Carotid Stenting for Chronic Total Occlusion of the Internal Carotid Artery
Dogma Debunked?

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In 1954, Eastcott et al1 opened the era of the surgical treatment of carotid atherosclerosis. In the ensuing 54 years, much has been learned about the benefits of carotid endarterectomy (CEA) for the treatment of symptomatic and asymptomatic carotid artery stenosis. Recently, carotid artery stenting has gained acceptance as a reasonable alternative to CEA for patients who are deemed at high risk for complications from surgery.2 Despite all of the advancements in the techniques of carotid artery revascularization, little progress has been made in the treatment of chronic total occlusion.

Through extensive personal experience, the early leaders of vascular surgery defined the parameters for carotid surgery. In 1965, De Bakey3 first highlighted the challenges associated with the treatment of internal carotid artery occlusion when he pointed out that “because of intracranial extension of the thrombotic process and its organization, the incidence of restoration of circulation for complete occlusion at (the internal carotid artery) declined sharply after 24 hours.” In 1970, Thompson et al4 published a landmark series of 592 patients undergoing CEA that included 118 totally occluded internal carotid arteries. In this subgroup, flow was restored in only 41%, with a mortality of 6.2%. Thompson concluded that “the patient with a totally occluded carotid artery should not be routinely operated on nor should he be categorically rejected for operation.”

When doubts arose in the 1980s about the benefits of CEA,5,6 prospective, randomized trials were organized to compare the results of CEA with medical management for the treatment of carotid artery stenosis. Unfortunately, because everyone “knew” that endarterectomy for total occlusion of the internal carotid artery was associated with dismal outcomes, patients with totally occluded internal carotid arteries were excluded from all of these landmark trials. Extracranial-intracranial bypass, a procedure described in the 1960s as a way of treating internal carotid artery occlusion or intracranial occlusive lesions, remained an option for the management of chronic occlusion of the internal carotid artery. Several nonrandomized studies suggested that extracranial-intracranial bypass could have a beneficial impact on symptoms for patients with lesions not amenable to standard extracranial carotid surgery. This procedure subsequently fell out of favor, however, after the results of a National Institutes of Health–sponsored, multinational, prospective, randomized trial were published in 1985.7 In the extracranial-intracranial bypass trial, 1377 symptomatic patients with internal carotid occlusion, surgically inaccessible internal carotid stenosis, or middle cerebral artery stenosis or occlusion were randomized to bypass versus medical therapy. At 5-year follow-up, there was no difference in outcomes between the 2 groups with regard to the primary end point of nonfatal and fatal stroke.

On the basis of these observations made when there were no CT or MRI images of the brain or any of the other sophisticated imaging modalities available to us today, the dogma that chronic total occlusion of the internal carotid artery should be treated medically became well established. The extracranial-intracranial bypass trial did not alter this dogma. So where does that leave the patient with chronic total occlusion of the internal carotid artery and recurrent symptoms of cerebral ischemia? We know that some of these patients will continue to have symptoms and may go on to experience a stroke while on medical therapy.8 In this issue of Circulation: Cardiovascular Interventions, Lin et al9 provide us with the first glimpse of the possible role of carotid stenting for patients with this difficult clinical problem. They attempted recanalization of chronic internal carotid occlusion in 54 patients, 87% of whom were symptomatic, with a technical success rate of 65% (35/54). The 3-month stroke or death rate was only 4%, and there were no complications of lasting significance. The authors are to be commended for challenging the traditional dogma and by showing that chronic total occlusion of the internal carotid can be stented with low short-term morbidity and mortality.

There are a number of limitations of this study worthy of mention. Little information is provided regarding the technical aspects of the procedure and the angiographic predictors of success. Only short-term follow-up is provided, and it remains to be proven that carotid stenting will provide long-term protection against stroke and symptoms of cerebral ischemia. Perfusion CT imaging with Diamox stress was performed on many of the patients, but no systematic data are provided on the results of these studies and the ultimate...
impact of stenting on cerebral perfusion. It also remains to be proven that the results achieved by this talented group of investigators are generalizable. This group of patients with total occlusion of the internal carotid artery actually fared better with stenting than did symptomatic patients with internal carotid stenoses, treated as part of the randomized Étude de Vieillissement Artériel-3S and SPACE trials.\textsuperscript{10,11}

The authors have asked an important question and have reported impressive data that stenting of the totally occluded internal carotid is feasible and can be done with good early results. Much is yet to be learned about the optimal equipment and techniques for chronic carotid artery occlusion recanalization. One might surmise that proximal embolic protection with active or passive flow reversal (MOMA or Parodi system) would optimally protect the brain from distal embolization during these procedures and overcome some of the challenges associated with delivery of a distal embolic protection device through the area of occlusion. As the authors correctly report, further prospective study incorporating objective neuroimaging tools and cognitive function assessment is required to better understand the benefits of this potentially risky intervention. Before this approach can be universally recommended, longer-term results must be reported and compared with a cohort of patients managed medically, ideally in a prospective, randomized trial.

**Disclosures**

Dr Laird serves as a member of the medical advisory board for Boston Scientific, Cordis, Medtronic Vascular, and eV3. Dr Pevec has no conflicts of interest to disclose.

**References**


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