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A Case of Ruptured Anterior Cerebral Artery Dissection Prevented from Re-rupture with Stenting and Modification of Antiplatelet Agents

Yu OTAKI,[1] Tatsuya SHIMIZU,[1] Masanori AIHARA,[1] Rei YAMAGUCHI,[1] Kaoru AISHIMA,[1] and Yuhei YOSHIMOTO[1]

[1]*Department of Neurosurgery, Gunma University Graduate School of Medicine, Maebashi, Gunma, Japan*

Abstract

A case of ruptured anterior cerebral artery (ACA) dissection was treated with multiple neck-bridge stents, with modification of antiplatelet administration according to changes in the shape of the aneurysm in the acute phase. A 67-year-old woman presented with severe subarachnoid hemorrhage and fusiform dilatation was observed in the left ACA between the A1 and A2 segments. The use of stents in the acute phase is associated with high risk of ischemic complications. Prasugrel administration, which is considered to have low drug resistance, may have allowed safe stent use in the acute phase.

Keywords: anterior cerebral artery dissection, stenting, antiplatelet, acute phase

Introduction

Dissection of the anterior cerebral artery (ACA) is a rare clinical entity that accounts for approximately 5% of intracranial dissections.[1)] The conventional treatment has been trapping with bypass, but endovascular treatment has recently been increasingly adopted.[2,3)] Reconstructive endovascular treatment for intracranial dissecting aneurysms has the advantage of preserving the parent artery without challenging bypass techniques,[4,5)] although curability remains a concern and management of antiplatelet agents is controversial after rupture.

We report a case of ruptured ACA dissection treated with multiple course neck-bridge stenting, particularly modification of antiplatelet administration based on changes in the aneurysm shape during the acute phase.

Case Description

A 67-year-old woman presented with severe subarachnoid hemorrhage, World Federation of Neurosurgical Society grade IV, and neuroimaging demonstrated a fusiform dilatation in the left ACA between the A1 and A2 segments (Fig. 1A and B). The rupture point was thought to correspond with a bleb projecting posteriorly at the A1 segment. Computed tomography angiography (CTA) failed to demonstrate the anterior communicating artery. Digital subtraction angiography with manual contralateral carotid compression showed poor cross-filling via the anterior communicating artery. Endovascular treatment was selected to prevent ischemic complications, particularly involving perforating branches such as the recurrent artery of Heubner originating from the A1-A2 junction (Fig. 1C). Preoperative loading of prasugrel 20 mg and aspirin 300 mg for 2 days was given. A braided stent (Low-profile Visualized Intraluminal Support [LVIS] Jr. 3.5 × 23 mm; MicroVention-Termo, Tokyo, Japan) was implanted in the A1-A2 segments to cover the dissection on day 2. No postoperative ischemic complications were observed. The use of stents in the acute rupture phase and of prasugrel in cerebrovascular field are off-label use in Japan. However, these treatments were thought to be useful in avoiding ischemic complications with preserving the main trunk. The informed consent was obtained from the family and these treatments were approved by the institutional review board of Gunma University (Protocol number: 200528-1-2a).

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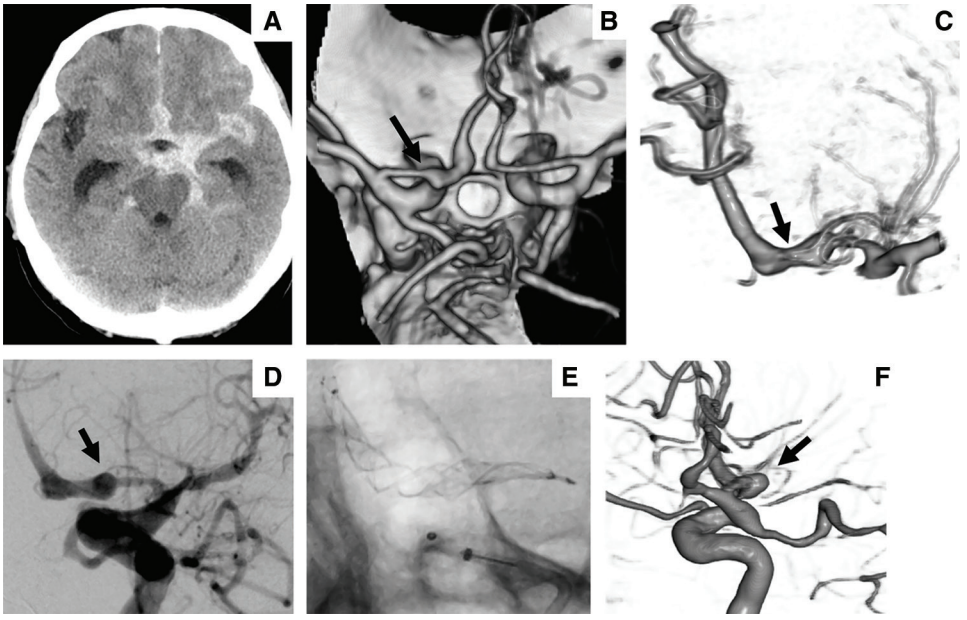

Fig. 1 (A) Non-contrast head CT scan demonstrating diffuse subarachnoid hemorrhage predominantly in the left carotid cistern. (B) Three-dimensional CT scan showing an irregular dilatation in the left ACA across the A1-A2 segments (arrow). (C) Digital subtraction angiogram showing the recurrent artery of Heubner originating from the A1-A2 junction (arrow). (D) Digital subtraction angiogram showing enlargement of the A1 segment on postoperative day 8 (arrow). (E) In-stent stenting using LVIS Jr. 3.5 × 23 mm was performed. The proximal end of the stent showed insufficient expansion. (F) Postoperative three-dimensional rotational angiogram showing the enlarged portion (arrow). ACA: anterior cerebral artery, CT: computed tomography.

Follow-up angiography on day 8 showed enlargement of the bleb thought to be the rupture point. In-stent stenting with a second LVIS Jr. 3.5 × 23 mm was performed. The proximal end of the stent was insufficiently expanded, but blood flow showed no problem (Fig. 1D–1F). The treatments for cerebral vasospasm included systemic management with nutrition and fluids, and administration of fasudil hydrochloride from days 5 to 14.

CTA on day 12 showed further enlargement of the bleb (Fig. 2A and 1B), so the administration of aspirin was discontinued. Prasugrel 3.75 mg/day was continued as a single antiplatelet agent. Follow-up angiography on day 22 showed progression of the thrombosis at the extra-stent component including the bleb (Fig. 2C and 2D).

Prasugrel was replaced with aspirin 100 mg/day and clopidogrel 75 mg/day from day 30, because of health insurance requirements. CTA on day 35 again detected the aneurysm. Administration of clopidogrel was discontinued, and aspirin 100 mg/day was continued as a single antiplatelet agent. Angiography on day 53 showed increased pooling of contrast medium in the bleb, but the mass remained. Additional coil embolization with the trans-cell approach was performed (Fig. 2E).

After careful follow-up, angiography on day 63 showed that thrombosis of the bleb had progressed further, and the distal neck area was partially filled with contrast medium, but the tip of the bleb was not visualized (Fig. 2F and 2G). CTA at 9 months after the final intervention showed thrombosis and shrinkage of the extra-stent component including the bleb (Fig. 2H). At 1 year after the onset of subarachnoid hemorrhage, this patient is independent in activities of daily living. The chronological courses of the aneurysm volume and the antiplatelet management are shown in Fig. 3.

Volume measurement used thin slice data collected by CTA or rotational angiography processed on a workstation (Synapse Vincent; Fujifilm Medical, Tokyo, Japan). The volume was measured by tracing the contrast area outside the stent in the axial plane. CTA data were acquired using a 320-slice CT scanner (Aquillion ONE, Canon Medical Systems, Otawara, Tochigi, Japan) with 80-ml intravenous contrast bolus injection (flow rate of 4.0 ml/s). Rotational angiography data were acquired using an angiographic system (Axiom Artis dBA, Siemens Healthcare, Erlangen, Germany) with 5 s rotation, flow rate of 2.0 ml/s, total volume of 11.5 ml, and X-ray delay of 1.5 s.

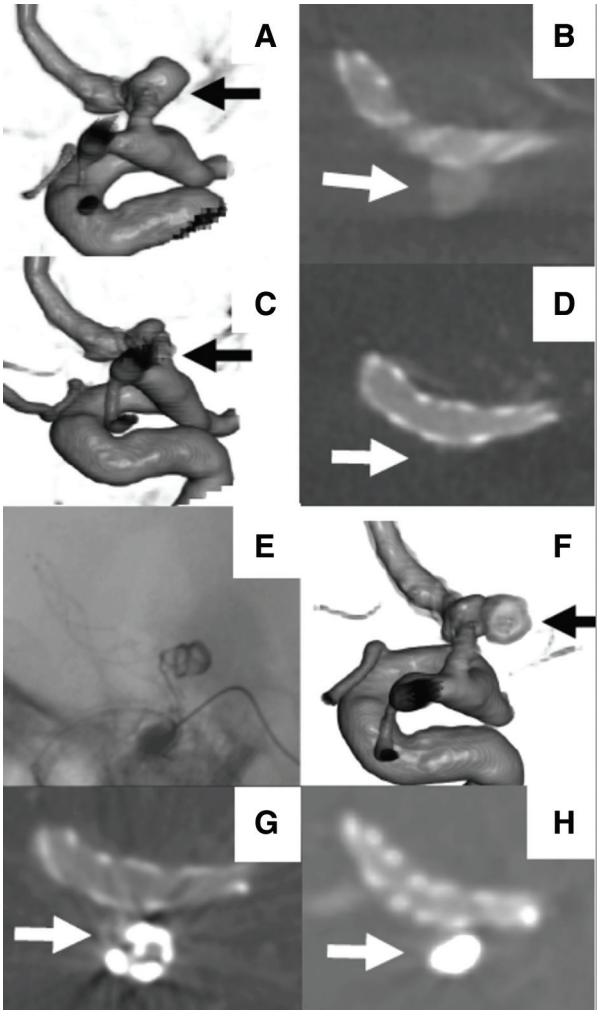

Fig. 2 (A, B) Digital subtraction angiograms on postoperative day 15 showing additional enlargement of the aneurysm. (C, D) Digital subtraction angiograms on postoperative day 22 showing thrombosis and shrinkage. (E, F) Digital subtraction angiogram on postoperative day 53 showing additional enlargement of the aneurysm. Contrast pooling in the aneurysm was observed. The microcatheter was navigated to the inflow of the aneurysm using the balloon catheter as a counter wall. Two coils were deployed into the aneurysm. (G) Digital subtraction angiograms on postoperative day 63 showing that the thrombosis of the bleb had progressed further, and the distal neck area was partially filled with contrast medium, but the tip of the bleb was not visualized. (H) Axial three-dimensional CT angiogram at 9 months after the final intervention showing thrombosis and shrinkage of the extra-stent component including the bleb (arrow). CT: computed tomography.

Discussion

Dissecting aneurysms often undergo shape changes in the acute phase. Various responses to such changes after the initial endovascular treatment include switching to direct trapping with bypass,[3] and additional coiling and/or stenting.[6]

Reconstructive endovascular treatment uses two main types of stents, flow diverter and neck-bridge stent. The LVIS is a braided neck-bridge stent with a metal coverage of approximately 23%. The metal coverage of the LVIS lies between simple neck-bridge stents (such as Enterprise and Neuroform) and the flow diverter, with metal coverages of approximately 10% and 35%, respectively. Stenting without coiling is expected to thrombose the aneurysm through the flow diversion effect with the use of the flow diverter or multiple neck-bridge stents. However, this technique raises several concerns in the acute phase of rupture: the risk of re-rupture is prolonged because thrombosis of the aneurysm takes time, and antiplatelet agents must be administered. The LVIS stent-only technique for ruptured aneurysms is rarely reported. A series of seven patients with ruptured aneurysms including two patients with internal carotid artery blister-like aneurysms and five patients with dissections including two ACA dissections were treated.[5] Aspirin 300 mg and clopidogrel were administered 2 hours before the operation, but no ischemic complications or re-rupture occurred. Angiographical complete obliteration of the aneurysm and good outcome were reported in all patients.

The reduction of antiplatelet agents has no definite consensus. The risk of in-stent thrombosis increases if antiplatelet function is completely lost early after stent deployment. Therefore, careful handling is necessary. Aspirin and clopidogrel are often used as antiplatelet therapy during endovascular treatment. However, aspirin resistance was observed in approximately 5%, and clopidogrel resistance was noted in 20–40%.[7] Clopidogrel resistance is caused by poor metabolism due to genetic polymorphisms in CYP2C19, which regulate the metabolic pathway of clopidogrel activation, in about 20% of Asians compared to 3–5% of Westerners.[8–10] The incidence of thromboembolic complication during neuroendovascular therapy tends to increase in these patients.[7]

Prasugrel is a thienopyridine antiplatelet drug similar to clopidogrel which is metabolized by multiple enzymes, but may not be influenced by the genetic polymorphisms of CYP2C19, so prasugrel resistance is rare.[11] Also, Prasugrel has been widely introduced in the cardiovascular field because of its rapid increase in blood concentration upon loading and faster onset of effect compared to clopidogrel.[12] Although off-label use at this time, efficacy and safety of prasugrel have been suggested in the treatment of cerebral infarction.[13] A case series of ruptured internal carotid artery blister-like aneurysms was treated with prasugrel 50 mg and aspirin 150 mg 2 hours

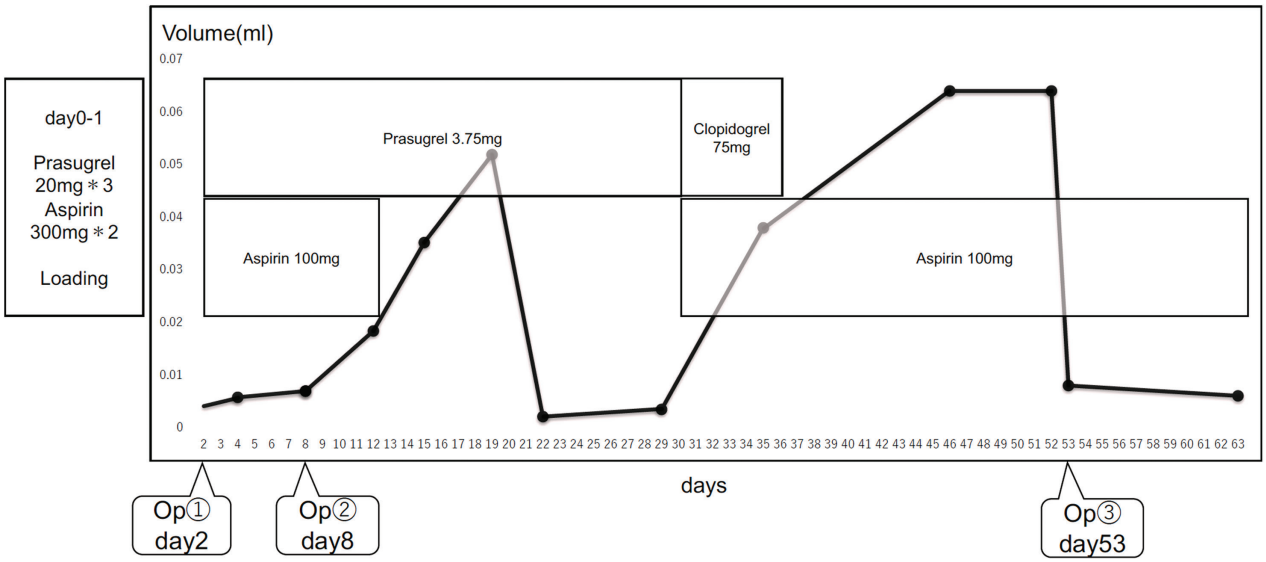

Fig. 3 Time course of aneurysm volume changes and antiplatelet drug dosage. Volume on the vertical axis relates to the non-thrombosed portion of the aneurysm. Volume measurement used thin slice data collected by CTA or rotational angiography processed on a workstation (Synapse Vincent; Fujifilm Medical, Tokyo, Japan). The volume was measured by tracing the contrast area outside the stent in the axial plane. CTA: computed tomography angiography.

before surgery, and a Pipeline (ev3-Covidien, Irvine, CA) was deployed without ischemic and hemorrhagic complications.[14] Median time from onset to the treatment was 4 days, and complete occlusion of the aneurysms was confirmed in all patients by 12 months. Therefore, prasugrel is an effective countermeasure to clopidogrel resistance.

In our case, we discontinued aspirin and used prasugrel as a single drug to treat enlargement of the bleb after deployment of the second stent. Subsequent thrombosis of the bleb was obtained, suggesting that reduction of the antiplatelet function may have been effective. This decision was possible because prasugrel resistance is rare and the risk of complete loss of antiplatelet function is very low even if used as a single agent.

Conclusions

The use of stents in the acute phase of subarachnoid hemorrhage is associated with a high risk of ischemic complications, so antiplatelet management is important. Prasugrel, which has low drug resistance, may allow safe stent use in the acute phase. Modification of antiplatelet administration may be effective for preventing re-rupture if shape changes of the aneurysm predict increased risk after stenting.

Ethics Approval

Preoperative loading of prasugrel and aspirin was given with the approval of the institutional review board of Gunma University (Protocol number: 200528-1-2a).

Conflicts of Interest Disclosure

The authors declare that they have no conflict of interest.

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Corresponding author: Yu Otaki, MD
Department of Neurosurgery, Gunma University Graduate School of Medicine, 3-39-22 Showamachi, Maebashi, Gunma 371-8511, Japan.
e-mail: m12201021@gunma-u.ac.jp