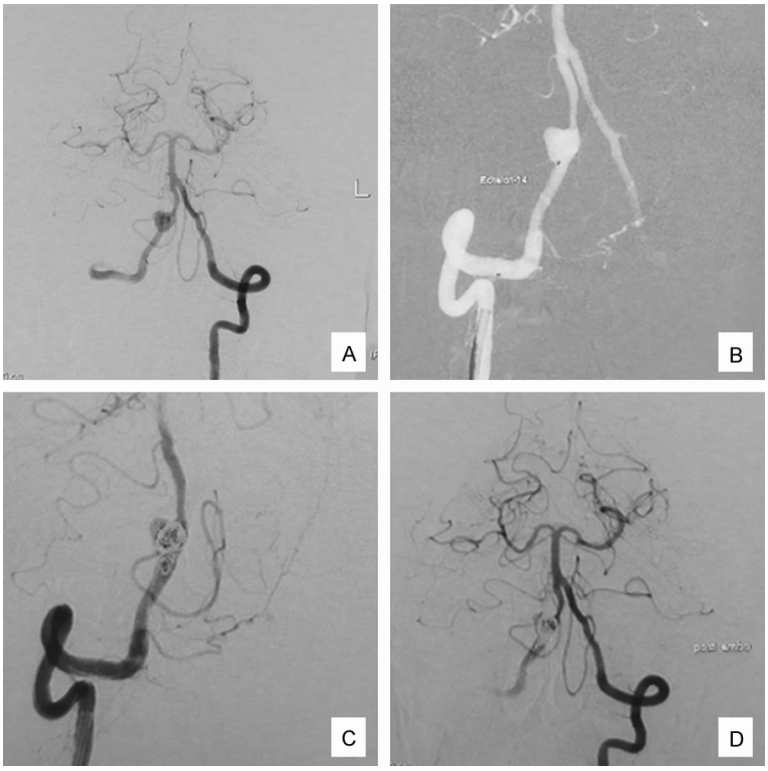

Figure 5. A. The left VA angiography demonstrated the left VA adequately supplied good collateral blood flow to the left VA, the dissecting aneurysm and the PICA. B. The microcatheter was positioned within the dissecting aneurysm. C. The dissecting aneurysm and the parent artery were incompletely occluded. D. Immediate angiography revealed the contrast medium were observed via retrograde flow into the dissecting aneurysm sac and the right PICA.

deficits through altered hemodynamics in the dissecting aneurysms. The present two cases had sufficient compensation of contralateral VA blood flow. In case 1, the parent artery was completely occluded and the dissecting aneurysm was mostly occluded using coils, with preserved blood flow from contralateral VA into the apex of the dissecting aneurysm sac and the PICA. The four-month follow-up angiography revealed the occlusion of dissecting aneurysm and a good patency of the left PICA due to the altered the blood flow direction and hemodynamics from the treatment. In case 2, in order to preserve the PICA blood flow, the coils were packed loosely in the true lumen of the dissecting aneurysm and the parent artery. With the decreased antegrade blood flow pressure, the coiling was stopped when contralateral VA blood flow became dominant. The VA dissecting aneurysm should be short-term monitored closely because of incomplete occlusion. After the initial incomplete occlusion treatment, the follow-up arteriography 4 month later demonstrated spontaneous complete occlusion of the vertebral artery dissecting aneurysm and the good collateral blood flowed to the PICA.

Recanalization may be caused by incomplete occlusion of VA dissecting aneurysm. Several investigators suggest that the mechanism underlying this recanalization involves occlusion of a pseudolumen in the initial procedure, allowing the compressed true lumen to reexpand and undergo recanalization by gradual healing [13, 14]. In the present cases, a microcatheter was navigated to the VA distal to the aneurysm over a microguidewire, which smoo-

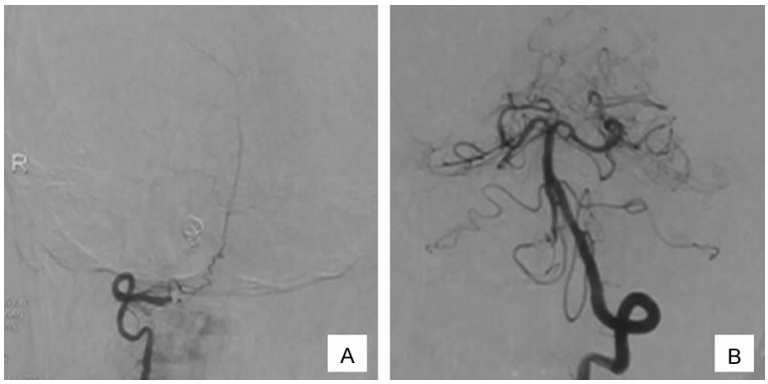

Figure 6. A. The right VA angiography 1 month later revealed the dissecting aneurysm and the affected right VA were completely occluded. B. Collateral blood flow could be seen from the left VA, and the right PICA was preserved.

thly crossed through the aneurysm to the distal VA. Then proper shaped microcatheters were introduced over microguidewires and navigated into the true lumen. Although the true lumen of the dissecting aneurysm and the affected VA were incompletely occluded, recanalization did not occur. The phenomenon might be related to the following mechanisms. First, the incomplete occlusion of the true lumen and proximal parent artery decreased antegrade blood flow velocity and pressure, which leaded to in-coil mass chronic thrombosis and subsequent complete occlusion of the dissecting aneurysm and proximal VA. Second, the heparin and antiplatelet drugs were not used after incomplete occlusion reducing risk of recanalization in acute stage. Third, the subsequent complete occlusion of the VA dissecting aneurysm and proximal parent artery prevented the recanalization by definitively occluding the entrance to the aneurysm pseudolumen.

Conclusions

The incomplete occlusion of the true lumen and the proximal parent artery by endovascular treatment may present a viable alternative strategy, especially when the VA dissecting aneurysm involving origin of PICA and with sufficient compensation of contralateral VA blood flow. Careful angiographic follow-up of the dissecting aneurysm is required. Further studies are needed to assess the efficacy and safety of the endovascular technology.

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Disclosure of conflict of interest

None.

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