

Partially Thrombosed Vertebral Artery Aneurysm With Wall Enhancement Treated by Stent-Assisted Coil Embolization

—Case Report—

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Abstract

A 50-year-old man presented with a 2-month history of dysarthria caused by a partially thrombosed vertebral artery (VA) aneurysm. Magnetic resonance imaging showed enhancement of the thickened wall and angiography detected staining. Stent-assisted coil embolization with protection of the parent artery patency was performed. The patient's clinical course was unremarkable and shrinking of the aneurysm was obtained. The stent-assisted coil embolization promoted intra-aneurysm flow disruption and stabilized the wall environment, suggesting another strategy for the treatment of partially thrombosed VA aneurysm.

Key words: partially thrombosed aneurysm, stent-assisted coil embolization, neovascularization, vasa vasorum, vertebral artery

Introduction

Partially thrombosed vertebral artery (VA) aneurysm includes saccular aneurysms at branching or non-branching sites, dissecting aneurysms, and dolichoectasia. However, the pathogenesis of aneurysm growth and management are not clearly understood. The prognosis for large thrombosed VA aneurysms is extremely poor after progression, so early intervention is important. Surgical trapping and aneurysmectomy is the established method of treatment, but the risk of complications cannot be ignored. Endovascular trapping and/or intra-aneurysmal coil embolization are important alternatives which are less invasive, but the efficacy and safety of these methods for large thrombosed aneurysms remain uncertain.

We report a case of partially thrombosed large VA aneurysm with unique radiological findings, which was successfully treated by stent-assisted coil embolization with protection of parent artery patency.

Case Report

A 50-year-old man presented with a 2-month history of mild dysarthria, difficulty in swallowing, and poor control of skilled motor behaviors of the fingers of the right hand. Computed tomography at an outside hospital revealed no

subarachnoid hemorrhage after onset of these symptoms. He has no history of hypertension, hyperlipidemia, or diabetes mellitus.

On admission, magnetic resonance (MR) imaging revealed a thrombosed aneurysm of the left VA. The largest diameter of the aneurysm was 16 mm. T₂-weighted MR imaging revealed mild compression and marked abnormal intensity of the medulla oblongata. T₁-weighted MR imaging showed heterogeneous, crescent enhancement along the thickened wall, but no large high intensity areas indicating massive intramural hemorrhage (Fig. 1). Angiography revealed a partially thrombosed aneurysm with staining of the thickened wall (Fig. 2A, B). Since the patient's symptoms had remained mild after onset, and he worked as a barber, we did not perform emergent treatment and decided to proceed with conservative management. His symptoms improved slightly, but persisted throughout the 2-month admission period. Repeat MR imaging and follow-up angiography detected no decrease in aneurysm size. Over the course of admission, changes in aneurysm lumen size, degree of staining of the aneurysm wall, and deformity of the contralateral VA wall were noted.

Balloon test occlusion of the left VA confirmed tolerance due to good flow of the contralateral VA. The test occlusion balloon was placed in the proximal VA to the aneurysm, and the left posterior inferior cerebellar artery originated from the left anterior inferior cerebellar artery.

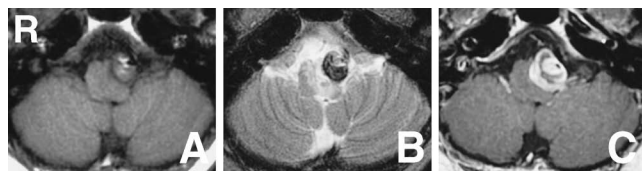


Fig. 1 A, B: Magnetic resonance images showing the aneurysm compressing the medulla oblongata as high and iso intensity on the T₁-weighted image (A), and high and low intensity on the T₂-weighted image (B), indicating slow flow of the aneurysm lumen and thickened aneurysm wall, respectively, and the medulla oblongata as high signal intensity on the T₂-weighted image (B). C: T₁-weighted image with gadolinium demonstrating onion-skin laminar pattern enhancement of the aneurysm wall.

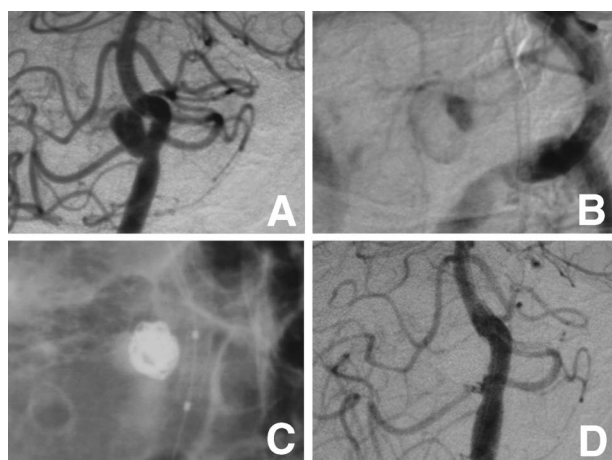


Fig. 2 Oblique views of the left vertebral angiography and intervention. A: Aneurysm arising from a non-branching site of the intracranial left vertebral artery. The aneurysm is directed medially and deformity of the contralateral wall of the vertebral artery is seen. Small linear contrast enhancement is seen at the tip of the lumen of the aneurysm. In the late arterial phase, the contrast medium spread to the upper portion of the aneurysm wall and extended to include its entirety during the venous phase. B: Contrast medium distributed to the peripheral wall in the late venous phase. C: Stent-assisted coiling was performed 6 weeks after initial angiography. D: Small neck remnant seen between the coil mass and stent at the end of procedure.

Coil embolization of thrombosed aneurysm is associated with recanalization of the aneurysm lumen, so we decided to proceed with endovascular treatment with stent-assisted coiling. In the event of clinical or neuroradiological deterioration, the backup strategy was endovascular parent artery occlusion and aneurysmectomy following parent artery trapping.

Stent-assisted coil embolization was performed under general anesthesia one week after the balloon test occlusion. A Driver coronary stent (3 mm in diameter and 9 mm in length; Medtronic, Inc., Minneapolis, Minnesota, USA) along with 14 detachable 0.01-inch bare platinum coils of 348 mm total length were placed into the aneurysm lumen.

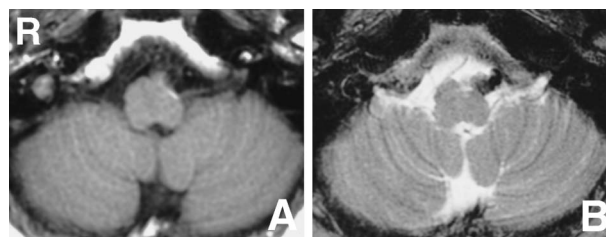


Fig. 3 Follow-up magnetic resonance images at 3 months after embolization showing decreased aneurysm size on the T₁-weighted image (A) and reduced abnormal signal in the medulla oblongata on the T₂-weighted image (B).

The first coil was three-dimensional shape, 5 mm in diameter and 90 mm length. A small slow flow neck remnant was noted at the end of the procedure (Fig. 2C, D). Antiplatelet medication with a combination of 100 mg aspirin and 75 mg clopidogrel per day was started 5 days before the balloon test occlusion and maintained for 6 months after the procedure.

His clinical symptoms gradually improved and fully recovered. Follow-up MR imaging revealed gradual disappearance of thrombosis enhancement and abnormal signal in the medulla oblongata, as well as decreased size of the aneurysm (Fig. 3).

Discussion

The present case may have been a dissecting aneurysm in the process of healing.⁹ The classical presentation includes symptoms and signs including neck pain, subarachnoid hemorrhage, and/or infarction, with the presence of the pearl-and-string sign or double lumen sign on angiography. This present case demonstrated mild stenosis of the VA at the origin of the aneurysm. We think that these findings suggest that the aneurysm had unusual etiology which is difficult to define.

Recently, the pathogenesis of partially thrombosed aneurysms was proposed to originate in structural vessel wall diseases. These “abluminal” aneurysmal vasculopathies could be aggravated by “luminal” aneurysmal vasculopathies.⁸ Abluminal factors may also be related to hypercholesterolemia, atherosclerosis, and chronic inflammation.⁴ A stepwise mechanism may account for progression of dolichoectatic aneurysms based on pathologic findings.¹⁰ We propose that enhancement on MR imaging and staining on angiography indicates neovascularization and/or proliferation of the vasa vasorum of the thickened wall. This type of aneurysm may show similar MR imaging findings.

The appropriate treatment strategy for partially thrombosed aneurysms is controversial,⁶ but a case was successfully treated by internal trapping following proximal clipping of VA.¹¹ On the other hand, partially thrombosed aneurysms showed rapid growth after endovascular parent artery occlusion.⁵ In the latter case, T₁-weighted MR imaging detected intramural hematoma in the thickened wall. Surgery for this type of aggressive aneurysm is

recommended. Parent artery endovascular occlusion or proximal endovascular occlusion can induce shrinking of the aneurysm in dolichoectatic aneurysms without massive intramural hematoma on T₁-weighted imaging and high signal intensity of surrounding structures on T₂-weighted imaging.¹⁰⁾ In a long-term follow-up study of 56 partially thrombosed aneurysms with mass effect, the clinical results of parent artery occlusion was much better than coil embolization, but the surgical option should be considered in the presence of impossible parent artery occlusion.²⁾ Intra-luminal coil embolization of partially thrombosed aneurysm frequently results in coil migration into the thrombus.⁷⁾ Usually, coil embolization is not selected for partially thrombosed aneurysm.

When considering suitable treatment for non-ruptured partially thrombosed aneurysms, three distinct stages of progression should be recognized. In the early stage, abluminal damage is reversible by reducing luminal stresses through intra-aneurysm flow disruption, as in this case or flow diversion. One case of partially thrombosed aneurysm was successfully treated by the solo stent technique.¹²⁾ Recently, infectious aneurysm of the cavernous carotid artery and partially thrombosed giant aneurysm of the midbasilar trunk were successfully treated by flow diverting stent graft.^{1,3)} In the next stage, abluminal damage is reversible by parent artery occlusion or trapping. In the final, most aggressive stage, abluminal damage is irreversible and the aneurysm will continue to grow even if parent artery occlusion is performed. In this stage, aneurysmectomy is recommended. Throughout all three stages, the aneurysm can rupture.

We speculate that this present case of thrombosed aneurysm was associated with neovascularization and/or proliferation of the vasa vasorum of the thickened wall, and slight internal bleeding, but not with intramural massive hematoma. The stent-assisted coil embolization promoted intra-aneurysm flow disruption and stabilized the aneurysm progression. Based on this case, we propose that stent-assisted coil embolization may be effective in specific instances of partially thrombosed aneurysm. Recently, intracranial stent was approved for coil embolization of large cerebral aneurysm, but flow diversion stent is not approved in Japan. Further study and case experience is required to identify the most effective treatment strategy for partially thrombosed aneurysm.

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