

REVIEW TOPIC OF THE WEEK

Carotid Artery Stenting

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JACC JOURNAL CME

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CME Objective for This Article: After reading this article the reader should understand: for patients requiring carotid revascularization to prevent

stroke, there is clinical equipoise for carotid endarterectomy and carotid stenting with regard to major adverse events (30-day stroke, death, and myocardial infarction) and 4-year ipsilateral stroke in average surgical risk patients; the risk of stroke in patients with significant carotid artery stenosis is much greater in symptomatic patients compared to asymptomatic patients, and is increased in patients with ulcerated plaque and homogenous lipid filled plaques; criteria have been established to identify patients at increased procedural risk for carotid surgery and for carotid stenting; the majority of asymptomatic patients (~80%) will not have any warning signs, such as a transient ischemic attack, prior to a stroke; and that there was no difference in the incidence of stroke over 4 years of follow-up in average surgical risk patients treated with surgery or stenting in the CREST trial.

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Carotid Artery Stenting

ABSTRACT

Carotid artery stenting (CAS) has achieved clinical equipoise with carotid endarterectomy (CEA), as evidenced by 2 large U.S. randomized clinical trials, multiple pivotal registry trials, and 2 multispecialty guideline documents endorsed by 14 professional societies. The largest randomized trial conducted in patients at average surgical risk of CEA, CREST (Carotid Revascularization Endarterectomy Versus Stenting Trial) found no difference between CAS and CEA for the combined endpoint of stroke, death, and myocardial infarction (MI) after 4 years of follow-up. The largest randomized trial comparing CAS and CEA in patients at increased surgical risk, SAPHIRE (Stenting and Angioplasty with Protection in Patients at High Risk for Endarterectomy), looked at 1-year stroke, death, and MI incidence and found no difference in symptomatic patients, but a significantly better outcome in asymptomatic patients for CAS (9.9% vs. 21.5%; $p = 0.02$). Given that >70% of carotid revascularization procedures are performed in asymptomatic patients for primary prevention of stroke, it is incumbent upon clinicians to demonstrate that revascularization has an incremental benefit over highly effective modern medical therapy alone. (J Am Coll Cardiol 2014;64:722-31) © 2014 by the American College of Cardiology Foundation.

Balloon angioplasty of extracranial carotid artery stenoses to prevent stroke was first reported >30 years ago (1). Thereafter, reports of carotid artery stenting (CAS), with or without embolic protection devices (EPDs), began to appear (2,3). CAS was developed to address the need for carotid revascularization in patients in whom open surgery was either difficult to perform (Fig. 1) or who were at high risk of complications (Table 1).

CAS may be one of the most studied clinical procedures in medicine, but one of the primary confounders in assessing CAS outcomes has been the dynamic, evolving nature of the CAS procedure compared with the mature, stable carotid endarterectomy (CEA) procedure. CAS procedures today produce more favorable outcomes than those performed 15 years ago (Central Illustration), and the dramatic improvement can be attributed to improved equipment as well as the increased experience of operators and endovascular teams. However, clinical growth and expansion of CAS in the United States face a major barrier in the conservative reimbursement strategy by Centers for Medicare & Medicaid Services and commercial third-party payers that severely limit patients' eligibility for coverage.

NATURAL HISTORY

More than three fourths of a million strokes occur each year, making it the third leading cause of death in the United States. Ischemic strokes, which are the most common, are often caused by atherosclerotic emboli from the carotid artery or aortic arch or are related to thromboembolism from the heart chambers.

Preventing these cerebrovascular events is a challenge given the large population of patients affected. The incidence of asymptomatic extracranial carotid stenosis ($\geq 50\%$) in persons older than 65 years of age is estimated to be between 5% and 10%, but less than 1% have a critical stenosis ($>80\%$) (4). Moreover, whereas 10% to 20% of all strokes arise from atherosclerotic carotid artery stenosis, most symptoms are due to carotid artery plaque rupture and only a minority to carotid artery occlusion. Risk assessment can be affected by variables such as symptom status, stenosis severity, existence of plaque ulceration, and the nature of the plaque (lipid rich, sclerotic, homogeneous, or heterogeneous in composition) (5-9). As stenosis severity increases, so too does the risk of ipsilateral stroke in symptomatic patients on medical therapy.

Further complicating the situation: the stenosis itself often provides few clues to assist in risk assessment. In the NASCET (North American Symptomatic Carotid Endarterectomy Trial), the 2-year stroke rate was 22% among those with moderate (50% to 69%) stenosis and 26% with 70% to 99% carotid stenosis (10). The asymptomatic patients at highest risk of stroke are those with severe stenoses or those with progressive carotid narrowing (4,6). Paradoxically, the very tightest symptomatic lesions, near occlusions of the carotid artery, do not appear to benefit from CEA (11,12). On the other hand, men tend to benefit more from CEA than women, particularly men with moderately severe (50% to 69%) stenosis and those with asymptomatic carotid lesions.

Using symptoms to guide clinical decision making will miss many high-risk patients. The annual risk of stroke is between <1.0% and 4.3% for asymptomatic

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