Endovascular Flow Diversion for Hemifacial Spasm Due to an Unruptured Fusiform Vertebral Artery Aneurysm: A Case Report

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BACKGROUND AND IMPORTANCE: Hemifacial spasm (HFS) caused by a fusiform aneurysm is rare and difficult to treat. We present the first case of successful endovascular flow diversion treatment for HFS due to a fusiform aneurysm.

CLINICAL PRESENTATION: A 46-year-old man suffered from right HFS for 6 months because of a fusiform right vertebral artery aneurysm compressing the root exit zone of cranial nerve VII. He successfully underwent flow diversion, with immediate disappearance of his HFS. Follow-up digital subtraction angiography 3 months after treatment showed complete resolution of the aneurysm.

CONCLUSION: Flow diversion might be a promising treatment option for HFS due to a fusiform vertebral artery aneurysm.

KEY WORDS: Flow diversion, Fusiform aneurysm, Hemifacial spasm, Vertebral artery

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Hemifacial spasm (HFS) is an involuntary contraction of the facial muscle, usually caused by mechanical compression of the facial nerve root at the root exit zone (REZ). The most common etiology is compression by an arterial loop of the anterior or posterior inferior cerebellar artery. However, other compressive pathologies can induce HFS, and 0.2% to 0.5% of the cases are caused by saccular or fusiform vertebral artery (VA) aneurysms.[1] HFS due to a saccular aneurysm is commonly treated by a combination of aneurysm neck clipping and microvascular decompression (MVD).[2] However, aneurysm neck clipping is difficult to perform in fusiform aneurysms. Therefore, MVD alone[3-6] and parental artery occlusion (PAO)[7-9] have been previously performed despite the associated risks of future aneurysm rupture and ischemic complications, respectively.

Flow diversion is an endovascular aneurysm treatment using low-porosity endoluminal devices that reduce blood inflow into aneurysms while preserving the parent arteries[10] and have recently emerged as a treatment option for complex intracranial aneurysms, including fusiform aneurysms.[11] Here, we report a successful case of endovascular flow diversion treatment for HFS caused by an unruptured fusiform VA aneurysm for the first time, which simultaneously resulted in disappearance of the aneurysm and cure of the HFS, with preservation of the parent artery.

ABBREVIATIONS: HFS, hemifacial spasm; **MVD,** microvascular decompression; **PAO,** parental artery occlusion; **REZ,** root exit zone; **VA,** vertebral artery; **VAG,** vertebral angiography.

CLINICAL PRESENTATION

History and Examination

A 46-year-old man was referred to our hospital with phasic type HFS from the right lower eyelid to the cheek for 6 months. Magnetic resonance (MR) imaging and angiography showed a fusiform VA aneurysm with a maximum diameter of 10 mm at the right V4 segment (Figure 1A and 1B), compressing the REZ of the right facial nerve (Figure 1C).

Treatment

The patient was given aspirin 100 mg and clopidogrel 75 mg daily for 2 weeks before treatment.

Under general anesthesia, the patient was systemically heparinized and a 5-Fr Axcelguide guide sheath (Medikit Co., Ltd) was inserted through the femoral artery. A triaxial system consisting of a 5-Fr

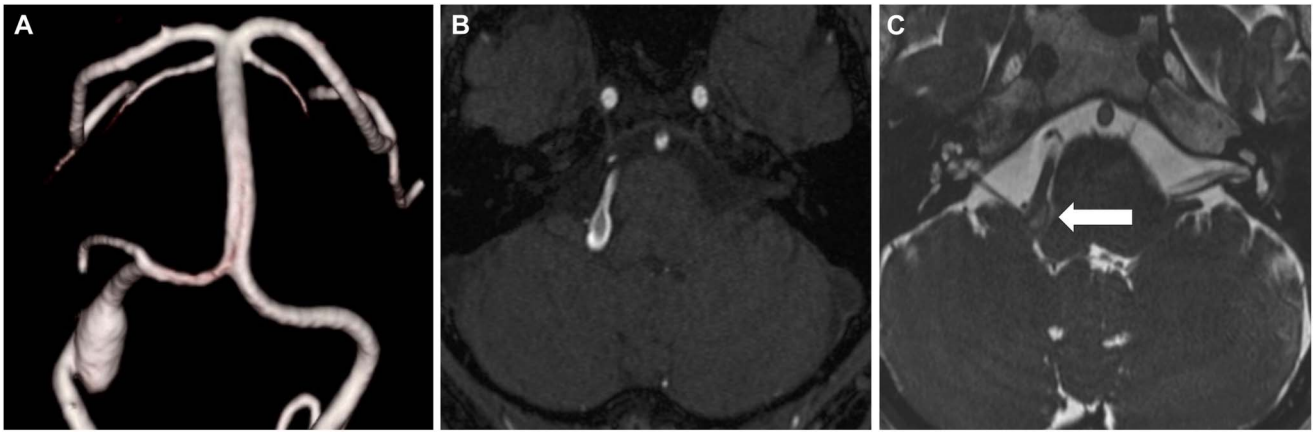

FIGURE 1. *Initial cranial MR imaging.* **A**, *Three dimension and* **B**, *time of flight MR angiography showed an unruptured, fusiform, right vertebral artery aneurysm, with a maximum diameter of 10 mm. Fast imaging employing steady-state acquisition MR imaging demonstrated compression of the root exit zone of the right facial nerve by the aneurysm (***C***, arrowhead). MR, magnetic resonance.*

Navien catheter (Medtronic Inc), a 0.027-inch Phenom 27 microcatheter (Medtronic Inc), and a 0.014-inch Chikai 14 200-cm microguidewire (Asahi Intecc Co., Ltd) was constructed and guided into position under roadmap guidance. Pretreatment right vertebral angiography (VAG) showed the fusiform aneurysm (Figure 2A).

Pipeline Flex Embolization Device with Shield Technology (3.5 × 30 mm) (Medtronic Inc) was deployed over the neck of the aneurysm (Figure 2B). Right VAG after the implantation showed that the neck of the aneurysm was adequately covered and there was an eclipse sign within the aneurysm (Figure 2C). Postoperatively, the patient recovered consciousness without any neurological symptoms.

Post-Treatment and Follow-up

The patient had complete resolution of HFS immediately after the treatment, and MR imaging 5 days after flow diversion showed nearly complete disappearance of the aneurysm without transposition of the right VA. Three months after treatment, there was no residual filling of the aneurysm on right VAG (Figure 2D) and no recurrence of HFS.

The corresponding author of this article has obtained patient consent for anonymized publication of the case.

DISCUSSION

HFS caused by VA aneurysms, especially fusiform VA aneurysms, is extremely rare. In fact, only 10 such patients have been reported to date,[3-9,12-14] including 5 male patients and 5 female patients, ranging from age 45 to 71 (mean 57) years. For the treatment of HFS, 4 of the previously reported patients underwent MVD alone[3-6] without preventive treatment of aneurysm rupture. MVD in combination with wrapping of the aneurysm was performed in 2 patients,[12,13] and proximal occlusion of the VA under microscopy along with MVD was performed in 1 patient.[14] Endovascular internal trapping was performed in the remaining 3 patients.[7-9] Although HFS disappeared after the treatment in all the patients mentioned above, these treatment strategies have some disadvantages. MVD alone leaves the aneurysm untreated, with the future risk of aneurysmal enlargement and rupture.[15] On the other hand, although proximal VA occlusion is an option, it was reportedly responsible for 28.9% of ischemic complications in the perforator territories.[16] In addition, PAO cannot be applied to patients with a hypoplastic VA on the contralateral side. Furthermore, aneurysm formation in the contralateral VA through a hemodynamic mechanism is another problem after PAO. In cases of HFS due to the compression by a dolichoectatic vertebrobasilar artery, the effectiveness of sling procedure has been reported.[17,18] This technique would also be effective for HFS due to a fusiform VA aneurysm. However, the future risk of aneurysmal enlargement and rupture would not be prevented as with simple MVD. In this case, PAO was a treatment option because the aneurysm was located on the nondominant side. However, because of the disadvantages of PAO described above, such as risks of ischemic complications in the perforator territories even in cases with treatment for nondominant side VA, or aneurysm formation in the contralateral VA through a hemodynamic mechanism, we performed the less invasive procedure of endovascular flow diversion, which eradicated the aneurysm while preserving the parent artery, resulting in complete relief of the HFS postoperatively. Therefore, it is suggested that flow diversion is extremely useful for the treatment of HFS secondary to a fusiform VA aneurysm.

HFS is believed to occur because of pulsatile compression and dysfunction of cranial nerve VII near the REZ, with symptoms resulting from an intermittent "short-circuiting" of signaling pathways.[19] In our case, MR imaging before treatment showed that the aneurysm compressed the REZ of the right facial nerve and obvious vascular transposition was not observed after treatment.

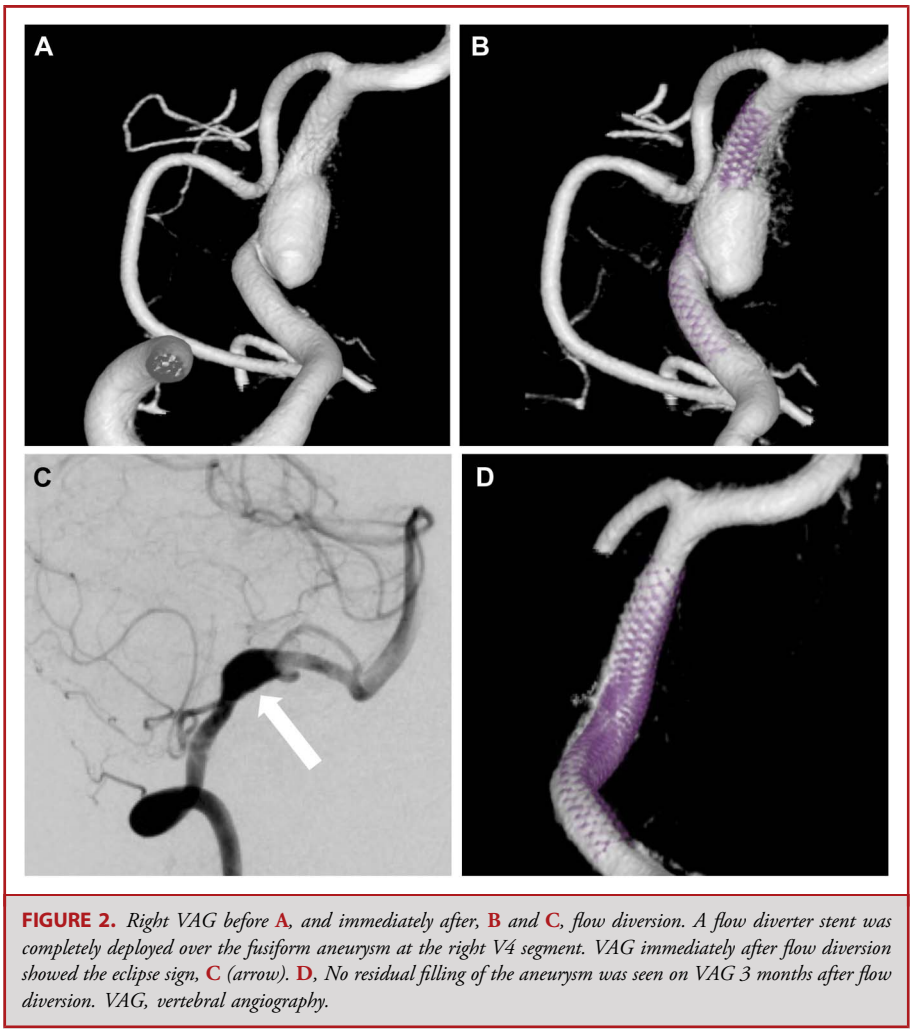

FIGURE 2. *Right VAG before* **A**, *and immediately after,* **B** *and* **C**, *flow diversion. A flow diverter stent was completely deployed over the fusiform aneurysm at the right V4 segment. VAG immediately after flow diversion showed the eclipse sign,* **C** *(arrow).* **D**, *No residual filling of the aneurysm was seen on VAG 3 months after flow diversion. VAG, vertebral angiography.*

VAG immediately after flow diversion revealed an eclipse sign, indicating decreased blood flow in the aneurysm. These findings suggest that the decrease in pulsatile compression, but not the decrease in contact to REZ, contributed to disappearance of HFS. A previous report of flow diversion for HFS due to a saccular VA aneurysm also supports this mechanism because HFS disappeared immediately after treatment in that case as well.[20]

Limitation

The pathological mechanism of HFS resolution is not fully understood, and more cases and longer follow-up periods are needed to determine whether flow diversion is as effective as MVD alone or PAO for HFS caused by fusiform aneurysms.

CONCLUSION

Flow diversion might be a promising treatment option for HFS due to fusiform VA aneurysms.

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The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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