

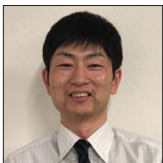
Case Report

Extracranial-intracranial high-flow bypass as a rescue therapy for incomplete cerebral aneurysm occlusion after flow diversion: A case report

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ABSTRACT

Background: Excellent treatment outcomes using a pipeline embolization device (PED) have been reported. However, several limitations exist. For example, patients must receive antiplatelet therapy for at least several months, and few alternative treatments exist except for inserting additional flow diverter stents in cases where aneurysm obliteration is not obtained.

Case Description: A 67-year-old female suffered from an asymptomatic large aneurysm of the left paraclinoid internal carotid artery (ICA). She underwent endovascular coil embolization, but coil compaction was confirmed at 2-year follow-up. A PED was inserted as an additional treatment. Unfortunately, the patient was required to discontinue antiplatelet therapy to undergo orthopedic surgery for her severe osteoarthritis of the knee. However, surveillance imaging performed 2 years after insertion of the PED revealed persistent filling into the aneurysm, and we could not stop the antiplatelet therapy to proceed with orthopedic surgery. Therefore, we performed ICA trapping with extracranial-intracranial high-flow bypass to cease antiplatelet therapy promptly. Antiplatelet therapy was completed 3 months after the rescue surgery, and the patient underwent orthopedic surgery.

Conclusion: The authors describe a case of failure of complete obliteration after treatment using a PED, which required cessation of antiplatelet therapy to receive orthopedic surgery. Although safety and efficacy of PED treatment have been reported, we must consider the possibility of other diseases requiring discontinuation of antiplatelet therapy after PED embolization.

Keywords: Antiplatelet therapy, Flow diverter stent, High-flow bypass, Incomplete occlusion

INTRODUCTION

The use of a pipeline embolization device (PED; Medtronic, Irvine, CA, USA) is well established for complex cerebral aneurysms and has been reported to have excellent treatment outcomes.^[2,5] However, antiplatelet therapy is required after placement of a PED, and the onset of cerebral infarction associated with discontinuation of antiplatelet agents has been reported.^[8,9] A precise protocol for withdrawal of these drugs has not been established, especially in cases without complete obliteration of treated aneurysms. In the present case, the patient was required to stop antiplatelet therapy to receive surgical treatment for severe osteoarthritis of the knee, although

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incomplete obliteration of the internal carotid artery (ICA) aneurysm treated by PED was confirmed. To cease antiplatelet therapy promptly, we decided to perform ICA trapping with extracranial-intracranial (EC-IC) high-flow bypass as a rescue therapy.

CASE DESCRIPTION

A 67-year-old female with a medical history of congenital dislocation of the hip, which required six surgeries, suffered from an asymptomatic large aneurysm of the left paraclinoid ICA, with agenesis of the right ICA [Figure 1a and b] and asymptomatic dilatation of ventricles. To prevent aneurysm rupture, endovascular coil embolization was performed. However, cerebral angiography performed 2 years after endovascular coiling showed coil compaction and persistent filling into the aneurysm [Figure 1c], and the patient underwent placement of a PED [Figure 1d]. The distal end of the stent was positioned just proximal to the posterior communicating artery (PCoA). Cerebral angiography performed 1 year after insertion of the PED demonstrated reduced filling into the aneurysm, but not complete occlusion. Unfortunately, she suffered from severe osteoarthritis of the knee and her symptoms, persistent pain, and gait disturbance, rapidly worsened. She needed to undergo orthopedic surgery, but her treatment was complicated and was required to stop antiplatelet therapy. Time-of-flight magnetic resonance angiography and cerebral angiography performed 2 years after insertion of the PED revealed increased filling into

the aneurysm [Figures 1e and f], and we believed that it would be difficult to cease antiplatelet therapy under these conditions. The patient strongly desired to proceed with orthopedic surgery promptly, and we decided to perform ICA trapping with EC-IC high-flow bypass to withdraw antiplatelet therapy.

In the operation, the superficial temporal artery (STA) and radial artery (RA) were prepared. The cervical neck was exposed, and the common carotid artery, ICA, and external carotid artery (ECA) were preserved. The Sylvian fissure was opened widely, and the middle cerebral artery (MCA) was exposed. STA-MCA (M4) bypass was performed to ensure cerebral blood flow during occlusion of the MCA (M2), and subsequently, an ECA-RA-MCA (M2) bypass was performed. The PED was clearly confirmed using indocyanine green (ICG) angiography [Figure 2a and b], and ICA trapping was completed from the cervical ICA to the proximal portion of the PCoA [Figure 2c]. Final ICG angiography revealed that PCoA flow through EC-IC high-flow bypass was preserved and complete occlusion of the aneurysm was achieved [Figure 2d].

A postoperative magnetic resonance imaging and angiography showed bypass patency without ischemic change [Figure 2e and f]. During the postoperative course, she experienced mild worsening of her gait due to inactivity. She was transferred to a rehabilitation hospital 1 month after the surgery and discharged home after 2 months of rehabilitation. Antiplatelet therapy was completed 3 months after the surgery, and she underwent orthopedic surgery.

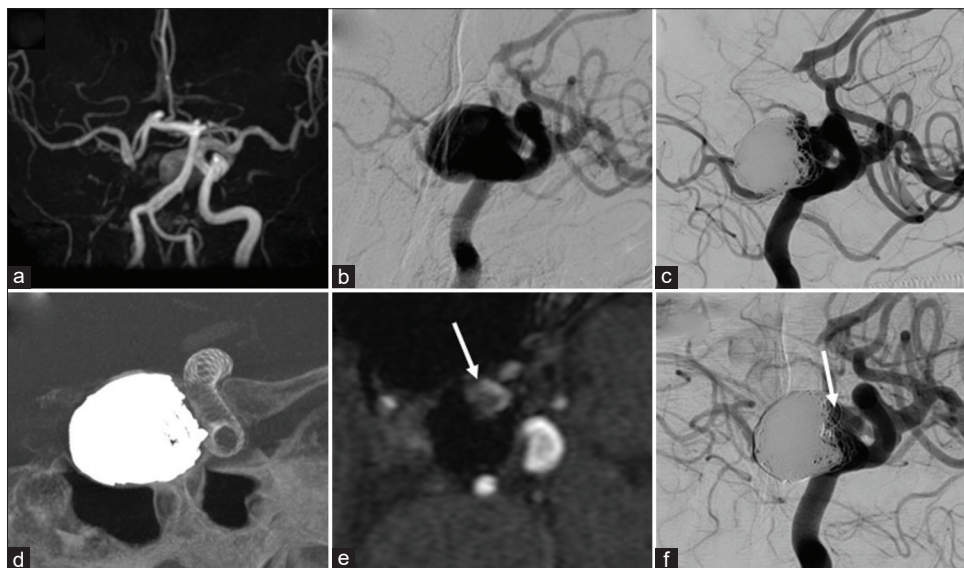


Figure 1: Pretreatment magnetic resonance angiography (MRA) (a) and left internal carotid angiography (b) showing a left large paraclinoid aneurysm and agenesis of the right internal carotid artery. Angiography 2 years after the coil embolization demonstrating aneurysm recurrence (c). Angiography showing the placement of the flow diverter stent (d). Time-of-flight MRA and angiography performed after 2 years after flow diversion showing residual flow into the aneurysm, increasing gradually (e and f arrows).

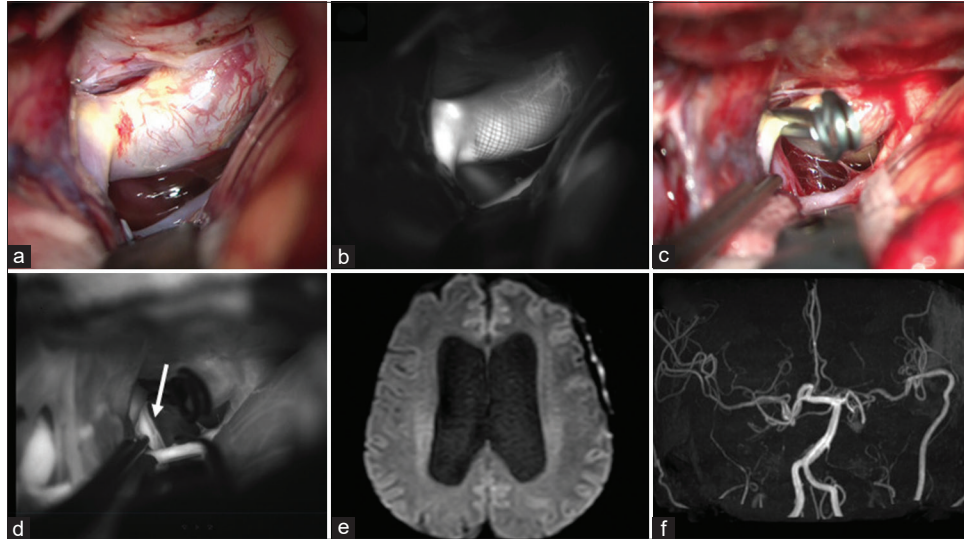


Figure 2: The flow diverter stent was identified (a) and indocyanine green (ICG) angiography showed the distal edge of the stent clearly (b). The internal carotid artery was trapped (c) and ICG angiography demonstrated retrograde flow of the posterior communicating artery was observed (d, arrow). Postoperative magnetic resonance imaging (e) and angiography (f) showing no ischemia and bypass patency.

DISCUSSION

The treatment of flow diverter stents has become mainstream for the treatment of intracranial large and giant wide-necked aneurysms, and numerous studies have reported the safety and efficacy of PED treatment.^[2,5] However, not a few cases result in failure of aneurysm obliteration after PED treatment. Older age (>70 years), fusiform aneurysm, aneurysm size (≥ 15 mm), male sex, smoking, and branching artery from the aneurysm neck have been reported as predictors of persistence after PED embolization.^[1,3,6,7] Only aneurysm size corresponded to those factors in our case; complete obliteration was not obtained, and increased flow into the aneurysm was confirmed. We planned to insert an additional PED, but we did not discontinue antiplatelet therapy and proceeded with the orthopedic surgery promptly.

A serious complication associated with PED treatment is parent artery occlusion due to the in-stent thrombosis.^[8,9] To avoid this complication, antiplatelet therapy before PED treatment and for at least several months afterward is mandatory, but the timing to discontinue antiplatelet agents is debated. Several authors have reported that antiplatelet therapy should not be stopped until complete aneurysm obliteration is confirmed after PED insertion because the device is not completely covered with the endothelium.^[4,8,9] In the present case, complete obliteration was not obtained, and increased filling into the aneurysm was confirmed. Therefore, we could not stop the antiplatelet therapy to proceed with orthopedic surgery.

While the relative incidence has declined since the approval of flow diverter stents, EC-IC bypass could offer an

important alternative treatment in a subset of appropriate patients.^[10] Furthermore, EC-IC bypass could be used as a salvage therapy after PED embolization, as in our case. The opposite ICA of our patient was aplastic and the patient had to receive invasive surgical treatment for knee osteoarthritis, which may have induced hypotension and hypovolemia during the perioperative period. Therefore, we selected an EC-IC high-flow bypass using a radial graft. Although fewer and fewer cases are treated by bypass surgery in this flow diversion era, the utility of EC-IC bypass, including high-flow bypass, continues and must serve as a treatment option and salvage therapy.

CONCLUSION

We described a case of incomplete aneurysm obliteration after PED treatment and ICA trapping with EC-IC high-flow bypass to discontinue antiplatelet therapy. A high rate of complete occlusion after PED treatment has been reported, but it is sometimes dangerous to discontinue antiplatelet therapy, especially in cases without complete aneurysm obliteration. Physicians must consider the possibility of other diseases requiring discontinuation of antiplatelet therapy over a long period after PED embolization.

Declaration of patient consent

Patient's consent not required as patients identify is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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