Objective: A case in which carotid artery stenting (CAS) was performed via the femoral artery for stenosis of the left common carotid artery ostium is reported.

Case Presentation: The patient was a 70-year-old man with multiple infarction of the right cerebral hemisphere that presented with a transient decrease in grip strength and numbness of the left hand. Occlusion of the right internal carotid artery and stenosis of the left common carotid artery ostium were demonstrated. CAS was performed using the buddy wire technique and a distal filter protection device for stenosis of the left common carotid artery ostium. The postoperative course was uneventful, and the patient was discharged to home 8 days after surgery.

Conclusion: In CAS for stenotic lesions of the common carotid artery ostium, the concomitant use of the buddy wire technique is useful.

Keywords ▶ carotid artery stenting, common carotid artery ostium, buddy wire technique

Introduction

Procedures including carotid endarterectomy (CEA) and carotid artery stenting (CAS) have been established as treatments for stenotic lesions near the internal carotid artery origin and are widely performed today.1) However, for more proximal stenotic lesions of the common carotid artery, no evidence-based surgical technique has been established. To the present, various techniques including bypass, transposition, ring-stripping retrograde CEA, retrograde percutaneous transluminal angioplasty (PTA), CAS, and transfemoral PTA or CAS have been reported, but all these procedures are more complex than CEA or CAS for stenosis of the internal carotid artery origin.2-12) In performing transfemoral CAS, securing of the stability of the guiding catheter poses a greater problem because of the more proximal location of the lesion, and various techniques for catheter stabilization have been developed.10-12) We performed CAS with the buddy wire technique3) and a distal filter protection device for a stenotic lesion at the origin of the common carotid artery and obtained a favorable outcome.

Case Presentation

The patient was a 70-year-old man who presented with a transient decrease in grip strength and numbness of the left hand. He had histories of hypertension, hyperlipidemia, and arteriosclerosis obliterans of the bilateral lower extremities.

One year before the present episode, the patient complained of pain on motion of the bilateral lower legs, was diagnosed with arteriosclerosis obliterans of the bilateral lower extremities, and underwent stenting of the left common iliac artery and right external iliac artery at the cardiology department of our hospital. CTA for screening at that time showed stenosis of the innominate artery, bilateral common carotid artery ostia, and left subclavian artery ostium, but no surgical intervention was made because the patient was asymptomatic. The cervical internal carotid artery origin was not evaluated. Intracranial MRA did not
demonstrate any stenotic lesion (Fig. 1B). After stenting, the patient was observed on dual-antiplatelet therapy with 100 mg aspirin and 75 mg clopidogrel.

The present episode occurred with a decrease in grip strength and numbness of the left hand for a few minutes, and MRI revealed multiple infarction of the right middle cerebral artery territory (Fig. 1A). No atrial fibrillation was noted. On MRA, the right internal carotid artery was not visualized, and collateral blood flow from the left internal carotid artery via the anterior communicating artery was observed (Fig. 1C). Cilostazol at 200 mg was added, and no progression or change of symptoms was observed during the course. The patient was referred to our department on the 19th hospital day concerning treatment for head and neck blood vessels.

Neurologic findings: Consciousness clear, no cranial nerve symptoms, impairment of coordinated movements but no muscle weakness in the left upper extremity, no sensation disorder, slight dysarthria, and normal gait.

Imaging findings: CTA showed occlusion of the right internal carotid artery ostium, mild stenosis of the left internal carotid artery ostium, moderate stenosis of the left common carotid artery ostium, mild stenosis of the distal left common carotid artery, and severe stenosis of the left subclavian artery. Resting single photon emission computed tomography (SPECT) with image processing using Neuroflexer (Nihon Medi-Physics, Tokyo, Japan) showed a 5% decrease in blood flow in the right cerebral hemisphere compared with the opposite side (Fig. 1D).

Assessment and treatment plan: Although we could not precisely assess when the right internal carotid artery was occluded, we thought the right internal carotid artery occlusion resulted in the present cerebral infarction, localized on the right side. Since symptoms were not changed after the onset, and based also on SPECT findings, we considered that cerebral infarction was more likely to have been induced simultaneously with occlusion of the right internal carotid artery by artery-to-artery embolism derived from severe stenosis of the right internal carotid artery rather than by hemodynamic problems associated with chronic occlusion of the right internal carotid artery. Actually, cerebral infarction occurred in spite of dual-antiplatelet therapy and we could not exclude the possibility that the present cerebral infarction was due to the stenosis of left common carotid artery ostium. To prevent recurrent cerebral infarction, and to keep the access route in the event of progressing stenosis at distal lesions, we decided to perform CAS for stenosis of left common carotid artery ostium by transfemoral approach.

Endovascular treatment: Endovascular treatment was carried out under general anesthesia on the 49th hospital day. Since a stent was placed in the right external iliac artery, a 9 Fr 25-cm sheath (Radifocus Introducer 11H;
Stenting of Common Carotid Artery Ostium by the Buddy Wire Technique

position. Next, a distal filter protection device (FilterWire EZ; Boston Scientific, Marlborough, MA, USA) was advanced to the distal left cervical internal carotid artery and deployed there. A balloon expandable stent (Express Vascular LD; Boston Scientific) 8 mm × 17 mm was selected and guided to the site of stenosis (Fig. 3A and 3B). In guiding the stent, the guiding catheter regressed further, and the marker part at its tip was located at the left common carotid artery ostium. The stent was expanded at 10 atmospheres over 20 seconds (Fig. 3C). The position and expansion of the stent were confirmed to be appropriate by angiography (Fig. 3D). After the balloon for stent expansion was withdrawn, the distal filter protection device was retrieved, and the guidewire advanced to the external carotid artery was removed. No debris was observed in the retrieved filter. The procedure was ended by extracting the sheath using a closure device (Angio-seal STS Plus; St. Jude Medical, St. Paul, MN, USA).

Postoperative course: Hyperperfusion was not noted on postoperative SPECT. MRI diffusion-weighted imaging showed a high-intensity spot in the right cerebral hemisphere, but there was no exacerbation of symptoms, and the patient was discharged to home on the 8th postoperative day. There was no recurrence of cerebral infarction for 2 years after the procedure, and the patient is still under observation.

Discussion

In transfemoral CAS for stenotic lesions of the left common carotid artery ostium, securing of stability of the guiding catheter poses a problem. To the present, techniques including the coaxial use of a distal protection device and a 0.014-inch guidewire, 10) penetration of the stenosed area using a guiding catheter, 11) and the use of two distal balloon protection devices12) have been reported. From the viewpoint of prevention of distal embolism as a complication, passing the guiding catheter through the stenosed area should be avoided. In our patient, as the contralateral internal carotid artery was occluded, the use of a filter rather than a balloon was considered preferable for distal protection.

We advanced a 0.025-inch 150-cm stiff-type guidewire (Radifocus Guidewire M Stiff type; Terumo) to the left external carotid artery as a buddy wire. The guiding catheter was unstable, and, after advancing the marker portion at the tip to a point near the entry of the site of stenosis, the guidewire could be introduced to the common carotid artery distal to the site of stenosis. In advancing the guidewire to the external carotid artery, the guiding catheter regressed to the previous position. Terumo, Tokyo, Japan) was placed in the left femoral artery. First, aortography was performed, and the left common carotid artery ostium was confirmed. A 9 Fr 95-cm guiding catheter (Cordis Brite Tip MPD; Cardinal Health, Dublin, OH, USA) was guided to the left common carotid artery ostium using a 4-6 Fr tapered CX angiocatheter JB2 (CX Catheter-U11; Gadelius Medical, Tokyo, Japan) and 0.035-inch 180-cm guidewire (Radifocus Guidewire M; Terumo). In the left oblique position, the CX angiocatheter was advanced to the aortic arch, and the curved 4 Fr part at the tip was directed to the left common carotid artery ostium. The guidewire was advanced to the tip of the CX angiocatheter, and, following it, the guiding catheter was placed at the position before the site of stenosis indicated by the white arrow in Fig. 2. Then, a 0.025-inch 150-cm stiff-type guidewire (Radifocus Guidewire M Stiff type; Terumo) was guided to the left external carotid artery as a buddy wire. The guiding catheter was unstable, and, after advancing the marker portion at the tip to a point near the entry of the site of stenosis, the guidewire could be introduced to the common carotid artery distal to the site of stenosis. In advancing the guidewire to the external carotid artery, the guiding catheter regressed to the previous position.
the stent. Although a 0.025-inch guidewire was used, the guiding catheter receded in stent placement. Therefore, a 0.014-inch guidewire would have been inadequate to support the guiding catheter. In addition, if the guidewire had been removed immediately after deployment of the distal filter, it would not have been placed outside the stent, but the support would have been even weaker. The operability of the device after the placement of the guidewire was adequate, and, although some resistance was felt in extraction of the balloon for stent expansion, the 0.025-inch guidewire outside the stent could be retrieved without problem. Also, as the procedure could be simplified, we used a balloon expandable Express Vascular LD as the stent. While a longer stent provides simplicity in positioning, it is more difficult to navigate. In our patient, we used a short stent (17 mm) as the lesion was short. The distal filter protection device placed distally to the stent showed no bend when it arrived at the lesion, and no bending was also noted in the distal common carotid artery after its placement.

Our patient presented with infarction of the right cerebral hemisphere, and it was first necessary to evaluate revascularization of the right anterior circulation. After the assessment of the cerebral blood flow, extracranial–intracranial arterial bypass was an option for the treatment. In our case, the preoperative resting blood flow evaluated by SPECT showed a 5% decrease compared with the opposite side, collateral blood flow from the left internal carotid artery via the anterior communicating artery was observed on preoperative MRA, and there was no change in symptoms. These conditions suggested that cerebral infarction was not due to hemodynamic problems. Additionally, the patient was under dual-antiplatelet therapy for the treatment of arteriosclerosis obliterans of the lower extremities. Therefore, we did not select the procedure. Next, endovascular recanalization of the completely occluded internal carotid artery would have been another option, but this procedure involves the risk of damaging the internal carotid artery, and its success rate is about 70%. We also avoided this procedure because the intracranial extradural internal carotid artery on the distal side was not visualized on MRA, and because the time of occlusion was unclear.

There have been various reports concerning the treatment for occlusion or stenosis of the supra-aortic vessels such as the innominate, subclavian, and left common carotid artery.
carotid arteries. While reports restricting the target to the common carotid artery lesions are few, Linni et al. observed the absence of cranial nerve damage and lymphorrhoea as advantages of endovascular treatment in a study restricted to 52 patients with common carotid artery lesions and recommended endovascular treatment as the first choice and other direct surgical procedures as useful alternatives. Van de Weijer et al. reported that lesion cross was impossible in 4 of the 144 patients who underwent endovascular treatment, particularly, in 2 of the 5 patients with occluded lesions. Although, in the future, a conclusion should be reached concerning this issue by large-scale clinical studies as in the case of lesions at the internal carotid artery bifurcation, we consider that endovascular treatment with stenting can be regarded as the first choice for such stenotic lesions.

Endovascular treatment may be performed by the transfemoral or retrograde approach. Retrograde CAS can be performed simultaneously with CEA for stenosis of the internal carotid artery ostium. An advantage of this procedure is not only the short distance from the puncture site to the lesion, but also distal protection is possible. Payne et al. reported that no emboli were detected in the middle cerebral artery by transcranial Doppler monitoring. In our patient, mild stenosis was observed in the distal common carotid artery and at the internal carotid artery ostium, but it was not considered severe stenosis, which would require treatment. We treated stenosis of the common carotid artery ostium alone by the transfemoral approach and decided to perform CAS as necessary if stenosis in the distal common carotid artery and the internal carotid artery ostium progresses in the future.

Our procedure can be performed safely under the condition that the guidewire can be advanced to the external carotid artery from the guiding catheter without problem. In treating severe stenotic or obstructive lesions through which the guidewire cannot be passed and complicated marked stenosis from the peripheral common carotid artery to the internal carotid artery ostium, this method should be compared with other procedures, and a safer option should be selected.

## Conclusion

A case of common carotid artery ostium stenosis in which CAS was performed using a balloon expandable stent with the buddy wire technique and a distal filter protection device was reported. There was concern over securing of stability of the guiding catheter, but the stent could be placed without problem by this method. This technique is useful in performing CAS for stenotic lesions of the common carotid artery ostium.

## Disclosure Statement

Neither the first author nor any of the co-authors have any conflicts of interest to disclose concerning this paper.

## References


