Staged Cerebral Revascularization in a Patient With an Occluded Common Carotid Artery

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Background and Purpose—We report a management strategy for cerebral revascularization in a patient with an occluded common carotid artery by first performing a subclavian to external carotid artery bypass, followed by superficial temporal artery middle cerebral artery (STA-MCA) bypass.

Methods—The patient presented with symptomatic left hemispheric hemodynamic insufficiency, associated with occlusion of the ipsilateral internal and common carotid arteries. The STA was not detectable. The patient was treated initially with a subclavian to external carotid artery bypass, with partial improvement in symptoms.

Results—Angiography demonstrated improvement in perfusion and STA filling, which was used for STA-MCA bypass, with resolution of symptoms.

Conclusion—Our experience with this case has led us to consider a staged approach for management of patients with an occluded common carotid artery.

Key Words: bypass surgery; carotid artery occlusion; cerebral ischemia

Although the usage of extracranial-to-intracranial bypass has decreased markedly since the 1980s, most physicians specializing in the treatment of occlusive cerebrovascular disease agree that a small subgroup of patients exists in whom cerebral revascularization will be beneficial.1,2 We report our experience with a patient with symptomatic left hemispheric hemodynamic insufficiency, whose ipsilateral common carotid artery was occluded, and whose distal superficial temporal artery (STA) was not detectable. He initially underwent subclavian-external carotid artery bypass, which partially alleviated his symptoms. He subsequently had a suitable STA for use as a donor vessel, and underwent STA middle cerebral artery (STA-MCA) bypass, with a satisfactory result.

Case Presentation

History
This 52-year-old man presented with a history of frequent episodes of difficulty with word finding, right hemibody weakness and numbness, and a subjective sense of cognitive difficulties. Three years previously, he experienced the sudden onset of similar symptoms, which lasted \( \approx 48 \) hours. Afterwards, he reported similar episodes occurring once or twice per day, lasting \( \approx 10 \) to 15 minutes.

Clinical Course
MRI/MRA demonstrated occlusion of both internal carotid arteries, the left common carotid artery, and an old left parietal stroke (Figure 1A). Angiography demonstrated that the left external carotid artery filled poorly via vertebral/occipital artery collaterals (Figure 1B). The left STA was not well visualized (Figure 1C). There was no STA pulse. The patient refused anticoagulation.

Vein bypass from the left subclavian to external carotid artery was performed. The rationale included the following: (1) potential augmentation of flow to the left hemisphere via recruitment of ophthalmic and/or middle meningeal artery collaterals; (2) preservation of flow in the external carotid artery for a possible external carotid artery-MCA vein bypass; and (3) potential salvage of the left STA for use in a possible STA-MCA bypass procedure.

Postoperatively, he noted a modest decrease in the incidence of attacks (1 to 2/week). A second angiogram demonstrated excellent flow through the graft and the STA (Figure 2A). A SPECT scan demonstrated flow to the left MCA distribution was decreased by \( \approx 30\% \), with no increase in flow in response to acetazolamide (Figure 3A).

Because of ongoing symptoms and profound asymmetry of flow, STA-MCA bypass was performed (Figure 2B). He has had no further ischemic events and also reported subjective improvement in cognition. A subsequent SPECT scan demonstrated marked improvement of perfusion to the left hemisphere (Figure 3B). The patient has remained asymptomatic for 8 years.

Discussion
It is well known that in the presence of occlusion of the cervical internal carotid artery, revascularization of the exter-
nal carotid artery can relieve ipsilateral hemispheric or retinal symptoms.3–9,12 Bypass to the external carotid artery has been performed using the contralateral common carotid artery or the aortic arch as an in-flow source.10 The most common inflow source is the ipsilateral subclavian artery.11 If these maneuvers are ineffective or unfeasible, the preferred method of revascularization is the STA-MCA bypass. When the superficial temporal artery is not available as a proper donor, a vein bypass from the external carotid artery to the MCA is usually entertained.13 In the presence of an occluded common carotid artery, long saphenous bypass, such as subclavian MCA bypass, procedures have also been described.13–15 Unfortunately, such procedures carry a higher complication profile and lower patency rate than an artery–artery anastomosis of similar-sized vessels.14,16,17

In 1978, Ausman et al were the first to describe the technique of salvaging the superficial temporal artery for bypass by first performing a subclavian-external carotid artery bypass, followed 6 weeks later by STA-MCA bypass in a patient with retinal ischemia.18 In 1982, Senter and Long reported simultaneous subclavian-external carotid and STA-MCA bypass in 3 patients with hemispheric ischemia.19 This is the first reported case of a staged subclavian-external carotid bypass and STA-MCA bypass in a patient having hemispheric ischemic symptoms, with long-term resolution of symptoms and supporting documentation of flow augmentation. We believe that the abundance of data in the literature describing improvement after external carotid artery revascularization warrant first performing this procedure before proceeding with STA-MCA bypass. Should the patient not respond satisfactorily, STA-MCA bypass may then be performed.

Figure 1. A, T2-weighted MRI scan demonstrating the left parietal infarct. B, Angiography of the aortic arch showing occlusion of the left common carotid artery. C, Left vertebral artery injection illustrates retrograde filling of the left external carotid artery via vertebral-occipital artery collateral circulation, with absent STA.

Figure 2. A, Arch aortagram after the left subclavian-external carotid artery bypass. B, Lateral projection after injection of the subclavian graft with robust filling of the superficial temporal artery.

Figure 3. A, SPECT scan with and without acetazolamide after the subclavian-external carotid artery bypass. The left hemisphere exhibits ~30% less flow than the right. B, After STA-MCA bypass, there is near-normalization of flow symmetry.
References
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