Direct Percutaneous Carotid Artery Stenting for a Patient with Absence of the Common Carotid Artery

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Summary

A 54-year-old man with symptomatic internal carotid artery stenosis with absence of the common carotid artery (CCA), who had been treated with surgery and postoperative radiotherapy for tonsillar carcinoma, underwent direct percutaneous carotid artery stenting (CAS). To our knowledge, this is the first report of direct percutaneous carotid artery stenting (CAS) for a patient with absent CCA.

Introduction

Absence of the common carotid artery (CCA) is a rare anomaly¹⁻⁵. We describe a case of radiation-associated stenosis of the internal carotid artery (ICA) with absence of the CCA. To our knowledge, this is the only report of direct percutaneous carotid artery stenting (CAS) for a patient with absent CCA.

Case Report

This 54-year-old man presented with sudden mild left hemiplegia. He had undergone a right axillo-right common iliac artery bypass for interrupted aortic arch at 34 years old, and also had been treated with surgery and postoperative radiotherapy for right tonsillar carcinoma at 49 years old. He was admitted to a local hospital because cranial CT scan demonstrated

cerebral infarction in the right parietal lobe. He was treated with conservative therapy and his condition improved until no neurological findings were found.

Twenty days after onset, he was transferred to our hospital for further examination of cerebral infarction. On admission to our department, neurological examination did not reveal significant abnormalities.

Fluid attenuated inversion recovery (FLAIR) magnetic resonance (MR) images revealed cerebral infarction in the right parietal lobe (Figure 1A). Carotid ultrasound scan was performed, and showed greater than 80% right ICA stenosis, but normal carotid bifurcation in the neck could not be found. Because of the interrupted aortic arch and occlusion of the right brachial artery, angiography via the femoral artery or the right brachial artery was impossible. We attempted angiography via the left brachial artery, but it was also impossible to introduce a catheter into the right brachiocephalic artery because of arterial elongation and tortuosity; therefore, intravenous 3D digital subtraction angiography (IV 3D DSA) was attempted⁶. Greater than 80% right ICA stenosis with absence of the right CCA was demonstrated. The external carotid artery (ECA) arose proximally from the right brachiocephalic artery. The ICA arose distal to the ECA (Figures 2, 4A). Brain single-photon emission tomography with 99mTc-HMPAO presented no apparent hypoperfusion in cerebral blood flow, and cerebral vasoreactivity to acetazola-

Figure 1 A) Fluid attenuated inversion recovery MR images on admission: cerebral infarction in the right parietal lobe was revealed. B) Diffusion-weighted MR images the day after the intervention: no complications related to the treatment occurred, except for subacute cerebral infarction in the right parietal lobe.

mide was maintained, except in the area of infarction in the right parietal lobe.

The patient was administered aspirin 100 mg/day and cilostazol 200 mg/day on admission. Because he had been treated with surgery and postoperative radiotherapy for right tonsillar carcinoma, we thought that CAS was preferable to carotid endarterectomy (CEA). As the access route to the right internal carotid artery (ICA) is difficult via the femoral or brachial artery, we performed direct percutaneous CAS.

Intervention

Under general anesthesia, the patient was positioned supine. Surgical cut down was performed with a small neck incision of 30 mm length just above the clavicle to expose the lower right cervical ICA. Systemic heparinization, loading, and maintenance were adminis-

tered to maintain the activated clotting time between 250 and 300 seconds. The lowest portion of the exposed ICA was clamped with a surgical clip to cease antegrade blood flow to the brain for cerebral protection. An 18-gauge needle was introduced directly into the cervical ICA as low as possible distally to the surgical clip: a 6F guiding sheath (Shuttle-SL Flexor; Cook, Bloomington, IL, USA) was placed over a 0.035-inch guidewire below the stenotic lesion (Figure 3A), and 5-0 prolene was placed around the carotid puncture to enable rapid hemostasis after the procedure. The ICA was then declamped and reperused for ten minutes. Occlusion time of the ICA was seven minutes.

The ICA was clamped again for cerebral protection. Through the guiding sheath, the stenotic lesion was crossed with a 0.014-inch

Figure 2 Preoperative IV 3D DSA (lateral view). Volume rendering images revealed greater than 80% right ICA stenosis, and could not demonstrate normal carotid bifurcation in the neck. Long arrow: right ECA; arrowheads: right ICA stenosis; short arrow: right vertebral artery.

micro-guidewire. Over the micro-guidewire, the stenotic lesion was predilated using a 3.5×20 mm catheter balloon (Submarine Rapido; Getz Brothers). A self-expandable stent (8×40 mm) (Precise; Cordis) was placed in the stenotic lesion. Postdilation was performed using a catheter balloon (4×30 mm) (Amiia; Cordis). After stenting, two aspiration runs were performed with the guiding sheath. An angiogram after stenting showed the stent to be in a good position with resolution of the stenosis (Figure 3B). The ICA was then declamped and reperused for ten minutes. Occlusion time of the ICA was eight minutes. Thereafter, the ICA was clamped again. After the carotid puncture was sutured with 5-0 prolene for hemostasis immediately after withdrawing the guiding sheath and the micro-guidewire,

the ICA was declamped. Occlusion time of the ICA was eight minutes. After complete hemostasis, the wound was closed. The postoperative course was uneventful. Diffusion-weighted MR images the day after CAS demonstrated no complications related to treatment (Figure 1B). Six weeks later, a follow-up IV 3D DSA confirmed no restenosis (Figure 4A,B). Four years after the procedure he remains symptom-free, with duplex surveillance negative for restenosis thus far.

Discussion

Absence of the CCA is rare, with fewer than 25 cases reported in the literature. Absence of the CCA has no side or sex preference, can occur bilaterally, and is asymptomatic unless associated with other conditions¹⁻⁵. Halstuk et al. described a patient with amaurosis fugax and extensive atherosclerosis of the ICA combined with an absent CCA that required extra-anatomic reconstruction¹. To our knowledge, our case is the only report of direct percutaneous CAS for a patient with absent CCA.

When absence of the CCA occurs on the right side, the ECA usually arises proximally from the brachiocephalic artery and the ICA arises distally from the subclavian artery proximal to the origin of the vertebral artery⁴. Embryology in absence of the CCA has been already described in detail elsewhere¹⁻⁵. Briefly, the usual form of absence of the CCA occurs either because of persistence of the ductus caroticus and regression of the third branchial arch or because of regression of the fourth branchial arch with resultant cervical aortic arch⁴.

Endovascular CAS has become increasingly popular for patients considered at high risk for CEA, anatomically inaccessible lesions, recurrent stenosis, radiation-induced stenosis, contralateral occlusion, and for patients with severe medical comorbidities^{7,8}. Radiation-associated carotid stenosis is more difficult to treat surgically because of periarterial scarring, ill-defined planes of dissection, risk of scar disruption, prosthetic infarction, anastomotic breakdown and restenosis, long lesion length, and increased rate of wound complications⁸. For these reasons, percutaneous transluminal angioplasty and stent placement may be the preferred method of revascularization in patients who have undergone radiation therapy

Figure. 3 A) Angiogram immediately before CAS (AP view): greater than 80% right ICA stenosis was demonstrated. A 6F guiding sheath was placed below the stenotic lesion. B) Angiogram immediately after CAS (AP view): the stent was shown to be in a good position with resolution of stenosis. Arrowheads: stent.

to the head or neck regions^{9,8}. It has been reported that angioplasty and stent placement have low rates of complications and restenosis in the treatment of radiation-associated carotid occlusive disease⁸. In the present patient, we considered that his right ICA stenosis was radiation-induced because he had been treated with radiotherapy for right tonsillar carcinoma after surgery. We also concluded that CAS was preferable to CEA.

Direct carotid puncture is an important option in endovascular surgery when a guiding catheter is not advanced into the CCA because of arterial tortuosity¹⁰⁻¹³. The main limitation of direct carotid exposure is insufficient distance from the bifurcation for comfortable sheath insertion. Puncture of the diseased carotid may be associated with a high risk of ca-

rotid plaque fragmentation and migration of distal debris with subsequent neurologic deficits¹³. In the present case, surgical cut down was performed just above the clavicle to expose the undiseased cervical ICA as low as possible.

During CAS, the use of cerebral protection devices appears to reduce thromboembolic complications, and a variety of cerebral protection methods have been reported^{14,15}. In the present case, we adopted direct proximal occlusion of the ICA with a surgical clip for cerebral protection because we thought that it was the most secure procedure for ceasing antegrade blood flow to the brain. In order to shorten the occlusion time of the ICA, we divided the procedure in three parts: the first was for placement of the guiding sheath, the

Figure 4 Post-operative IV 3D DSA. A) Volume rendering images (view from left side): absence of the right CCA was demonstrated. The ECA arose proximally from the right brachiocephalic artery. The ICA arose distal to the ECA. The stent was shown to be in a good position. Long arrow: right ECA; arrowheads: stent in the right ica; short arrow: right vertebral artery; white arrow: right brachiocephalic artery. B) Curved multi planer reconstruction images: the stent was shown to be in a good position, and restenosis was not recognized.

second was for stent placement, and the third was for hemostasis. In each part, the ICA was clamped for brain protection for less than eight minutes, and thereafter, it was declamped and reperfused for ten minutes. There were no ischemic complications related to the treatment.

Conclusions

We describe the first case of direct percutaneous CAS for a patient with absence of the CCA. In the present case, proximal occlusion of the ICA was feasible for cerebral protection during CAS.

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