Trapping and Vascular Reconstruction for Ruptured Fusiform Aneurysm in the Proximal A1 Segment of the Anterior Cerebral Artery

—Case Report—

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Abstract

A 65-year-old woman presented with subarachnoid hemorrhage (SAH). Angiography detected a small bulge in the A1 segment of the right anterior cerebral artery (ACA). The patient was managed conservatively. Ten days after the initial SAH, the patient suffered a second SAH. Cerebral angiography demonstrated a fusiform aneurysm in the right A1 segment and vasospasm in the left A1 segment. The aneurysm of the right A1 segment was trapped and the right superficial temporal artery (STA) was end-to-end anastomosed to the distal portion of the right A1 segment. The patient had no postoperative cerebral ischemic events. Postoperative cerebral angiography revealed that the bypass flow through the right STA perfused the right ACA territories. STA-A1 end-to-end anastomosis can prevent cerebral ischemic events following parent vessel occlusion or microsurgical trapping for fusiform cerebral aneurysms in the A1 segment without sufficient collateral flow to the ipsilateral ACA territory from the contralateral ACA.

Key words: vascular reconstruction, fusiform aneurysm, anterior cerebral artery

Introduction

Vascular reconstruction may be necessary to prevent cerebral ischemic events following parent vessel occlusion or microsurgical trapping for unclippable large or fusiform cerebral aneurysms. Various reconstruction procedures of anterior cerebral artery (ACA) include end-to-end,6,7) end-to-side,10) and side-to-side3) anastomosis.

We treated a patient with a ruptured fusiform aneurysm in the A1 segment of the ACA associated with fibromuscular dysplasia (FMD) by microsurgical trapping of the aneurysm combined with vascular reconstruction by end-to-end anastomosis using a superficial temporal artery (STA).

Case Report

A 65-year-old woman with no history of head trauma or cerebrovascular disease suffered severe headache and subsequent loss of consciousness and was admitted to our hospital. There was no focal neurological abnormality. Initial computed tomography (CT) showed typical findings of subarachnoid hemorrhage (SAH) in the basal cistern. Cerebral angiography revealed a “diverticulum-like outpouching” appearance in the cervicocephalic portions of the bilateral internal carotid arteries, suggesting FMD5) (Fig. 1). No saccular aneurysm was observed, but a small bulge was seen in the A1 segment of the right ACA. There was no difference in the calibers of the bilateral A1 segments of the ACA, and the anterior communicating artery (ACoA) was patent (Fig. 2). The patient was managed conservatively. Ten days after the initial SAH, the patient again developed severe headache followed by loss of consciousness. CT revealed SAH in the basal cistern. Cerebral angiography showed a fusiform aneurysm in the right A1 segment (Fig. 3) and vasospasm in the left A1 segment (Fig. 4).

On the following day, the patient underwent right
Fig. 1 Right (A) and left (B) carotid angiograms, lateral view, showing “diverticulum-like outpouching” appearance in the cervico-cephalic portions of the bilateral internal carotid arteries.

Fig. 2 Left carotid angiogram with right carotid artery compression taken on the day of onset of the first subarachnoid hemorrhage showing no aneurysm in the A1 segment of the right anterior cerebral artery, but a small bulge in the right A1 portion (arrow). Both the right and left A1 segments are approximately equally developed, and the anterior communicating artery was patent.

Fig. 3 Right carotid angiogram taken 10 days after onset of the first subarachnoid hemorrhage showing new aneurysmal formation in the A1 segment of the right anterior cerebral artery.

Fig. 4 Left carotid angiogram taken 10 days after onset of the first subarachnoid hemorrhage showing angiographical vasospasm in the left A1 segment, and flow reduction in the anterior cerebral artery area.

Frontotemporal craniotomy. A fusiform aneurysm was found in the right A1 segment. The surroundings of the right A1 segment were occupied by fresh clot, suggesting that this aneurysm was responsible for the SAH. Perforating arteries arising from the A1 distal to the aneurysm were not seen. After trapping and resection of the right ACA, the right STA was end-to-end anastomosed to the distal portion of the right A1 (Fig. 5). Histological examination of the excised artery including the aneurysm of the right A1 segment revealed intimal fibrous thickening, disruption and defect of the internal elastic lamina, and thickening of the media, which indicated FMD. No evidence of dissection was identified.

Postoperatively, the patient experienced no cerebral ischemic events including visual disturbance. Follow-up cerebral angiography 7 days after the operation showed disappearance of the aneurysm. The bypass flow through the right STA
Fig. 5  Diagram showing the end-to-end anastomosis (arrowheads) of the right superficial temporal artery (STA) to the distal portion of the A1 segment of the right anterior cerebral artery (A1). ACoA: anterior communicating artery, ICA: internal carotid artery, MCA: middle cerebral artery, TC: temporary clip.

Fig. 6  Right carotid angiogram taken 7 days after onset of the second subarachnoid hemorrhage showing the patent bypass (arrow).

perfused the right ACA territories (Fig. 6). However, CT identified signs of normal pressure hydrocephalus 1 month after the operation. The patient received a ventriculoperitoneal shunt.

Discussion

The choice of surgical procedure for unclippable fusiform aneurysms at the A1 segment remains controversial. Microsurgical trapping was performed in two of the three reported cases\(^8,9\) and endovascular trapping was performed in one case.\(^4\)

In the latter case, the contralateral A1 was not hypoplastic and collateral flow to the ipsilateral A2 via the ACoA was sufficient, so the patient underwent only trapping of the A1, which did not result in cerebral ischemic events. On the other hand, A2-A3 side-to-side or end-to-side anastomosis was performed in cases of large or giant unclippable ACoA aneurysms.\(^3,10\) This anastomosis may prevent ischemic complications due to trapping of the aneurysm of the ACoA with the hypoplastic ipsilateral A1 segment and the long duration of temporary occlusion of the parent artery required for the clipping procedure. However, this technique would not be effective in cases of surgical occlusion of the A1 segment with hypoplasia of the contralateral A1 segment.\(^1\)

In the present patient, cerebral angiography performed after the second SAH revealed vasospasm in the contralateral A1 segment and flow reduction in the contralateral ACA territory. The A1 segment can be safely divided without requiring revascularization if the ACoA collateralizes the distal ACA territory. In this case, the collateral flow to the ipsilateral ACA territory from the contralateral ACA was considered to be insufficient after the ipsilateral A1 was surgically occluded. Therefore, we trapped the lesion in the ipsilateral A1 segment combined with vascular reconstruction using end-to-end anastomosis with the STA to prevent ischemia in the ipsilateral ACA territory. Angioplasty might be an option for dealing with the contralateral ACA vasospasm. However, angioplasty for the contralateral A1 before treatment of the ipsilateral A1 aneurysm might induce rupture of the lesion.

The site for anastomosis of the A1 segments of the ACA should be carefully selected due to the presence of perforating vessels. The A1 segment has four or five perforating branches of more than 0.1 mm outer diameter in its proximal half, and one to three perforators in its distal half.\(^1\) In the present case, no perforating arteries arising from the A1 distal to the aneurysm were seen.

The high frequency of aneurysms associated with FMD is well known. The deficiency of smooth muscle or internal elastic lamina in patients with FMD may allow the formation of cerebral aneurysms.\(^2\) Furthermore, the wall of the cerebral artery is likely to be fragile in patients with FMD. Therefore, anastomosis of the arteries should be carefully performed in such patients.

In conclusion, STA-A1 end-to-end anastomosis is effective to prevent cerebral ischemic events in patients with fusiform aneurysm in the A1 without sufficient collateral flow to the ipsilateral ACA territory from the contralateral ACA.

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References


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