Combined Treatment with OA-PICA Bypass for the Aneurysm of the Vertebral Artery and Its Branches

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Introduction

Not all intracranial aneurysms of the vertebral artery (VA) and its branches are eligible for conventional treatments. Therefore, patients with ineligible aneurysms need an alternative strategy such as trapping with revascularization.

Here, we report our experience with seven cases of these complex aneurysms that were treated with occipital artery (OA)–posterior inferior cerebellar artery (PICA) bypass.

Methods

We retrospectively reviewed patients who were treated for intracranial aneurysms arising from the VA and its branches in our institution from January 2009 to December 2012.

Patients were assessed according to the following inclusion criteria

- 1) Patients who underwent bypass treatment for intracranial aneurysms arising at the VA and its branches
- 2) The use of the occipital artery (OA) as the donor graft and the PICA as the recipient artery
- 3) All cases regardless of SAH and modality for obliteration of the aneurysm

Clinical outcomes were analyzed using the modified Rankin score (mRS) immediately postoperatively and at 6 months after treatment.

The patency of the bypass grafts and the obliteration of the aneurysms were assessed immediate postoperatively and 6 months after treatments using TFCA or computed tomographic angiography (CTA).

Results

The characteristics of the patients, treatment procedures, outcomes are described in Table 1.

For obliteration of the aneurysm, trapping of the aneurysm with surgical clips was performed in five patients. For one patient (case 2), proximal occlusion of the right PICA using a surgical clip at its origin site from the VA was performed after OA-PICA bypass followed by endovascular trapping of the dissected segment of the right VA with coils. For the other patient (case 5), clipping was performed at the neck of the saccular aneurysm which filled with coils; however, additional endovascular coiling was also performed because residual sac was revealed on postoperative TFCA .

Angiography performed at 6 months after treatment showed good patency of bypass grafts in 6 patients. The aneurysms were completely obliterated in all patients at 6 months after treatment.

Table 1. Characteristics of the reviewed patients and aneurysms, treatment procedures and outcomes

	Age/Sex	H-H grade	Pervious treatment	Location	Morphology	Size (mm)	Obliteration of aneurysm[a]	Radiologic outcome			Clinical outcome (mRS)
								Graft patency	Aneurysm obliteration		
									Immediate	6months	6month
Case 1	42/F	0	None	Left distal PICA Lateral medullary segment	Fusiform Dissecting	8.5×3.8[c]	Trapping of the aneurysm with surgical clips	Good	Complete	Complete	0
Case 2	45/M	2/0[b]	Stent assisted coiling	Right VA including the VA-PICA junction	Fusiform Dissecting (Recurrence)	19.2×6.0[c]	Proximal occlusion of right PICA with surgical clip and trapping of VA with coils	Good	Complete	Complete	0
Case 3	33/M	2	None	Left distal PICA Lateral medullary segment	Fusiform Dissecting	6.1×2.3[c]	Trapping of the aneurysm with surgical clips	Good	Complete	Complete	0
Case 4	54/F	0	None	Right VA including the VA-PICA junction	Fusiform Dissecting	17.3×7.1[c]	Trapping of the aneurysm with surgical clips	Good	Partial	Complete	0
Case 5	32/F	3/0[b]	Coil embolization	Left VA-PICA junction	Saccular (Recurrence)	3.9×2.5[d]	Coil embolization after partial clipping	Occluded	Complete	Complete	2
Case 6	56/F	2	None	Collateral artery from left VA to PICA[e]	Fusiform Dissecting	2.6×1.8[c]	Trapping of the aneurysm with surgical clips	Good	Complete	Complete	0
Case 7	42/M	0	None	Left VA including the VA-PICA junction	Fusiform Dissecting	15.1×5.3[c]	Trapping of the aneurysm with surgical clips	Good	Complete	Complete	0

[a]The former is the H-H grade when the patients underwent previous treatment and the latter is the H-H grade when we recognized the recurrence., [b]The left VA was totally occluded atthe proximal V4 segment. Blood flow of the left PICA was maintained by an unusual collateral artery from the distal end of the occluded left VA to the ipsilateral PICA. [c]Longest length × largest diameter, [d] Height of dome × length of neck, [e]A far lateral approach and an OA-PICA bypass wereperformed before obliteration of the aneurysm in all patients., H-H grade, Hunt and Hess grade of subarachnoid hemorrhage; mRS, the modified Rankin Scale; VA, vertebral artery; PICA, posterior inferior cerebellar artery; OA, occipital artery

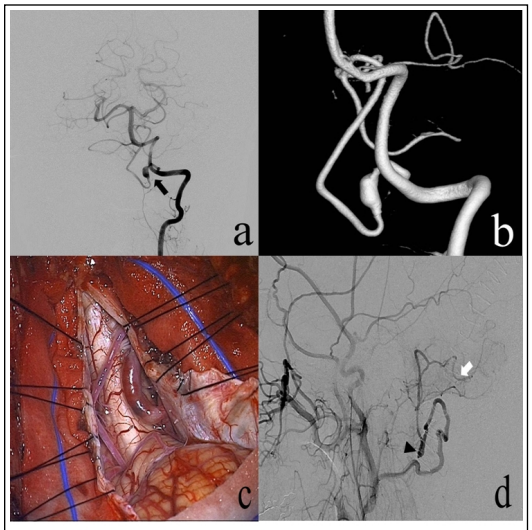

Fig. 1 (Case 2) A fusiform dissecting aneurysm at the lateral medullary segment of the left posterior inferior cerebellar artery (PICA). **b** Three dimensional (3D) image of the aneurysm **c** Intraoperative photograph of the aneurysm**d** The patency of the occipital artery-PICA bypass graft and distal flow of the PICA were verified with a left exteranl carotid arteriogram.; the aneurysm (black arrow), the site of anastomosis (black arrow head), and distal flow of the PICA (white arrow).

Discussion

If it becomes obvious that blood flow through the PICA will be diminished after surgery or endovascular treatment for the obliteration, revascularization of PICA should be considered to prevent cerebellar infarction and lateral medullary syndrome. However the OA-PICA bypass has limitations. Dissection of the OA is a difficult procedure because the OA lies deep. In addition, EC-IC bypasses are more vulnerable to trauma and occlusion with external compression. Despite these disadvantages, we chose to perform the OA-PICA bypass for several reasons. First, adhesion of both PICAs with a hematoma could occur in the cases with SAH. Therefore, further dangerous manipulations of the arteries would be required for PICA-PICA bypass. During these procedures, not only the PICA from disease segment, but also the contralateral PICA could be damaged. Second, we used a far lateral approach. Therefore, the depth of the surgical field for PICA-PICA bypass was deeper than that for OA-PICA bypass

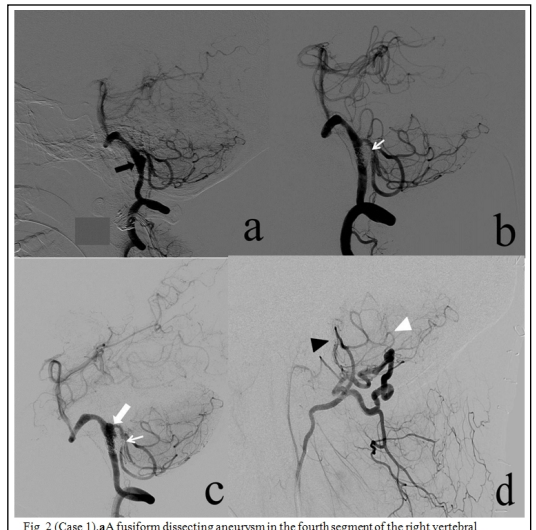

Fig 2 (Case 1). **a** A fusiform dissecting aneurysm in the fourth segment of the right vertebral artery(VA) just below the junction of theVA-posterior inferior cerebellar artery(PICA). **b**The aneurysm was treated with stent-assisted coil embolization. **c** Recurrence and increased length of the dissecting aneurysm were revealed 9 months after endovascular treatment. **d**The patency of the occipital artery (OA)-PICA bypass graft and distal flow of the PICA were verified with right external carotid arteriogram.;the aneurysm (black arrow), stent and coils (white small arrow),recurrence of the aneurysm which was treated by endovascular procedures (white arrow), the site of anastomosis (black arrow head), and distal flow of the PICA (white arrow head).

Conclusions

OA-PICA bypass with trapping of the aneurysm is one of the optimal treatments of complex intracranial aneurysms arising at the VA and its branches.

Learning Objectives

Identify an effective treatment of the complex aneurysm of the vertebral artery and its branches.