Combined surgical and endovascular approach to treat symptomatic in-stent occlusion of the left common carotid artery origin

Technical note

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Symptomatic occlusive lesions at the origins of the supra-aortic vessels pose challenges for treatment. Endovascular angioplasty and stent placement via the transfemoral approach is possible, but obtaining a stable position for the guide catheter via this approach is technically difficult. The authors describe the case of a 56-year-old man presenting with symptomatic occlusion of a previously placed stent at the origin of the left common carotid artery (CCA). An endovascular revascularization of the left CCA was planned. However, the absence of a lumen proximal to the stent prevented stable placement of a guide catheter via the transfemoral route. Consequently, the authors used a combined surgical and endovascular approach to gain access to the lesion. The left CCA was exposed surgically distal to the occlusion and clamped just proximal to its bifurcation to preserve flow from the external to the internal carotid artery (ICA) and to prevent embolism into the ICA. A wire was passed retrograde through the occlusive lesion and then was subsequently advanced proximally into the femoral sheath. This allowed transfemoral advancement of the appropriate endovascular devices to perform an angioplasty and placement of a stent. The patient remained neurologically stable, and postoperative studies showed improvement in cerebral perfusion. This case demonstrates the feasibility of distal-to-proximal stent delivery with a combined endovascular and surgical approach.

Key Words • balloon angioplasty • carotid artery • carotid angioplasty and stent placement • endarterectomy • endovascular occlusion

REVASCULARIZATION of symptomatic complete occlusion of the proximal great vessels poses a technical challenge for either a surgical or an endovascular approach. The traditional surgical approach requires intrathoracic exposure of the supra-aortic vessels or extraanatomical reconstruction.19 The main restriction of the transfemoral endovascular approach is the inability to gain or maintain stable access in the vessel. We describe a case in which a combined endovascular and surgical approach allowed effective treatment while circumventing the major technical obstacles of a purely endovascular or purely surgical approach. A sheath was placed through a surgical cutdown into the distal CCA while the artery was temporarily clamped, followed by angioplasty and stent placement in the occluded proximal CCA.

Case Report

History and Examination. This 56-year-old man presented with right facial weakness, partial visual field deficit, right upper-extremity weakness, moderate aphasia, dysarthria, dysmetria, and partial right-sided neglect. His NIHSS score was 13 on admission. His medical history included cigarette smoking, hypertension, and previous stent placement at the origin of the left CCA for symp-
tomatic stenosis treated 4 years earlier at another hospital. A CT perfusion study demonstrated a focal area of absent perfusion in the left frontal operculum. A larger surrounding area in the left MCA distribution demonstrated elevated mean transit time, decreased cerebral blood flow, and normal-to-increased cerebral blood volume. Cerebral angiography revealed complete occlusion of the stent at the origin of the left CCA and collateral filling of the left ICA through the ascending cervical artery, into the OA, and then through the ECA (Fig. 1). We considered the following options: 1) angioplasty performed via a transfemoral approach; 2) a subclavian artery-CCA bypass; and 3) a combined surgical and endovascular approach. Ultimately, we chose a combined approach.

Operation. The patient was brought to the operating room, and the left CCA bifurcation was exposed after induction of general anesthesia. The distal CCA was punctured 2 cm proximal to its bifurcation. A 6 Fr sheath was then placed retrograde in the distal CCA. A Fogarty clamp was positioned immediately distal to the CCA puncture to maintain the collateral circuit filling the left ICA throughout the procedure and to prevent distal embolism. A 6 Fr sheath was also placed in the right common femoral artery. We advanced a 0.035-in exchange-length guidewire through the carotid sheath in a retrograde manner and crossed the in-stent occlusion at the origin of the left CCA. The wire was then navigated into the aortic arch, and ultimately into the right common iliac artery. A 7-mm microsnare (EV3, Microvena) was passed through the femoral sheath, and the wire was trapped in the right common iliac artery and retrieved through the femoral sheath. The femoral access was obtained for two main reasons. First, it gave us access to pass the diagnostic catheter to acquire images after angioplasty through the percutaneous carotid route. Second, we believed that the femoral access provided an alternative route during the procedure if larger-caliber devices such as stents were eventually required (which would necessitate the use of larger guide sheaths), thus avoiding exchange of the surgically inserted carotid sheath in the angiographic suite (Fig. 2A and B). An 8 × 20-mm balloon (Powerflex; Cordis, Johnson & Johnson) was advanced through the carotid sheath in a retrograde fashion across the lesion. The balloon was inflated several times to its nominal pressure to dilate the occlusive lesion, starting distally and moving proximally (Fig. 2C).

The distal CCA remained clamped during the angioplasty. After the angioplasty, 100 ml of blood was suctioned through the carotid sheath to remove any embolic debris. The clamp was then removed, and angiography demonstrated restoration of blood flow through the previously occluded stent, but also demonstrated a high-grade stenosis immediately distal to the stent. Subsequently, an 8 × 40-mm stent (Protégé, EV3; Microvena) was introduced through the carotid sheath and placed across the lesion, overlapping with the original stent.

Follow-Up Neuroimaging. Final angiography studies demonstrated a < 30% residual stenosis at the origin of the left CCA (Fig. 3). Good filling was seen in the left ACA and through the leptomeningeal collateral vessels supplying the left MCA territory (Fig. 4). For the chronic MCA occlusion, a superficial temporal artery–MCA bypass was not considered because the patient had a natural ECA-ICA bypass by the collateral circuit described above. A postoperative CT perfusion scan demonstrated improved blood flow in the left MCA distribution.

Postoperative Course. At the time of discharge, the patient’s neurological examination results had improved to an NIHSS score of 4. Three months later, his NIHSS score was 0, and his modified Rankin scale score was 0.

Discussion

Traditional surgical treatment of great-vessel occlu-
Combined approach for symptomatic occlusion of the left CCA origin

The rate of perioperative stroke and death from these procedures varies from 0 to 6.3% in published series. Several previous reports have described a combined approach (carotid endarterectomy with endovascular angioplasty and stent placement) for treatment of CCA stenosis. Our case was unique because there was an occlusion within a stent previously placed at the origin of the CCA, and no lumen was available proximal to the occlusion to place any delivery system via a transfemoral approach. Thus, we used a combined approach with a carotid cutdown and placement of a sheath in the distal CCA, with a second sheath in the right common femoral artery. This allowed distal protection by temporary clamping of the distal CCA, preserving the collateral vessels to the brain via the ECA, and at the same time permitted retrograde transluminal angioplasty and stent placement. The concomitant transfemoral approach provided stability of the guidewire throughout the procedure and transfemoral placement of guide catheters, allowing contrast injections for adequate visualization of delivery of devices and intraprocedural results. We were also able to use suction from both directions for any debris in the vessel prior to removing the clamp.

Conclusions

We demonstrate technical success of revascularization in a case of proximal CCA occlusion by using a combined surgical and endovascular approach. This method of retrograde angioplasty may be considered when direct
revascularization is necessary and traditional endovascular approaches are not feasible. This report adds to the growing body of work demonstrating the complementary roles of surgical and endovascular strategies.

Disclaimer

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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Fig. 4. Follow-up angiographic studies. A: Left CCA, intracranial AP view. Good flow through ICA, left ACA, and cross-filling through the anterior communicating artery are demonstrated. There is chronic occlusion of the left MCA (arrow). B: Left CCA, intracranial AP view. Midarterial phase, demonstrating leptomeningeal collateral vessels through branches of ECA with MCA (circle).