Online May 29, 2020
Journal of Neuroendovascular Therapy 2020; 14: 331–335 DOI: 10.5797/jnet.tn.2020-0035

Technical Note

Open Retrograde Stenting with a Sheathless Method Using a Balloon-guiding Catheter for Proximal Common Carotid Artery Stenosis

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Objective: Carotid artery stenting (CAS) and carotid endarterectomy are relatively difficult for proximal common carotid artery (CCA) stenosis because of the difficulty in anatomical approach. We treated proximal CCA stenosis by retrograde stenting using a 9Fr Optimo for peripheral intervention with a sheathless method.
Case Presentation: A 60-year-old woman was scheduled for total arch replacement (TAR) for an aortic arch aneurysm. Preoperative cervical MRI incidentally revealed tandem stenosis in the left CCA. We intended to treat CCA stenosis prior to aortic arch replacement. Under general anesthesia, distal left CCA was exposed. A 9Fr Optimo was introduced into CCA by retrograde with a sheathless method. The retrograde CAS was performed under distal balloon protection. Her postoperative course was uneventful.
Conclusion: Retrograde stenting using a 9Fr Optimo for peripheral intervention with a sheathless method was safe and useful for proximal CCA stenosis.

Keywords ▶ common carotid artery stenting, hybrid treatment, sheathless method

Introduction

Reports on the treatment of proximal common carotid artery (CCA) stenosis are rare because of its rare incidence compared with internal carotid artery (ICA) stenosis. Proximal CCA lesions are often reported as a part of supraaortic trunk lesions including innominate artery and subcravian artery. Since 1950s, these lesions have been treated surgically with endarterectomy or bypass.[1–3] Since 1980s, endovascular treatment (percutaneous transluminal angioplasty [PTA] with or without stenting) has been reported as an alternative approach.[4,5] The hybrid approach was first reported by Diethrich et al.[6] in 1996. They treated tandem stenosis of carotid bifurcation and proximal CCA stenosis by open retrograde stenting followed by carotid endarterectomy. In previous reports about the hybrid treatment, ICA or CCA clamping is used for embolic protection.[6–10] We treated a left proximal CCA stenosis with a hybrid treatment using a balloon-guiding catheter as distal embolic protection.

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Received: February 12, 2020; Accepted: April 20, 2020
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Case Presentation

A 62-year-old female patient was admitted to a different hospital for the treatment of heart failure. Bilateral renal artery stenosis was detected as a cause of heart failure and treated with stenting. She was also diagnosed with an aortic arch aneurysm. After 6 months, the aortic arch aneurysm enlarged from 30 mm to 40 mm in size and total arch replacement (TAR) was planned. However, she was detected with severe tandem stenosis in the origin of left CCA and proximal CCA with CT angiography. Prior to TAR, she was referred to our hospital for treatment of CCA stenosis.

A 3D CT aortogram showed an aortic arch aneurysm and diffuse atherosclerosis of the aorta (**Fig. 1A**). A cervical 3D CT angiography and MR angiography showed severe tandem stenosis at the origin of left CCA and proximal CCA (**Fig. 1B** and **1C**). The plaque of the proximal CCA lesion

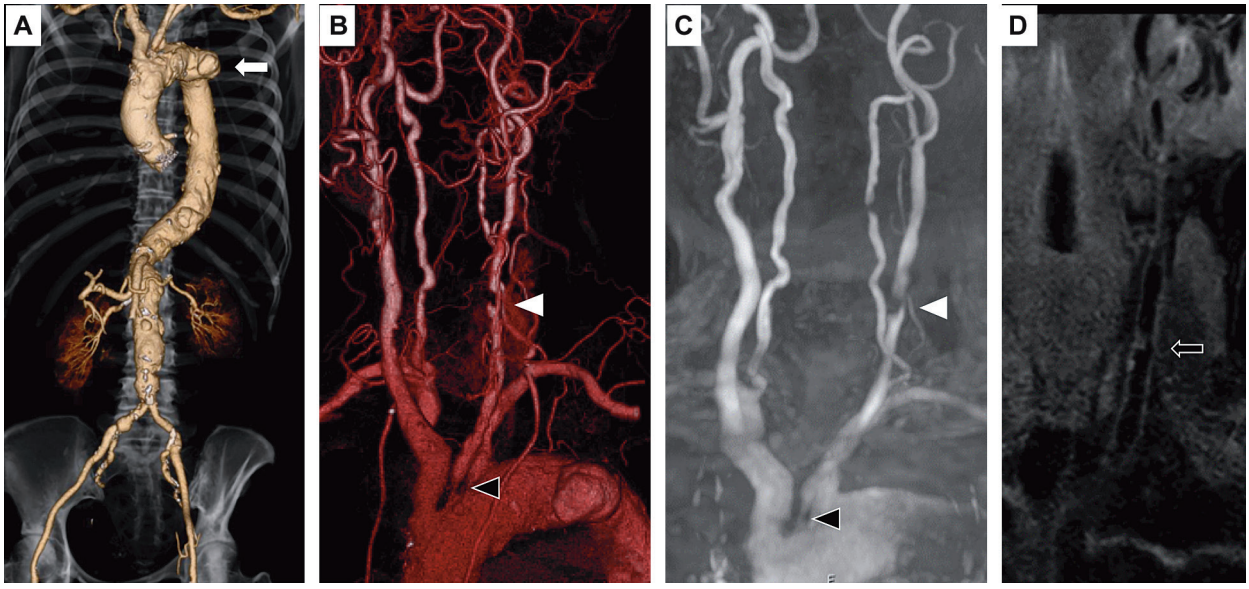

Fig. 1 Preoperative images. (**A**) A 3D CT aortography shows the aortic arch aneurysm (white arrow) and diffuse atherosclerosis of the aorta. A cervical 3D CT angiography (**B**) and MR angiography (**C**) show tandem stenosis in the origin of left CCA (black arrow heads) and proximal CCA (white arrow heads). (**D**) The plaque of proximal left CCA stenosis shows isointensity by black blood imaging (black arrow). CCA: common carotid artery

showed isointensity by black blood T1 imaging (**Fig. 1D**). Head MRI showed no past ischemic lesion. A carotid ultrasonography showed 87% stenosis by the area method in the proximal CCA stenosis. The peak systolic velocity of the proximal CCA stenosis was 473 cm per second.

For preventing a periprocedural ischemic complication during TAR such as embolization related to the insertion of the blood supply tube, we intended to treat the proximal left CCA stenosis with open retrograde stenting. The CCA origin stenosis would be resected simultaneously with TAR.

In open retrograde carotid artery stenting (CAS), we considered how to establish the embolic protection. We used a 9Fr OPTIMO PPI sheathless kit (Tokai Medical Products, Kasugai, Aichi, Japan) which is a balloon-guiding catheter for percutaneous peripheral intervention as embolic protection during CAS. The kit is composed with a pre-dilator and dilator for sheatheless insertion (**Fig. 2A** and **2B**).

She was treated with dual antiplatelets for 7 days before the procedure. Under general anesthesia, the distal left CCA was exposed using a 6 cm linear skin incision along the frontal edge of the sternocleidomastoid muscle. The left CCA was punctured with an 18 G needle through the skin so as to not introduce the guiding catheter at right angle. A 0.035 inch guidewire was introduced into the CCA. After dilating the puncture site using a pre-dilator, a 9Fr OPTIMO PPI was introduced to the CCA using a dilator (**Fig. 3A**). These procedures were monitored using ultrasonography so as to not cross the stenosis before protection. After

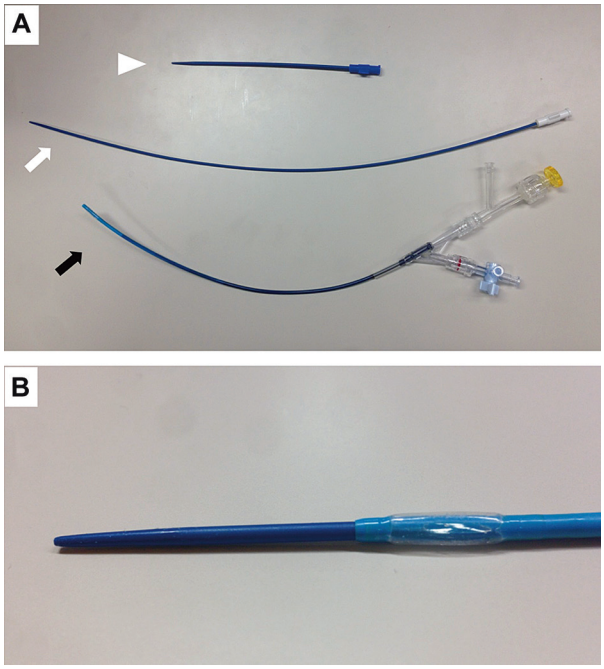

Fig. 2 A 9Fr Optimo PPI sheathless kit (Tokai Medical Products, Kasugai, Aichi, Japan). (**A**) The kit is composed with a pre-dilator (white arrowhead), dilator (white arrow), and a balloon-guiding catheter (black arrow). (**B**) The tip of the balloon-guiding catheter combined with a dilator.

systemic heparinization, distal balloon protection was established by inflating the guiding balloon. The lesion was traversed with 0.014 inch guide wire and pre-dilatated with a 3.0 mm × 40 mm PTA balloon (RX-Genity; Kaneka

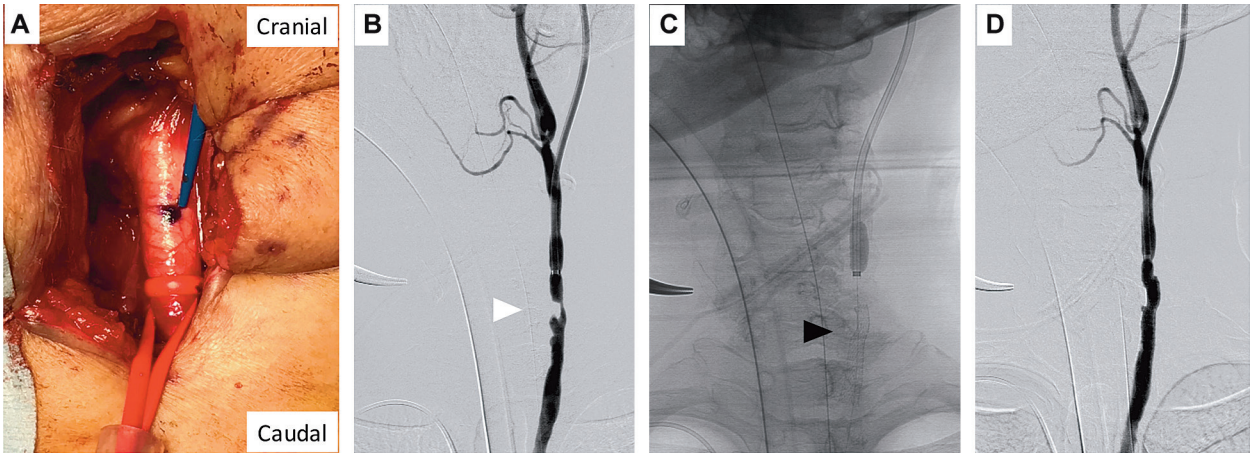

Fig. 3 (**A**) A picture during operation shows the left CCA exposed using a 6 cm linear skin incision along the along the frontal edge of the sternocleidomastoid muscle. The guiding catheter was introduced into the CCA from the caudal side through the skin. (**B**) Frontal view of angiogram before stenting shows severe CCA stenosis (white arrowhead). (**C**) A stent (black arrowhead) was deployed under distal balloon protection. (**D**) Frontal view of angiogram after stenting shows improvement of the stenosis. CCA: common carotid artery

Medix, Osaka, Japan); a 6.0 mm × 30 mm self-expandable stent (PRECISE; Cardinal Health, Tokyo, Japan) was deployed (**Fig. 3B–3D**). The lesion was post-dilated with a 3.5 mm × 40 mm PTA balloon (RX-Genity; Kaneka Medix, Osaka, Japan). The blood in the CCA was suctioned via guiding catheter before deflating the guiding balloon. After removing the guiding catheter, the puncture site was sutured using a 6-0 monofilament surgical suture.

Postoperatively, she was admitted to the intensive care unit. There was no postoperative neurological symptom. Postoperative MRI showed no ischemic lesion related to the intervention (**Fig. 4A**). The patency of the stent was confirmed by carotid ultrasonography (**Fig. 4B**). She was discharged 8 days after the procedure. The dual antiplatelets were continued for a month. Subsequently, single antiplatelet treatment was continued. She underwent TAR without any ischemic complication.

Discussion

We described the usefulness of sheathless open retrograde stenting using a balloon-guiding catheter for proximal CCA stenosis.

The literature about the treatment focused on proximal CCA is rare. Linni et al. treated 52 procedures of proximal CCA lesions, including 24 by surgical (11 bypasses, 12 transpositions, and retrograde endarterectomy) and 28 by endovascular (13 open transcervical and 15 transfemoral stent implantations) treatment between November 1991 and February 2010.[9] Treatment strategies have changed from open surgery to endovascular treatment to reduce complications, such as central nerve injury and lymphatic damage, and to shorten hospital stay. There is a reported the 100% of technical success rate, 3.6% (1/28) of perioperative death and stroke, 89.3% of 5 year patency, and 79.6% of 5-year survival for the endovascular group.

In previous reports about the hybrid approach for proximal CCA stenosis, ICA or CCA clamping was used for prevention of embolism.[6–10] In open retrograde stenting using a balloon-guiding catheter, the distal balloon protection can be established only by inflating a guiding balloon. The ICA or CCA clamping also seems simple; however, the surgical field get busy by the co-existing guiding sheath and clamping. In this case, we obtained successful embolic protection. In fact, there were no ischemic symptoms or ischemic lesion after procedure. During the hybrid approach, the guiding catheter often extracted easily because the length of catheter in the vascular lumen is short. The balloon-guiding catheter is fixed in the vascular lumen, which prevents inappropriate extraction of the catheter. Usually, the insertion of a balloon-guiding catheter requires a vascular sheath. Sheathless insertion contributes to shortening the catheter length in the vascular lumen. We used a 9Fr OPTIMO PPI sheathless kit, which is used for percutaneous peripheral intervention with sheathless method. The pre-dilator and dilator included in the kit enabled a smooth insertion. Bleeding from the surgical site is also a concern during the hybrid approach because antiplatelet therapy and systemic heparinization are required. Our approach seems less invasive because we can perform procedures with less exposure of the CCA. In addition, the puncture site is completely closed by suture. Minimizing

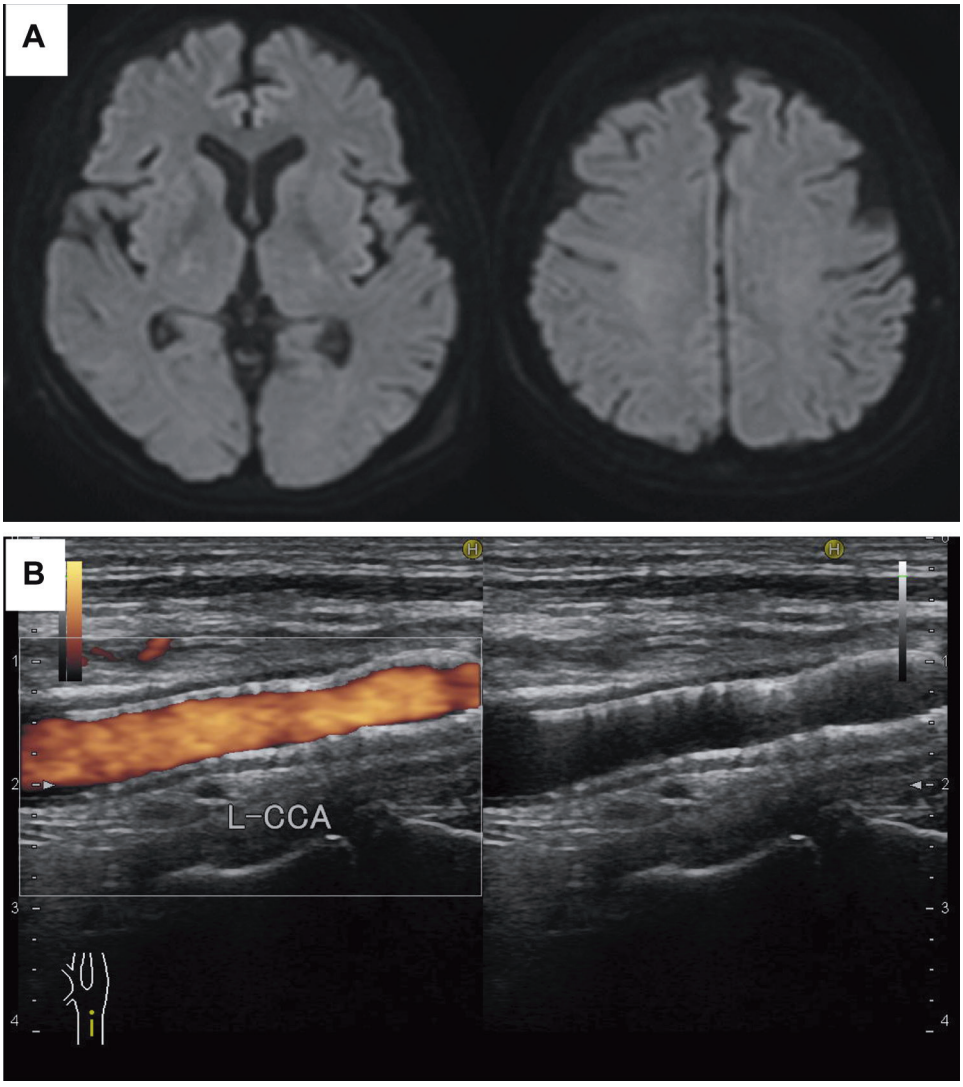

Fig. 4 (**A**) Diffusion-weighted images show no ischemic lesion. (**B**) The patency of the stent was confirmed with carotid ultrasonography.

exposure may contribute to reducing any potential postoperative subcutaneous bleeding.

Conclusion

The retrograde CAS using sheathless insertion of a balloon-guiding catheter was safe and enabled us to establish distal balloon protection less invasively and easily.

Disclosure Statement

The authors declare that there is no conflict of interest.

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