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Technical Note

Use of Contralateral Trans-Anterior Communicating Artery Snare to Rescue Lost Access to a Pipeline Embolization Device Unsheathed in an Aneurysm

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Objective: A pipeline embolization device (PED; Medtronic, Minneapolis, MI, USA) is a new vascular reconstruction device used to treat large internal carotid artery (ICA) aneurysms in Japan. We herein present a PED-related complication and describe its rescue strategy. Rescue therapy using a snare via the posterior communicating artery from the contralateral side has already been reported. However, this is the first report of therapy via the anterior communicating artery (AcomA).
Case Presentation: A 49-year-old woman underwent vascular reconstruction with a PED for a large cavernous ICA aneurysm. During the placement of the PED, the proximal side of the PED slipped into the aneurysm. It was impossible to enter the true lumen of the PED from the proximal side because the orifice of the stent faced the aneurysmal wall. Contralateral trans-AcomA access to the PED was obtained through the distal ICA. The microwire from the distal ICA was connected with Goose Neck snares (Medtronic) from the proximal ICA. Pulling the snares to the proximal side, the PED was straightened and distal access was regained. Another PED was deployed such that it overlapped with the first PED to achieve vascular reconstruction. The patient finally recovered from aphasia, but paralysis of the right upper limb remained after rehabilitation.
Conclusion: If the stent slips into the aneurysm, distal access through the true stent lumen may be very difficult. We presented a rescue technique for this complication, through the AcomA from the contralateral side.

Keywords ▶ complication management, giant aneurysm, pipeline embolization device

Introduction

A pipeline embolization device (PED; Medtronic, Minneapolis, MI, USA) is the only flow diverter system available in Japan. When deploying a PED, confirming a collateral pathway is important, considering the risk of stent occlusion. We report a case of a patient in whom the proximal part of the PED had slipped into an aneurysm, making access impossible. The true lumen of the PED was approached from the distal side, through the anterior communicating artery (AcomA) from the contralateral side, and distal access was regained with a snare. Rescue therapy using a snare via the posterior communicating artery from the contralateral side has already been reported. However, this is the first report of therapy via the AcomA.

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Case Presentation

Present illness: A 49-year-old woman visited our hospital due to diplopia and ptosis. She was under medication for hypertension and had no family history of any other diseases. Left ocular pain developed, and left ptosis and adduction disorder of the left eye gradually appeared. At the cavernous sinus of the left internal carotid artery (ICA), an aneurysm, measuring 15 mm in maximum diameter, with partial thrombosis was detected. Treatment using a PED was selected.

Neurological findings: She was alert and conscious. Incomplete paralysis of the left oculomotor nerve was noted.

Imaging findings: The aneurysm measured 14 mm × 15 mm. Its neck was 10 mm. The distal and proximal neck diameters were 3.4 and 3.36 mm, respectively (**Fig. 1**). A small aneurysm was also detected at the bifurcation of the ophthalmic artery. As it might have been trapped after pipeline insertion, intra-aneurysmal embolization of the small aneurysm was planned concomitantly and performed using the jail technique.

Treatment: The operation was performed under general anesthesia. A Launcher 8F/90 cm ST (Medtronic) was inserted as a guiding catheter and a Navien 5F/125 cm (Medtronic) was inserted as a distal access catheter. Excelsior SL-10 45° (Boston Scientific, Natic, MA, USA) was placed into the distal aneurysm for the jailing technique. The catheter for stent deployment was guided into the distal normal ICA. The catheter for the jailing technique was guided into the aneurysm and the PED was deployed (**Fig. 2A**). Its distal side was carefully placed to prevent the stent from involving AcomA or middle cerebral arteries, and the PED was deployed to the proximal side of the aneurysm while filling the stent mesh with the aneurysmal neck. While collecting a delivery wire from the Marksman, it interfered with the PED and the system migrated to the distal side, with intra-aneurysmal migration of the proximal side of the PED (**Fig. 2B–2E**). A microcatheter and microwire were selected to capture the true lumen of the stent on the ipsilateral side, but the orifice of the stent faced the aneurysmal wall, making capture impossible. Using an AMPLATZ GOOSE NECK Microsnare kit (Goose Neck Snares; Medtronic), we attempted to collect the PED, but it was impossible. In the present case, the AcomA was thick and developed enough and thus we planned to secure the true lumen from the distal side through the AcomA. A Chaperon 5F (MicroVention Terumo, Tustin, CA, USA) was inserted into the right ICA and an Excelsior SL-10 J (Boston Scientific) was inserted through the AcomA to

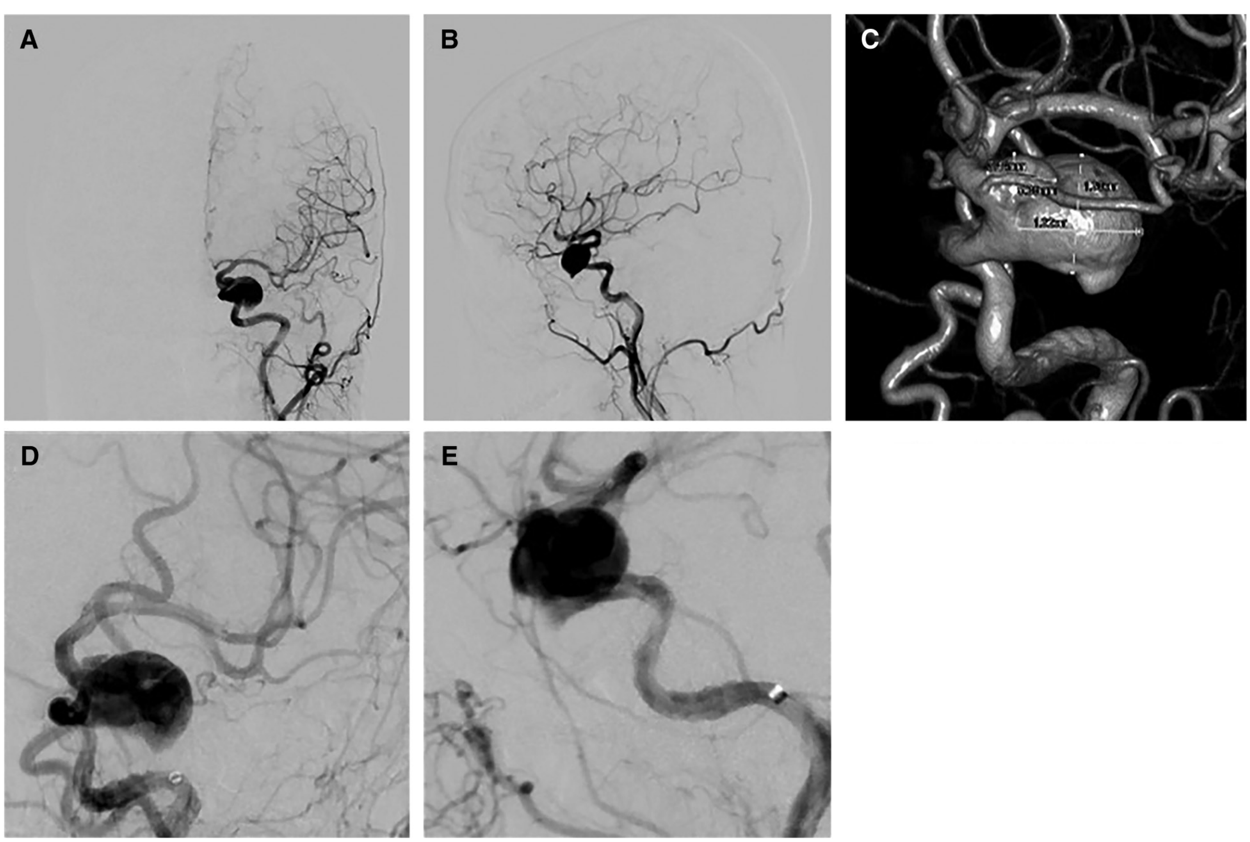

Fig. 1 Preoperative left internal carotid angiogram. (**A**) Anteroposterior and (**B**) lateral views. (**C**) Three-dimensional reconstruction imaging. (**D**) Anteroposterior and (**E**) lateral working views of a pre-intervention digital subtraction angiogram during the left ICA injection (The cavernous giant aneurysm measures measured 14 × 15 mm). ICA: internal carotid artery

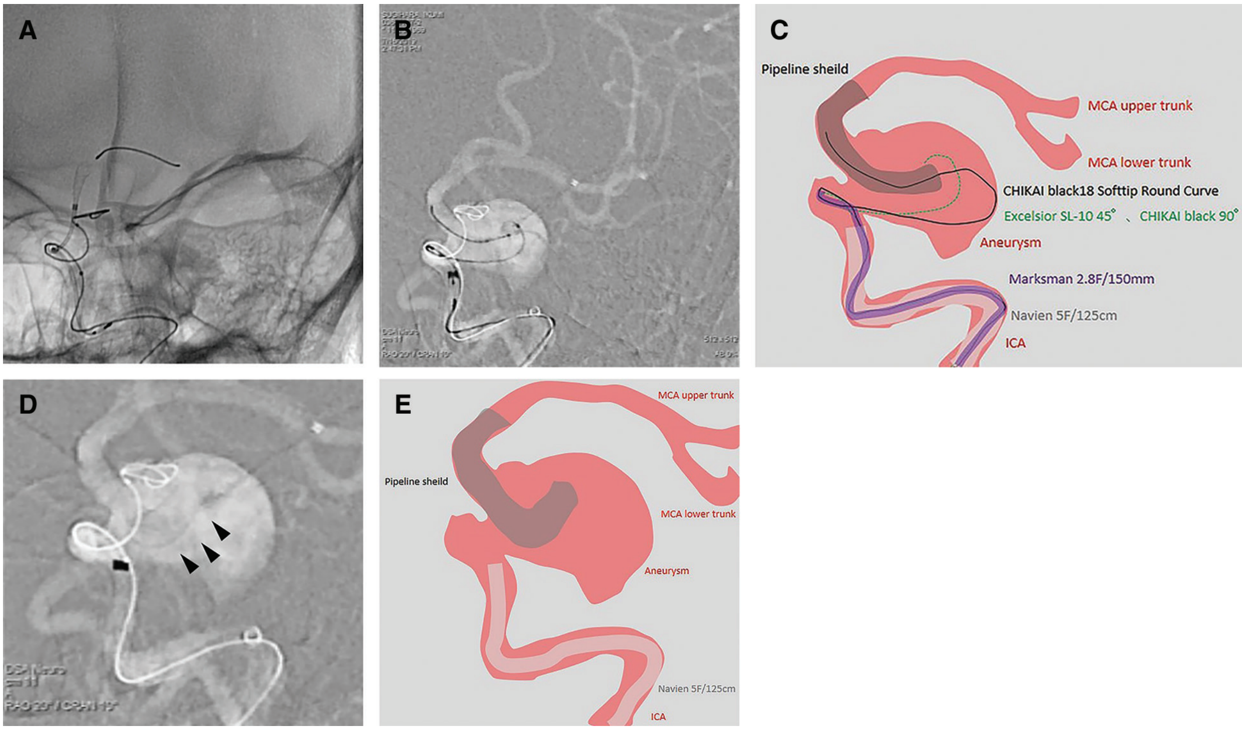

Fig. 2 Deployment of a PED (Medtronic, Minneapolis, MN, USA). (**A**) After guiding a catheter into the aneurysm for the jail technique, the PED was deployed on the distal side of the aneurysm. (**B**) After deploying the PED to the proximal side of the aneurysm, we attempted to secure a true lumen using a Marksman 2.8F/150 mm (Medtronic). Due to system interference, the proximal side of the PED migrated into the aneurysm. (**C**) Scheme of Figure 2B. ICA: Internal carotid artery; MCA: middle cerebral artery; dark gray: Pipeline Shield 3.75 mm/20 mm (Medtronic); light gray: Navien 5F/125 cm (Medtronic); purple: Marksman 2.8F/150 mm (Medtronic); black: CHIKAI black18 Softtip Round Curve (Asahi Intecc, Aichi, Japan), dotted green line: Excelsior SL-10 45° (Boston Scientific, Natic, MA, USA) or CHIKAI black 90° (Asahi Intecc). (**D**) Magnification of intra-aneurysmal PED deployment. The PED was deployed toward the lateral side in the aneurysm (arrowhead). (**E**) Scheme of Figure 2D. ICA: Internal carotid artery; MCA: middle cerebral artery; dark gray: Pipeline Shield 3.75 mm/20 mm (Medtronic); light gray: Navien 5F/125 cm (Medtronic); PED: pipeline embolization device

secure the distal-side true lumen of the stent (**Fig. 3A** and **3B**). Thus, a CHIKAI black18 Softtip Round Curve was guided into the aneurysm from the distal side of the PED and connected with the Goose Neck snares. While pulling the Goose Neck snares up to the distal side of the PED, the PED was linearized (**Fig. 3C**). A Marksman 2.8F/150 mm (Medtronic) was successfully guided to the distal side of the PED along the Goose Neck snares. A Pipeline Shield 4.0 mm/20 mm stent was overlapped with the inner area of the linearized PED (**Fig. 3D**). After confirming intra-aneurysmal flow reduction, the surgery was completed (**Fig. 3E** and **3F**). After awakening from general anesthesia, motor aphasia and paralysis of the right upper limb were noted. No high signal intensity suggestive of cerebral infarction was noted on magnetic resonance imaging diffusion-weighted imaging. Arterial spin labeling demonstrated hypoperfusion (**Fig. 4A** and **4B**). On magnetic resonance angiography, visualization of peripheral blood vessels was reduced (**Fig. 4C**). Hyperperfusion was noted the day after surgery (**Fig. 4D–4F**) and we considered the symptoms to be related to hyperperfusion. One month after the surgery, the hyperperfusion decreased (**Fig. 4G–4I**), but proximal-side paralysis of the right upper limb remained. The patient was referred to a rehabilitation hospital with a modified Rankin Scale score of 2. Based on this study, the emergency use of Goose Neck snares as a rescue therapy in neuroendovascular treatment was retrospectively approved by the ethics review board of our hospital.

Discussion

We herein presented a rescue technique for a complication wherein the stent slips into the aneurysm and distal access through the true stent lumen may be very difficult. According to a previous study,[1] the proximal part of a PED slipped into an aneurysm during surgery or follow-up in 12 of 100 patients. Regarding device migration, another study reported PED migration in 2 of 54 patients.[2] The causes included the "accordion effect," gravity-related inferior

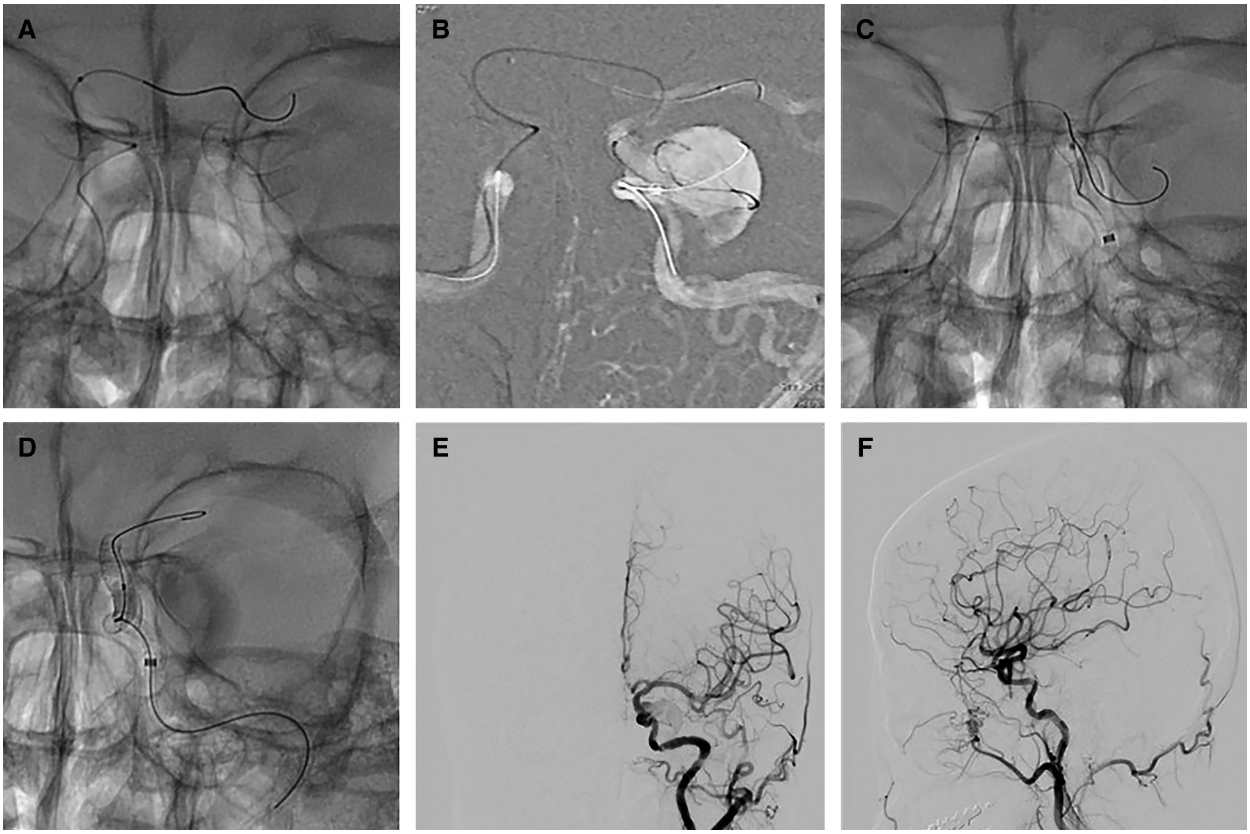

Fig. 3 Approaching from the contralateral side after the PED (Medtronic, Minneapolis, MI, USA) slipped. (**A**) A true lumen was secured via the anterior communicating artery from the contralateral side. (**B**) A guidewire that had reached the aneurysm from the distal side of the PED was connected with the Goose Neck snares (Medtronic) that had been deployed in the aneurysm on the ipsilateral side. (**C**) While pulling the connected Goose Neck snares up to the distal side of the PED, the PED was linearized and a Marksman 2.8F/150 mm (Medtronic) was guided. (**D**) Another PED was deployed such that it overlapped with the inner area of the linearized PED. Frontal view on left internal carotid angiography after the completion of treatment (**E**). Lateral view (**F**). PED: pipeline embolization device

deviation, the "watermelon seeding effect," delivery wire recapture failure, and torsion-related kinking.[3] In the present case, system interference when retrieving the delivery wire during deployment of PED led to slipping of the proximal part of the PED. In our hospital, when capturing a delivery wire, a method involving catheter guidance to the end of the delivery wire and capturing it without pulling it to the proximal side, is adopted to always maintain a true lumen. In the present case, if delivery wire collection on the distal side had been switched to the proximal side at the time of interference on collection, PED slipping may have been avoided.

Several rescue techniques for a PED slipping into an aneurysm have been reported. Chalouhi et al.[4] reported that a J-shaped guidewire was useful for intra-stent guidance after a PED slipping into an aneurysm. In one case report, a PED that slipped into an aneurysm was pulled through from the distal side using Goose Neck snares via the posterior communicating artery.[5] Another study presented a patient with PED dilation failure in whom the PED was dilated using a balloon the AcomA from the contralateral side.[6] However, this is the first report of a case in which a wire was guided into an aneurysm through the AcomA and connected with the Goose Neck snares guided on the ipsilateral side. Regarding why Goose Neck snares were used on the ipsilateral side, their use from the contralateral side may affect operability and induce vascular injury due to their hardness. Furthermore, in the present case, a stent facing the outside of the aneurysm could be linearized by pulling the wire with the Goose Neck snares, which was advantageous. However, Goose Neck snares are a device for collecting foreign objects, and the complication in the current case is not included in the indications for its use. There were no hemorrhagic or ischemic complications related to the AcomA-mediated procedure in this case, but the risks of vascular dissociation and subarachnoid hemorrhage are high due to device handling in thin blood vessels; this high-risk procedure should be

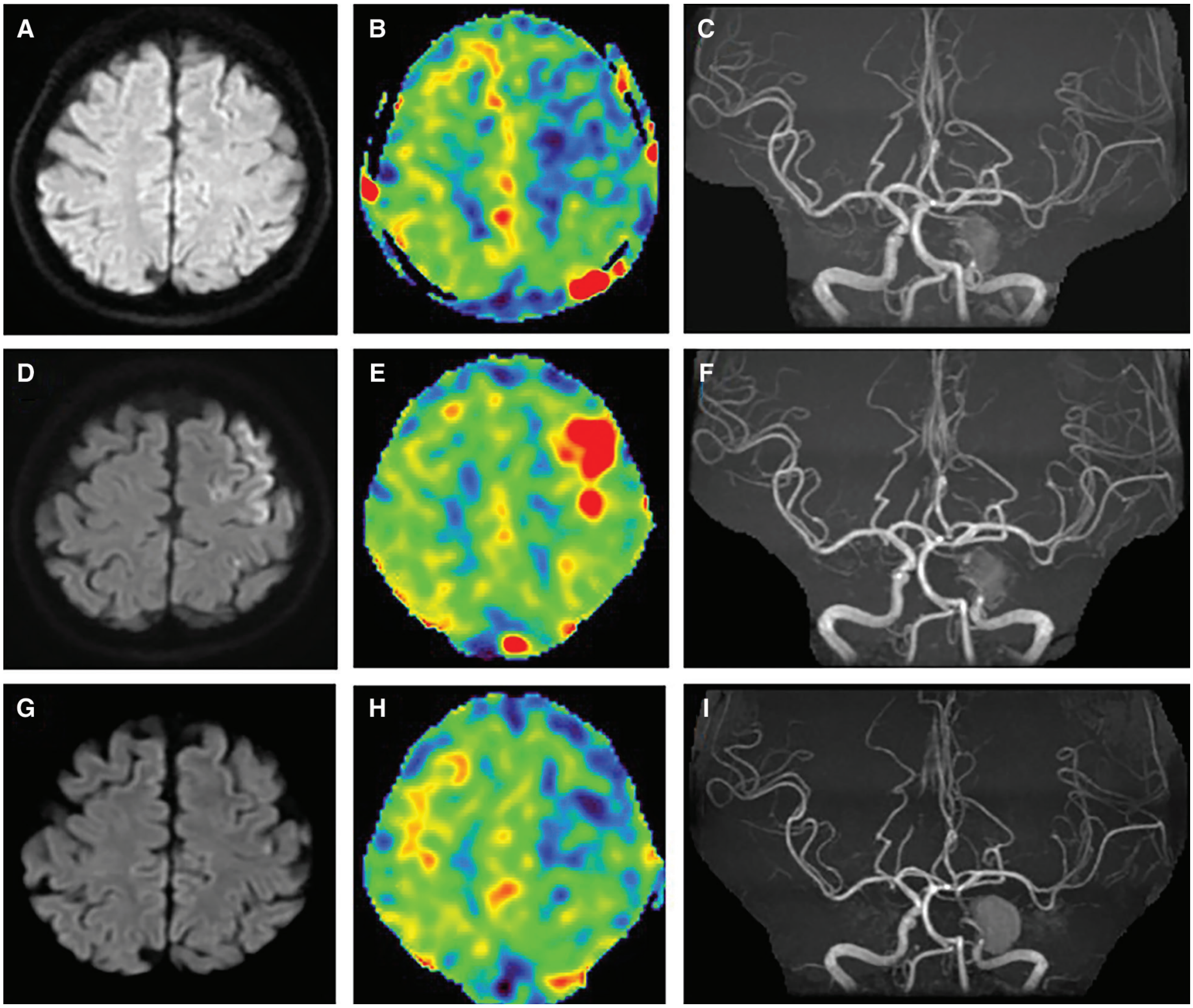

Fig. 4 (**A–C**) MRI immediately after surgery. (**A**) There was no high signal intensity suggestive of cerebral infarction on DWI. (**B**) ASL showed low signal intensity, suggesting hypoperfusion. (**C**) On MRA, visualization of peripheral blood vessels was reduced. (**D–F**) MRI the day after surgery. High signal intensity localized in the left frontal lobe cortex on DWI (D) and at the same site on ASL (E) was detected. On MRA, visualization of blood vessels improved (**F**). (**G–I**) MRI 28 days after surgery. The high signal intensity in the left frontal lobe cortex on DWI disappeared (**G**) and that on ASL decreased (**E**). The vascular visualization-improving effects on MRA were also reduced (**H**). ASL: arterial spin labeling; DWI: diffusion-weighted imaging; MRA: magnetic resonance angiography; MRI: magnetic resonance imaging

considered as the last option. The use of Goose Neck snares in the present case was approved by the ethics review board of our hospital.

In the present case, the AcomA was thick and developed enough, facilitating the procedure. However, emergency embolization of a parent blood vessel with high flow bypass must be considered in patients in whom a collateral-pathway-mediated approach is difficult.

Flow diverter systems are epoch-making, but accumulation of more cases is necessary. The importance of troubleshooting for insertion has been recognized. It is important to evaluate a collateral pathway using computed tomography angiography or angiography before surgery. A collateral pathway may become an access route in accordance with the vascular diameter, in addition to its role in blood flow maintenance in the presence of intraoperative occlusion. Furthermore, in our hospital, a strategy is employed to deploy the distal side of the stent through the ICA more proximal to the A1 origin to preserve the contralateral route through the AcomA. If a stent is deployed on an access route for stenting, rescue techniques may be impossible in some cases. Therefore, if possible, a stent should be inserted such that it does not involve a collateral pathway.

Conclusion

When a stent slips into an aneurysm, it is sometimes difficult to access the aneurysm. However, an approach using the AcomA facilitated evaluation of a parent blood vessel from the distal side; this was useful as a rescue method.

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Disclosure Statement

We declare no conflicts of interest.

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