A Patient Who Underwent Stenting for Dissection That Occurred during Carotid Endarterectomy

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Purpose: We report a patient who underwent stenting for dissection related to internal-shunt insertion during carotid endarterectomy (CEA).

Case Presentation: A 77-year-old female with a history of stenosis of the left carotid artery. During admission due to infectious enteritis, right hemiplegia occurred, and arteriogenic embolism was observed. After an improvement in the general condition was achieved, CEA was performed. Intimal thickening involving the periphery to the most stenotic site was noted. When inserting a shunt into the internal carotid artery, there was a resistance, and there was no blood flow regurgitation, suggesting iatrogenic dissection. After plaque removal and vascular suture, the patient was transferred to the angiography room while maintaining general anesthesia, and a stent was inserted to the site of dissection. Anterograde blood flow was achieved, and the postoperative course was favorable.

Conclusion: Stenting for carotid artery dissection related to shunt insertion during CEA may be effective.

Keywords: carotid endarterectomy, internal shunt, dissection, carotid artery stenting

Introduction

Carotid endarterectomy (CEA) for carotid artery stenosis has been established, with much evidence. However, surgical techniques/procedures vary among medical institutions. One of such variations is the presence or absence of internal-shunt usage. As a merit of internal-shunt usage, the intraoperative maintenance of intracranial perfusion is indicated. On the other hand, as its demerit, there is a risk of dissection at the time of insertion. In this study, we report a patient in whom dissection occurred as a complication during surgery, and stenting was performed on the same session, leading to a favorable outcome.

Case Presentation

Case: A 77-year-old female.
Complaint: Right incomplete hemiplegia.
Medical history: Hypertension, dyslipidemia, diabetes mellitus, and a 4-year history of left carotid artery stenosis (Fig. 1A). Under a diagnosis of right middle cerebral artery occlusion, aspirin and cilostazol had been administered. Present illness: Vomiting and diarrhea occurred, and fever was noted the following day. The patient consulted a local clinic, and antibiotic therapy was administered, but there was no improvement. She was referred to our hospital 4 days after onset. The hematological data showed sepsis and acute renal disorder. In the Department of Internal Medicine of our hospital, fasting, fluid therapy, and antibiotic therapy were administered. The administration of an antiplatelet drug was discontinued with fasting. The general condition slightly improved, but right hemiplegia was noted on waking-up 6 days after admission. The patient was referred to our department.
Neurologic findings: Consciousness was clear. There was no cranial nerve symptom. Mild right incomplete hemiplegia was noted.
Neuroradiological findings: MRI revealed diffuse infarction in the watershed area of the left middle cerebral artery.
MRA showed the progression of left internal carotid artery stenosis, and the peripheral signal intensity was reduced (Fig. 1B and 1C). DSA revealed a non-typical contrast enhancement defect of the left common carotid artery, suggesting marked stenosis. The bifurcation was present at the level of the inferior margin of the third cervical vertebra. A lateral view showed the site of defect involving the common carotid artery alone, but the defect medially involved the internal carotid artery on a frontal view (Fig. 2A and 2B). However, this finding was not recognized before surgery. Concerning the collateral pathway, neither the horizontal region (A1) of the left anterior cerebral artery nor left posterior communicating artery could be confirmed although we did not perform the Matas or Alcock tests; a direct collateral pathway was considered to be absent.

Clinical course: The time of onset was unclear, and the symptoms were mild. We did not administer tissue plasminogen activator (t-PA). Conservative treatment by the drip infusion of argatroban and oral administration of aspirin and clopidogrel was started. Surgery for carotid artery stenosis was considered to be adaptable, but we adopted a strategy to review this after achieving an improvement in the general condition. We confirmed improvements in the hematological data 9 days after admission, and performed DSA. CEA was considered to be possible based on the general condition and height of the lesion, and it was performed under general anesthesia on the same day.

CEA: Using the standard procedure, the bifurcation and its periphery were exfoliated, as shown in Fig. 3A. An incision involving the internal carotid artery was prepared, as shown in Fig. 3B. A contiguous thin plaque was observed, and the lumen could not be sufficiently confirmed. However, a Furui’s three-way type biballoon shunt (outer diameter: 3.0 mm, length: 22 cm; Inter Medical, Aichi, Japan) was inserted into the internal carotid artery. There was a resistance on shunt insertion, and blood regurgitation could not be obtained from the shunt after balloon dilation. Subsequently, when confirming the vascular lumen, the plaque was compressed to the peripheral side (Fig. 3C). When relieving the blockage of the internal carotid artery, blood regurgitation was obtained, suggesting iatrogenic dissection. Repair by surgical procedures was considered difficult, and endovascular treatment was selected for the treatment of dissection. The plaque was removed, and the carotid artery was sutured. After confirming hemostasis, the wound was simply closed with a stapler. While maintaining general anesthesia, the patient was transferred to the angiography room.

Endovascular treatment: The staples at the wound site were removed, and the common carotid artery was punctured using an 18G indwelling needle through the skin at the inferior margin of the common carotid artery incision.
Angiography was performed. As shown in Fig. 4, there was no contrast enhancement of the vascular lumen at the site of plaque removal, and anterograde blood flow was delayed. Using a 0.035-inch guidewire, an 18G indwelling needle was exchanged for a 6Fr sheath (10 cm). The tip (2 to 3 cm) was inserted into the blood vessel, and the sheath was fixed to the skin for stabilization. Lesion-crossing was conducted by combining an Excelsior SL-10 (Stryker, Kalamazoo, MI, USA) with a CHIKAI 14 200 cm (Asahi Intec, Aichi, Japan), and it was confirmed that they had reached the true lumen using microcatheter angiography (Fig. 4B). A microguidewire was guided again, and the
microcatheter was removed. A Carotid Wall 8 × 21 mm (Boston Scientific, Natrick, MA, USA) was inserted so that it was localized in the internal carotid artery through a normal blood vessel. Subsequently, an improvement in antegrade blood flow was achieved (Fig. 4C). The interval from the start of carotid artery blockage on CEA until the resumption of blood flow was 1 hour and 33 minutes. At the site of puncture, hemostasis by suture was performed, and the wound was closed again. The procedure was completed.

Postoperative course: After surgery, transient sublingual nerve paralysis was observed. There was no enlargement of cerebral infarction on postoperative MRI. There was no sign of hyperperfusion. The patient was referred to another hospital for rehabilitation 22 days after surgery. Thereafter, the patient was discharged, and the modified Rankin scale score was evaluated as 1 after 3 months. As antithrombotic therapy, aspirin was combined with clopidogrel until 3 months after surgery. Subsequently, monotherapy with aspirin was administered. After surgery, there was no cerebral ischemic attack.

### Discussion

According to the North American Symptomatic Carotid Endarterectomy Trial (NASCET) study, the incidence of perioperative complications related to CEA was 6.5%. Intraoperative cerebral infarction accounted for 2.1%, and acute occlusion accounted for 0.4%. Anzuini et al. reported that the incidence of vascular dissection during CEA was 0.8%. Several studies indicated dissection related to the shunt procedure during CEA. The timing of onset varied: immediately after surgery to 13 days after surgery. However, in these studies, intraoperative shunt insertion was successful, and intimal injury related to the tube or balloon on the peripheral side may have been involved in the mechanism. As treatment methods, conservative treatment was selected for patients with asymptomatic dissection, and extracranial-intracranial (EC-IC) bypass or surgical reconstruction for those with ischemia, leading to a favorable course. In the present case, dissection was detected during surgery, and we reviewed whether surgical repair, involving further exfoliation of the peripheral tissue of the internal carotid artery and an additional incision at the periphery, should be selected. However, visually, the plaque was compressed to a distal area, and endovascular treatment was performed, considering the risk of ischemia related to surgical repair requiring many hours. When confirming angiography findings (Fig. 4A), the distal end of dissection was located at an area peripheral to the cross point with the occipital artery; surgical reconstruction may
have been difficult, as reported by Uno et al. Anzuini et al. also retrospectively examined the management of perioperative ischemia related to CEA, and reported that an improvement was achieved in 12 of 13 patients who underwent stenting, whereas it was achieved in only one of five patients who underwent surgical reconstruction, suggesting the usefulness of stenting as a management method.

In our hospital, CEA for symptomatic carotid artery stenosis is performed as early as possible after the onset of ischemia. Various studies indicated the efficacy of early CEA. Rantner et al. reported that early CEA was more effective than early carotid artery stenting (CAS) based on the results of a sub-analysis of four randomized studies. In our hospital, CAS is also conducted in the early stage, but it is limited to lesions for which CEA is difficult. Actually, CAS is selected due to various factors in some cases. However, when performing CAS in the acute stage, the blood concentration of an antiplatelet drug is not sufficient, and acute occlusion may occur. Therefore, in our hospital, the administration of two antiplatelet drugs is started before determining a surgical procedure on the day of onset. Illuminati et al. reported that CEA during combination therapy with two drugs did not increase the risk of hemorrhage. We also consider that CEA can be safely performed, as indicated by them. In the present case, treatment in accordance with CAS in the acute stage was required as a result, but two antiplatelet drugs had been orally administered for 4 days prior to surgery; their inhibitory effects on platelet aggregation may have been obtained to some degree. Furthermore, Rantner et al. emphasized that distal embolism caused by acute-phase pre-stabilization plaques on device passage was a factor involved in an increase in the risk of complications related to CAS in the acute stage. With respect to this, in the present case, antiplatelet drugs had been orally administered to some degree, and most plaques had been removed via a direct approach; these factors may have effectively acted.

During CEA, plaques can be confirmed under direct vision, and the risk of intraoperative embolic complications is lower than during CAS. For this reason, plaque imaging in patients for whom CEA was scheduled was not essential in our hospital. However, in the present case, the presence of a plaque connected to the internal carotid artery could not be recognized as plaque imaging was neglected. Endo et al. reported a patient in whom plaque removal at a distal area was performed under a microscope prior to shunt insertion because the plaque was more advanced than predicted before surgery. In the present case, preoperative plaque imaging was neglected, leading to the underestimation of the plaque extent; shunt insertion was conducted easily despite insufficient development at a distal area and non-capturing of the true lumen, which may have resulted in the development of dissection.

Concerning endovascular treatment procedures, common carotid artery puncture, which facilitates a prompt access and is applicable for troubles at the site of vascular suture, may be appropriate as an approaching method. In addition, it facilitates puncture/hemostasis by suture under direct vision. As this procedure is performed under direct vision, complete proximal protection with a tourniquet is possible. However, when performing carotid artery puncture using a 10-cm sheath, it is impossible to insert the greater portion of the entire length into a blood vessel. Therefore, a short sheath should be used, or a sheath should be inserted through the skin, and fixed to the skin to obtain its stabilization, as demonstrated in the present case.

In the present case, a transfer between operating rooms was necessary due to a hospital-equipment-related problem. While transferring the patient, the anterograde blood flow volume of the internal carotid artery was extremely reduced; the risk of hemodynamic ischemia or thromboembolism from the site of dissection was high. As preoperative DSA confirmed the absence of cross flow in the present case, the subsequent endovascular procedure was performed without conducting vascular blockage so that anterograde blood flow might be maintained. Fortunately, there was no peripheral embolism after surgery, but the risk of peripheral thromboembolism related to anterograde blood flow maintenance may have been present. If collateral pathways are abundant, there may be an option to block the common carotid artery for thromboembolism prevention and promote a transfer between operating rooms or subsequent management in the absence of anterograde blood flow. Furthermore, more prompt treatment would have been possible if intraoperative DSA or a hybrid operating room had been available.

Conclusion

CAS for arterial dissection related to shunt insertion during CEA is effective.

Disclosure Statement

There is no conflict of interest for the main author or coauthors.
References


