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Carotid Artery Stenting and Cardiac Surgery in Symptomatic Patients

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Objectives The purpose of this study was to evaluate the feasibility and safety of the combined outcome of carotid artery stenting (CAS) and coronary artery bypass graft (CABG) surgery in neurologically symptomatic patients.

Background The risk of perioperative stroke in patients undergoing CABG who report a prior history of transient ischemic attack or stroke has been associated with a 4-fold increased risk as compared to the risk for neurologically asymptomatic patients. It seems appropriate to offer prophylactic carotid endarterectomy to neurologically symptomatic patients who have significant carotid artery disease and are scheduled for CABG. The CAS-CABG outcome for symptomatic patients remains underreported, notwithstanding randomized data supporting CAS for high-risk patients.

Methods In a prospective, single-center study, the periprocedural and long-term outcomes of 57 consecutive patients who underwent CAS before cardiac surgery were analyzed.

Results The procedural success rate of CAS was 98%. The combined death, stroke, and myocardial infarction rate was 12.3%. The death and major stroke rate from time of CAS to 30 days after cardiac surgery was 3.5%. The myocardial infarction rate from time of CAS to 30 days after cardiac surgery was 1.5%.

Conclusions This is the first single-center study reporting the combined outcome of CAS-CABG in symptomatic patients. The periprocedural complication rate and long-term results of the CAS-CABG strategy in this high-risk population support the reliability of this approach. In such a high-risk population, this strategy might offer a valuable alternative to the combined surgical approach; however, a large randomized trial is clearly warranted. (J Am Coll Cardiol Intv 2011;4:1190–6) © 2011 by the American College of Cardiology Foundation

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Optimal treatment of patients with concurrent carotid and coronary artery disease remains debatable despite more than 100 publications during the last 30 years (1–3). Stroke is still a major noncardiac complication of coronary artery bypass graft (CABG) surgery, with an absolute incidence of 2%. Carotid artery disease has been associated with an increased risk of perioperative stroke after CABG, rising from 3% in predominantly asymptomatic patients with unilateral 50% to 99% stenosis, to 5% in those with

See page 1197

bilateral 50% to 99% stenosis, and 7% to 11% in patients with carotid occlusion (1,4,5). Moreover, the risk of perioperative stroke in CABG patients who report a prior history of transient ischemic attack (TIA) or stroke has been associated with a 4-fold increased risk as compared to the risk for neurologically asymptomatic patients (8.5% [95% confidence interval (CI): 4.9 to 12.1] versus 2.2% [95% CI: 1.4 to 3.1]) (1). Therefore, it seems appropriate to offer prophylactic carotid endarterectomy (CEA) to neurologically symptomatic patients undergoing CABG who have significant carotid artery disease (2,6–8).

The findings from the SAPPHIRE (Stenting and Angioplasty With Protection in Patients at High Risk for Endarterectomy) trial, including patients with significant cardiac disease, showed that among high-risk patients with severe carotid artery stenosis and coexisting conditions, carotid artery stenting (CAS) using an emboli-protection device is not inferior to CEA (9,10). The CAS-CABG outcome for symptomatic patients remains underreported, notwithstanding these randomized data supporting CAS for high-risk patients. In the available data describing the CAS or CEA-CABG strategy, periprocedural event rates of the symptomatic and the asymptomatic patients are scarcely reported separately. We report the results of CAS and subsequent cardiac surgery in 57 patients with symptomatic carotid artery disease.

Methods

Patient population. In a prospective, nonrandomized study, we entered 57 consecutive symptomatic patients scheduled for CAS and cardiac surgery between December 1998 and January 2008.

Patients were considered symptomatic if an ipsilateral carotid territory stroke or TIA had occurred within 4 months before the procedure. A carotid artery stenosis was considered significant when a diameter reduction of at least 70% on duplex and an angiographic stenosis of more than 50% (using the quantitative coronary analysis technique) of the luminal diameter was measured in the common carotid artery, internal carotid artery, or at the bifurcation according to the NASCET (North American Symptomatic Carotid Endarterectomy Trial) criteria (11,12).

The indications for cardiac surgery were symptomatic (documented myocardial ischemia) severe coronary artery disease (including bypass failure) not eligible for percutaneous revascularization, symptomatic valve disease, and disease (aneurysm or dissection) of the ascending aorta or arch that demanded reconstructive surgery. Exclusion criteria included: severe renal impairment (serum creatinine ≥300 μmol/l), peripheral vascular disease precluding femoral artery access, major neurological deficit or any other illness impeding informed consent, severe diffuse atherosclerosis of the common carotid artery, chronic total occlusions, long pre-occlusive lesions ("string sign" lesions). All patients gave written informed consent. This registry was approved by the ethical committee of our hospital.

Endpoint definition. The primary endpoint of the present study was the combined incidence of death, all strokes, and myocardial infarction (MI) from time of CAS to 30 days after cardiac surgery. Secondary endpoints were MI rate and death and major stroke rate from time of CAS to 30 days after cardiac surgery. In the long-term outcome, cumulative event rates at 5 years are reported.

Strokes were considered disabling (major) if patients had a modified Rankin score of more than 3 at 30 days after onset of symptoms. A minor stroke was defined as a Rankin score of 3 or less that resolved completely within 30 days (13). The diagnosis of Q-wave MI, evaluated by an independent cardiologist, was based on the presence of acute chest pain, new Q waves on the electrocardiogram, and an elevated creatine kinase to at least 2× the upper limit of the normal range with an elevated level of MB isoenzyme. In the absence of pathological Q waves, the diagnosis of non–Q-wave MI was based on the increase of creatine kinase level to more than twice the upper limit of the normal range with an elevated level of MB isoenzyme. In our institution, cardiac enzymes are drawn routinely every 8 h during the first 24 h after each procedure. A 12-lead electrocardiogram was performed in all patients following CAS and cardiac surgery. The electrocardiogram was performed daily during the first 48 h following cardiac surgery and in case of unexplained chest pain during the remaining period of hospitalization. Cardio-cerebrovascular mortality was reported separately and was defined as death related to a cardiac or neurological event (14).

Abbreviations and Acronyms

CABG = coronary artery bypass graft
CAS = carotid artery stenting
CEA = carotid endarterectomy
CI = confidence interval
MI = myocardial infarction
TIA = transient ischemic attack

CAS procedure and subsequent cardiac surgery. Carotid stenting has been performed following the highest standard of care using a distal embolic protection device since 2002. Cardiac surgery (including coronary artery bypass,