

Flow Diverter Therapy of a Giant Fusiform Vertebrobasilar Junction Aneurysm in a Child: Case Report

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The management of giant vertebrobasilar junction (VBJ) aneurysms is extremely challenging. Flow diverter (FD) therapy has become an important alternative to treat difficult intracranial aneurysms for both open surgery and conventional endovascular therapy. Herein, we report a rare case of a giant fusiform VBJ aneurysm in a child that is successfully treated with FD therapy.

Keywords: flow diverter, intracranial aneurysm, vertebrobasilar junction

Introduction

The management of giant vertebrobasilar junction (VBJ) aneurysms is extremely challenging with a very high rate of morbidity and mortality in both neurosurgical and endovascular practices.^{1–8} Flow diverter (FD) therapy has become an important alternative to treat difficult intracranial aneurysms for both open surgery and conventional endovascular therapy. The pipeline embolic device (PED, Pipeline Flex, Covidien, Irvine, CA, USA) is a popular FD that can be used to occlude an aneurysm sac thrombosis due to the flow alternation with the device which covers the small arteries and perforators preserving their blood flow. Herein, we report a rare case of a giant fusiform VBJ aneurysm in a child that is successfully treated with FD therapy using two PEDs intentionally telescoped within the aneurysm sac.

Case Presentation

An 11-year-old boy presented with a 6-month history of intermittent severe headaches with nausea. Although the neurological examinations did not detect any neurological deficits, the computed tomographic (CT) and magnetic resonance images (MRIs) showed a partially thrombosed giant VBJ aneurysm in front of the pons with marked compression on the pons (Fig. 1A). The etiology of this aneurysm was unknown, however, it might have been congenital because

there was no clinical evidence of a mycotic or traumatic origin. Cerebral angiography confirmed the giant VBJ aneurysm involving the bilateral vertebral arteries (VAs) and the lower third of the basilar artery (BA) (Fig. 2). The longest and shortest aneurysm lengths including the thrombosed part observable in the MRIs were 26.5 and 16.1 mm, the aneurysm cavity lengths revealed in the angiography were 26.2 and 6.1 mm. Because the patient was considered to be intolerable for a bilateral VA occlusion due to the absence of posterior communicating arteries, a balloon occlusion test was not performed. Because open surgery or conventional endovascular therapy were not likely options for an anatomical cure without a high risk of morbidity or mortality, FD therapy using two telescoped PEDs was recommended to the patient and his parents. Although PED embolization for posterior circulation aneurysms has not yet been approved for clinical procedures in Japan, the treatment was approved by the institution's ethics review board. Written informed consent was also obtained from the patient and his parents. Dual antiplatelet therapy (DAPT) of aspirin 100 mg and clopidogrel 50 mg was administered to the patient 10 days before the procedure. Because the anterior spinal artery (ASA) originated from the right VA only as revealed in the angiography, we decided to occlude the left VA and deploy the PED into the right VA to preserve the antegrade blood flow of the ASA. After the introduction of general anesthesia, a 6-French (Fr) ultra-long guiding sheath to perform as a guiding catheter was inserted into the right vertebral artery through the right femoral artery, and a 5-Fr ultra-long guiding sheath was inserted into the left VA through the left femoral artery. After systemic heparinization within the target 250–300 s of activated clotting time (ACT) was achieved, the fenestrated left VA was occluded with coils slightly distal to the origin of the left posterior inferior cerebellar artery (Fig. 3). Subsequently, a coaxial system consisting of a Navien distal support catheter (Covidien) and a Marksman microcatheter (Covidien) for PED delivery was inserted into the distal BA with the aid of a 0.014-inch microguidewire through the aneurysm sac. Two PEDs, first a 3.5 × 35-mm PED and then a 3.75 × 35-mm PED were telescopically deployed from the tip of the BA to the right VA to fully cover the aneurysm sac (Fig. 4). Slower flow and contrast stagnation were clearly observed in the aneurysm sac immediately after the FD deployment. The diagram shows the anatomical relationship of the deployed PEDs and coil occlusion of the left VA (Fig. 5).

The patient recovered rapidly from the general anesthesia, and the post-operative course was uneventful. He was

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Received: July 4, 2018; Accepted: September 27, 2018
Online December 18, 2018

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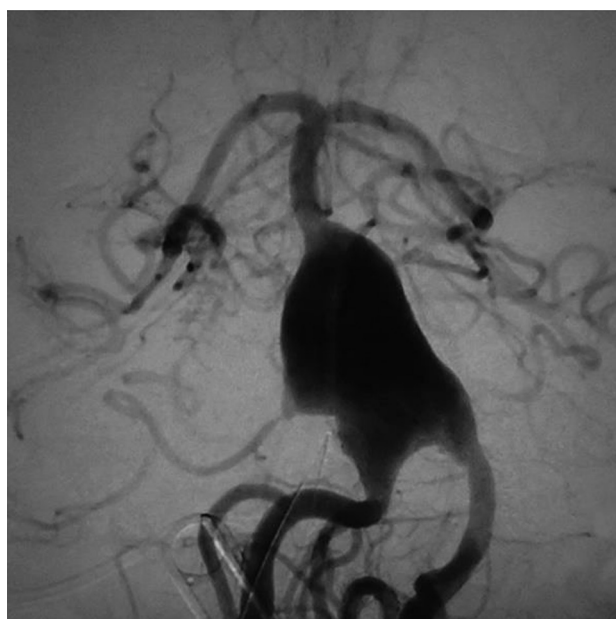
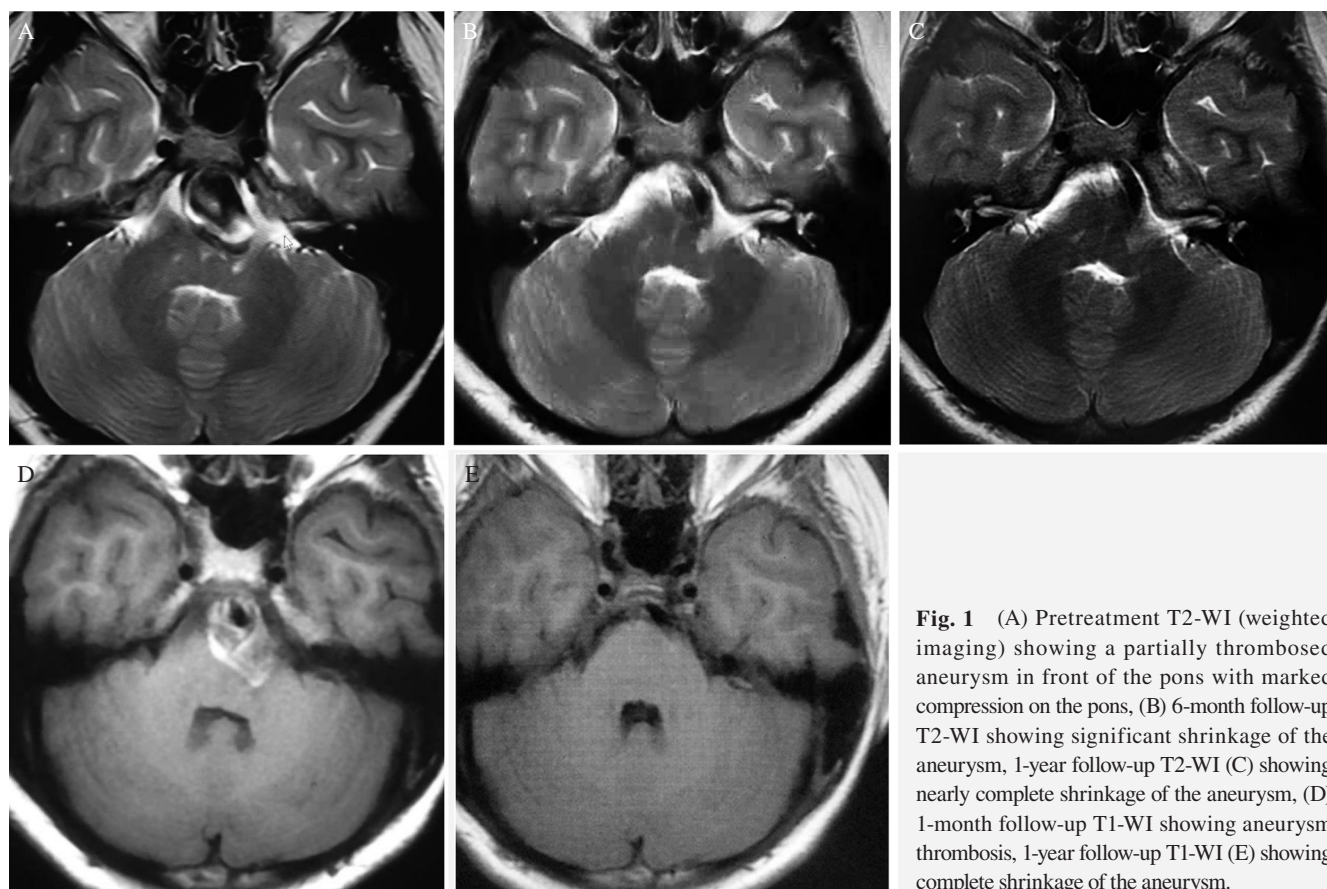


Fig. 2 Pretreatment vertebral angiography showing a giant vertebro-basilar fusiform aneurysm.

discharged without any neurological deficits with the same antiplatelet therapy as before the intervention. The frequency of the patient's headaches with nausea was significantly decreased, and those symptoms had completely disappeared



Fig. 3 Left fenestrated VA was occluded with coils slightly distal to the origin of the PICA (posterior inferior cerebellar artery).

by the 6-month follow-up in the outpatient clinic. The angiography at that time showed complete aneurysm occlusion with preservation of the antegrade flow of the BA (Fig. 6). Although the right AICA (anterior inferior cerebellar artery)

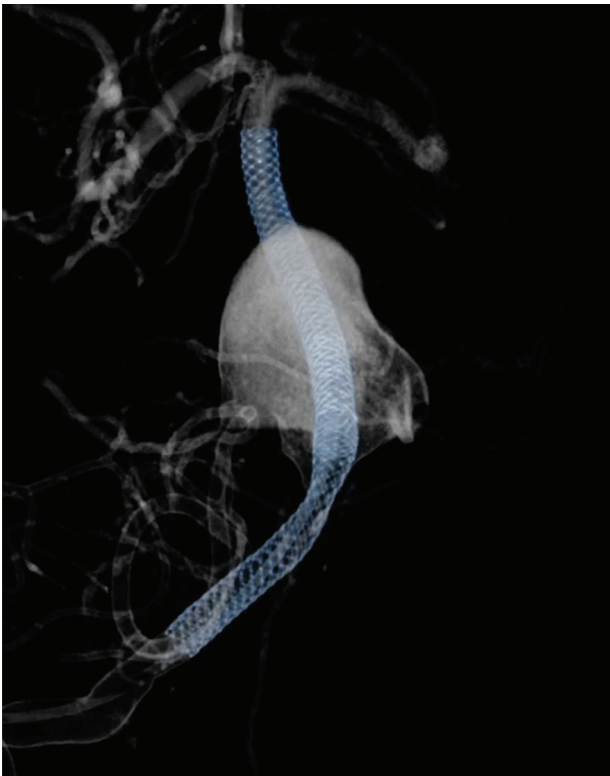


Fig. 4 Cone-beam CT image showing the telescopically deployed PEDs.

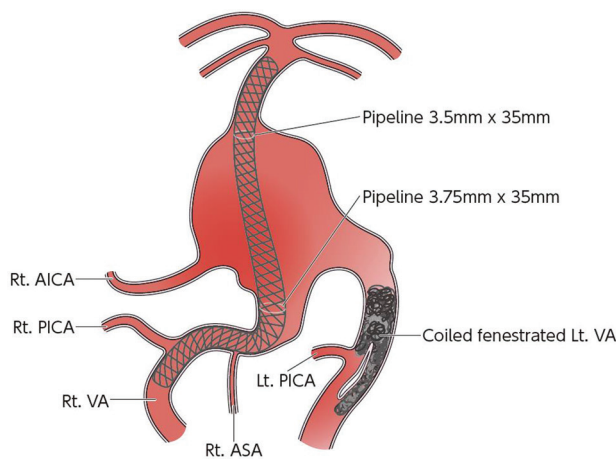


Fig. 5 Diagram showing the anatomical relationship of the deployed PEDs and coil occlusion of the left VA.

was not observable nor was any retrograde flow in the angiography, 6-month and 1-year follow-up T2-weighted MRIs showed no ischemic lesions, and there was significant shrinkage of the thrombosed aneurysm with resolution of the prior compression (Figs. 1B and 1C). Furthermore, 1-month and 1-year follow-up T1-weighted MRIs apparently showed the aneurysm thrombosis and the shrinkage (Figs. 1D and 1E). Currently, maintenance DAPT at the same dose is being continued following the 1-year follow-up without any symptoms.



Fig. 6 Six-month follow-up angiography showing complete aneurysm occlusion with the preservation of antegrade flow of the posterior circulation.

Discussion

Despite the improvement of neurosurgical and endovascular techniques, the management of giant vertebrobasilar aneurysms remains challenging, and carries with it a high rate of morbidity and mortality, because of the complex angioarchitecture associated with small branch vessels and perforating arteries to the brain stem and cerebellum. In the present case, the aneurysm location and the fusiform configuration precluded a safe surgical access and curative treatment for both modalities. Although proximal artery occlusion with bypass surgery for flow alternation could be considered as a possible treatment strategy, the risk and efficacy of such is unclear.^{5,9,10} Moreover, that option requires dedicated surgeons with extremely high technical skills. However, the fusiform configuration makes endosaccular coil embolization unfeasible.

Recently, FD therapy using a PED has been developed to enable the blood flow diversion that leads to aneurysm sac thrombosis with antegrade blood flow preservation of the small branches and perforators that are covered with the device. Furthermore, FD therapy can be used to repair the damaged vessel wall using a PED as scaffolding for endothelial and neointimal overgrowth within the diseased segment. However, FD deployment for posterior circulation aneurysms carries more risk of perforator occlusion compared to that for anterior circulation aneurysms because the posterior circulation, particularly that of a vertebrobasilar artery, is a perforator rich region. Fiorella et al.¹¹ warned that caution must be exercised to avoid multilayer or densely packed coverage to preserve the perforating vessels. Therefore, we telescoped two PEDs within the aneurysm sac to prevent the occlusion of the perforating artery originating at the upper BA and VA. Graziano et al.¹² reported that parent artery reconstruction using a FD device is a feasible and

successful technique, especially involving the lower third of the BA. The present case also shows, that even in one of the most extreme cases there is, that FD therapy can be used to construct de novo vertebrobasilar arteries while preserving the surrounding eloquent brain stem blood circulation. Unfortunately, the mechanism of perforating arteries blood flow preservation during the aneurysm-shrinkage period under the floated PEDs in the aneurysm cavity is unknown.

Aneurysm rupture after FD therapy is well known to be a fatal complication. Adjunctive coil placement was reported as helping to prevent a delayed aneurysm rupture. We did not do that, however, because there was concern about the risk of occlusion of the perforating arteries.

Conclusion

We reported a case of a giant fusiform VBJ aneurysm successfully treated with FD therapy using two telescoped PEDs. PED embolization should be considered an important treatment option for difficult intracranial aneurysms in both neurosurgical and endovascular practices.

Acknowledgment

We thank Robert E. Brandt, Founder, CEO, and CME, of MedEd Japan, for editing and formatting the manuscript.

Conflicts of Interest Disclosure

Hidehiko Oishi receives 1 million yen or more annually from Medtronic Japan for attending conferences and giving presentations and 2 million yen or more annually from Medtronic Japan as a scholarship donation to him as an endowed chair of his department. The other authors declare that they have no conflicts of interest.

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