The American Journal of Surgery (2015) 209, 403-412

The American Journal of Surgery®

Review

Endarterectomy or carotid artery stenting: the quest continues part two

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KEYWORDS:
Carotid artery disease;
Stent;
Carotid endarterectomy

Abstract

BACKGROUND: Although randomized trials on carotid artery stenting (CAS) could not establish its equivalence to carotid endarterectomy (CEA) in patients with symptomatic carotid disease, CAS is rapidly evolving. Data on long-term outcome after CAS from randomized trials have now become available and ongoing, prospectively held registries frequently publish their results in increasing numbers of patients. We have therefore reviewed the currently available literature and provide an update of our previous article on this topic.

DATA SOURCES: PubMed literature searches were performed to identify relevant studies regarding current status of CEA and stenting for symptomatic carotid stenosis.

CONCLUSIONS: The efficacy of CAS in patients with symptomatic carotid artery stenosis remains unclear because of varying results in randomized trials. Although multiple registries do report promising results after CAS, peri-interventional stroke/death rates still exceed those rates currently found after CEA. Therefore, CEA remains the "gold standard" in treating these patients.

The North American Symptomatic Carotid Endarterectomy Trial (NASCET) and European Carotid Surgery Trial (ECST) demonstrated that best medical treatment (BMT) combined with carotid endarterectomy (CEA) reduce the absolute risk of developing severe stroke or death in patients with symptomatic severe or moderate stenosis.[1,2] Current guidelines on how to treat these patients best are still based on these studies, which have been published almost 2 decades ago. Since then, many developments have taken place in the era of stroke prevention. The recognition of the importance of life-style adjustments and BMT has grown tremendously, reflected by national programs to discourage tobacco use worldwide and the growing use of statins to become standard care in all patients with vascular disease nowadays. Furthermore, percutaneous transluminal carotid angioplasty and stenting (CAS) have made its entrance into the field of treating patients with carotid stenosis and have already been studied widely as an alternative to CEA. CAS is less invasive compared with CEA and has a decreased risk for cranial nerve damage as well as the ability to treat lesions that are beyond the reach of CEA. However, early trials were not able to demonstrate superiority or noninferiority of CAS with respect to 30-day stroke rate and/or death in symptomatic patients and CEA still remained "gold standard" for treatment.[3–7]

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Manuscript received October 29, 2013; revised manuscript May 28, 2014

0002-9610/$ - see front matter © 2015 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.amjsurg.2014.06.012

In 2008, our group published a review describing the early literature regarding CAS in this journal.[8] Meanwhile, ongoing surveillance studies demonstrate that increase in operator experience and better patient selection translate into improved results after CAS.[9] Furthermore, long-term results of the early CAS trials have been published and more studies have been published on the value of CAS in real-world patients. In some guidelines, CAS has even already been proposed as an alternative to CEA in symptomatic patients and highly selected asymptomatic patients.[10] We have therefore reviewed the currently available literature on this topic and provide an update in this subsequent article.

Randomized Controlled Trials Comparing Carotid Artery Stenting and Carotid Endarterectomy

Several randomized controlled trials have been performed to establish the validity of endovascular treatment as an alternative to CEA in patients with symptomatic carotid stenosis. Because of the limitations of several early prospective studies, such as the inclusion of predominantly asymptomatic patients or the performance of angioplasty without stenting, and the substantial larger amounts of patients in the more recent studies, we will mainly discuss the following trials in this article: "stenting in patients with symptomatic severe carotid stenosis" (EVA-3S), the "stent protected angioplasty versus carotid endarterectomy" (SPACE) study, the "international carotid stenting study" (ICSS), and the "carotid revascularization endarterectomy versus stenting trial" (CREST).[5,7,11,12] The characteristics of these studies are provided in Table 1 and the short-term and long-term results in Tables 2 and 3.

We already discussed the short-term results of EVA-3S and SPACE in our earlier report.[8] In short, both were European noninferiority studies including symptomatic patients. Interim analysis in EVA-3S showed a significant higher risk for death or any stroke at 30 days for CAS (9.6%) compared with CEA (3.9%). For reasons of both safety and futility, EVA-3S was terminated early, leaving the inferiority question unanswered.[5] In contrast, in SPACE, the risk for severe ipsilateral stroke or death between randomization and 30 days after treatment was comparable in patients treated by CAS and patients treated by CEA (6.8% vs 6.3%, respectively). However, noninferiority of CAS could not be demonstrated.[7]

The cumulative risks of periprocedural stroke or death and nonprocedural ipsilateral stroke after 4 years of follow-up in the enrolled patients in EVA-3S remained significantly higher in patients who had undergone CAS (11.1% vs 6.2% after CEA). This was mainly caused by the poor 30-day results: the risk of ipsilateral stroke beyond the periprocedural period was low and similar in both groups.[13] Long-term outcome in SPACE after 2 years of follow-up was similar for both treatments: in the postprocedural period, the ipsilateral stroke rate was 2.2% for the stenting group versus 1.9% in the CEA group.[14]

In 2010, the short-term results of ICSS were published.[12] Interim analysis after 120 days showed a higher 30-day incidence of any stroke, myocardial infarction (MI), or death in the CAS group compared with the CEA group (Table 2). Nondisabling stroke as well as fatal stroke occurred more often in the CAS group (4.6% vs 1.6% and 1.1% vs .2%, respectively). Because the number of nondisabling strokes could be underestimated in the CEA group because of the use of general anesthesia, a substudy of the ICSS was performed to investigate the rate of ischemic brain injury detectable on MRI 1 day after treatment. About 3 times more patients in the stenting group had new ischemic lesions on post-treatment scans compared with patients in the endarterectomy group. Interestingly, cerebral protection devices (CPDs) did not seem to

Table 1 Characteristics of 4 prospective randomized trials focusing on early and late outcome of carotid endarterectomy or carotid artery stenting in patients with symptomatic carotid stenosis

	Patients		
Study	*n*	Percentage of patients with symptomatic stenosis	Primary outcome
EVA-3S[5]	527	100	Composite of any stroke or death occurring within 30 days after treatment
SPACE[7]	1,200	100	Ipsilateral stroke or death of any cause between randomization and 30 days after treatment
ICSS[12]	1,713	100	Fatal or disabling stroke in any territory within 3 years after procedure
CREST[10]	2,502	52	Composite of any stroke, myocardial infarction, or death during the periprocedural period or ipsilateral stroke within 4 years after randomization

CREST = carotid revascularization endarterectomy versus stenting trial; EVA-3S = stenting in patients with symptomatic severe carotid stenosis; ICSS = international carotid stenting study; SPACE = stent protected angioplasty versus carotid endarterectomy.