A Case of Carotid Artery Stenting through Surgical Exposure and Direct Puncture of the Femoral Artery with Severe Arteriosclerosis Obliterans: A Technical Note

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Objective: A case of carotid artery stent placement performed by exposing and directly puncturing the femoral artery through a small surgical incision is reported.

Case Presentation: In this patient, who had undergone multiple bypass surgeries for arteriosclerosis obliterans of the bilateral lower extremities, the inguinal region was scarred and atrophied, and percutaneous puncturing of the femoral artery was difficult. In addition, the possible area of device insertion was limited to a short segment of the left femoral artery. Also, as stenting through the right brachial artery was difficult due to flexion contracture of the elbow as a sequel of cerebral infarction, stent placement was performed by surgically exposing and puncturing the femoral artery under local anesthesia.

Conclusion: This stenting method was useful as it could be performed similarly to the usual percutaneous stenting procedure under local anesthesia with limited physical and psychological burden to the patient.

Keywords: carotid stenting, arteriosclerosis obliterans, femoral artery exposure, femoral artery puncture, endovascular treatment

Introduction

Carotid artery stenting (CAS) is usually performed via the femoral or brachial artery, but access is often difficult to obtain due to complications, including systemic arteriosclerotic lesions.

In the patient reported here, who had internal carotid artery (ICA) stenosis and a history of multiple treatments including bypass surgery for arteriosclerosis obliterans (ASO) of the bilateral lower extremities, CAS could be performed by surgically exposing and directly puncturing the femoral artery through a small incision and transfemorally inserting the device.

Case Presentation

The patient was a 72-year-old male. He underwent superficial temporal artery to middle cerebral artery bypass at another hospital for left ICA occlusion that had onset with a minor stroke, but 80% stenosis (by the criteria of the North American Symptomatic Carotid Endarterectomy Trial) was detected in the right ICA during the follow-up. The patient was capable of unassisted ambulation despite paralysis of the right upper extremity and independent in activities of daily living. Since stenosis was progressive, revascularization was evaluated. However, as the affected site was located in the high cervical portion (extending distally to the C2 level) and the contralateral ICA was occluded, the risk of carotid endarterectomy was judged to be high, and CAS was selected.

The patient had a history of repeated revascularization for ASO of the bilateral lower extremities, and axillofemoral bypass, femorofemoral (F-F) bypass, and iliofemoral bypass had been performed using artificial vessels in the right lower extremity, but the right common iliac artery and all grafts were eventually occluded, and revascularization was thereafter renounced. He had also undergone open osteosynthesis for fracture of the trochanter of the right femur.
The left external iliac artery had been stented. On 3D-CTA, the peripheral arteries were clearly delineated, but F-F bypass was anastomosed to the peripheral end of the stent, and the graft was occluded and formed a blind end (Figs. 1A and 1B).

In the bilateral inguinal regions, scars after skin incisions about 15 cm long were observed along the femoral arteries, and as contracture and atrophy of the skin and subcutaneous tissue were severe, percutaneous puncture was judged to be impossible (Fig. 1C). Also, the right elbow was flexed and difficult to extend as a sequela of left cerebral infarction (Fig. 1D), and the use of the right brachial artery as an access was also judged to be difficult.

As the puncture site, a short segment of the left common femoral artery (CFA) distal to the anastomosis of the F-F bypass graft was judged to be usable. It was decided to expose the autogenous CFA by a small surgical incision and to directly puncture it under direct vision.

The patient had been orally administered two antiplatelet drugs, and the prescription was maintained. A cardiovascular surgeon made a small incision using part of the surgical scar in the left inguinal region and exposed the left CFA. It was secured using vascular tape, and a 6-0 prolene was applied to the arterial wall in anticipation of tobacco suture around the puncture site (Fig. 2A). The CFA was directly punctured under direct vision, the lumen was secured, and a 6 Fr short sheath was inserted (Fig. 2B). By performing angiograms through the sheath, the patency of the treatment route, including the lumen of the proximal stent, was confirmed (Figs. 2C and 2D). The abdominal aorta was secured with a 0.035-inch guidewire, and the 6 Fr short sheath was replaced by a 6 Fr 90-cm guiding sheath (Shuttle; Cook medical, Bloomington, IN, USA). CAS was performed by the same procedure as the usual percutaneous transfemoral procedure. Under general heparinization, a guiding sheath was advanced to the right common carotid artery. Under distal
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route for CAS may be restricted. The radial artery, axillary artery, ulnar artery, and carotid artery have been reported as puncture sites other than the CFA and brachial artery, but they are not yet prevalent.

In the present case, the right brachial artery could not be used as an approach due to flexion contraction of the right elbow. While the right CFA was occluded, the left CFA was judged to be usable as a treatment route. However, there was the risk of mispuncture of the artificial graft present near the right CFA or the anastomosis site itself, causing difficulty in hemostasis, failure in suture/formation of pseudoaneurysm, graft infection, and rupture of pseudointima/thrombus formation. In addition, if the graft was mispunctured in this patient, it was expected to be difficult to turn the device and advance it proximally through the CFA. Therefore, it was

Discussion

ICA stenosis is often complicated by systemic arteriosclerotic lesions, such as ASO, and the puncture site and treatment

Fig. 2 Operative images (arrow: the puncture site). (A) The left common femoral artery (CFA) was surgically exposed and 6-0 monofilament, nonabsorbable suture was prepared on the vessel wall. (B) A 6-Fr short sheath was inserted into the CFA. (C, D) Left CFA angiogram via the sheath showing the angioplasty stent and the femorofemoral bypass graft in the CFA proximal to the puncture site.
necessary to ensure puncturing of the autogenous artery by avoiding the graft and its anastomosis. There was also the possibility that tissue resistance was increased due to postoperative scars along the CFA, making the introduction of the sheath itself difficult. For these reasons, we judged that usual percutaneous puncture would be difficult but that it was possible to insert the device by surgically exposing the CFA and directly puncturing the autogenous part of the vessel.

Generally, endovascular treatment by puncturing the artificial graft is an alternative in patients after surgical repair of the CFA, but Hayashi et al. recommended direct puncture of the graft through a small incision, which we performed in the present case, due to the above risk of complications such as the difficulty in hemostasis.

While this procedure can be performed under local anesthesia, it is more advantageous than puncturing the carotid artery in consideration of the patient’s psychological burden, because the puncture site is out of the patient’s sight. Since endovascular treatment requires general heparinization, it is also desirable to avoid lumbar spinal anesthesia, but pain could be adequately controlled in our patient by local anesthesia alone. Nevertheless, consideration to protect the wound such as removing the retractors during the procedure was considered necessary (Fig. 2B). Also, CAS could be performed similarly to the usual percutaneous transfemoral procedure, which was advantageous also to the surgeon. Another advantage is that hemostasis can be assured by suturing. In the present case, we removed the sheath after reversing heparin, achieved hemostasis by suturing the puncture site, and closed the surgical wound, but hemostasis was easy at both the puncture and incision sites, and, in retrospect, reversing heparin may have been unnecessary.

Exposure of the CFA by making a small incision is a basic technique in vascular surgery. In the present case, about 15 mins was needed from inguinal skin incision to the insertion of the 6 Fr short sheath. Exposure and direct puncture of the CFA are performed also in endovascular treatment for thoracic/abdominal aneurysms, and the introduction of devices 12–24 Fr is reportedly possible. However, the use of as low-profile a device as possible is desirable in patients with severe ASO, and, in our patient, complications at the puncture site could be avoided by the use of a 6 Fr guiding sheath instead of a common 8 Fr sheath. The skin incision may be longitudinal or oblique, but longitudinal incision is performed more frequently on the basis of the anatomy of lymphatic tissue to reduce its damage. Complications include poor wound...
healing, necrosis, lymph fistula, and infection, and a low cardiac output, progression of arteriosclerosis, renal dysfunction, and obesity are their risk factors.\textsuperscript{7}

Complications have been reportedly reduced by transcervical CAS in difficult-to-access elderly patients, etc.\textsuperscript{9} Complications of transcervical CAS include difficulty in hemostasis, cranial nerve palsy, detachment/migration of the sheath, and difficulty in stent placement due to interference with the sheath, and some may be serious. In the present case, since there was no problem in access to the carotid artery after puncture, we judged the present method to be safer.

\section*{Conclusion}

CAS by direct puncture of the CFA through a small surgical incision could be performed similarly to the usual percutaneous CAS procedure under local anesthesia with less physical and psychological burden to the patient and was useful.

\section*{Disclosure Statement}

The top author or any of the co-authors has no conflict of interest.

\section*{References}