

5 years following endarterectomy. These results were based on predicted long-term mortality. The current study uses actual mortality and found that 18% of patients die within 5 years following endarterectomy. In both studies, incidence of postoperative stroke, death, and myocardial infarction were also higher in patients defined as high risk. Overall, the results from these two separate databases gave quite similar results.

Regarding your second question about late survival, all of the data from VSGNE were linked to Social Security Death Index to determine mortality for this study.

**Dr Jacob Schneiderman** (*Ramat Gan, Israel*). In your presentation, you don't consider carotid plaque composition as a risk factor. If you were given the information that a 60% stenosing internal carotid artery plaque in an asymptomatic patient has a giant vulnerable component, namely a sizable necrotic core with a thin fibrous cap, would you consider this rupture-prone plaque as risk-full, thus necessitating carotid endarterectomy?

**Dr Wallaert**. Yes, I probably would consider that a high-risk patient and would certainly factor those details into my decision to operate or not for that individual. Unfortunately, this study uses registry data that do not include measures such as the plaque characteristics you described. Therefore, we were unable to account for such variables in our analysis.

**Dr William Jordan** (*Birmingham, Ala*). I actually have some disagreement with your conclusions specifically relative to your high-risk cohort. I think you're looking at the glass as half empty instead of half full. Specifically, while you've identified this high-risk group after the operation, could their survival be improved if we directed more efforts on treating their medical disease? Stated differently, I don't believe the operation itself is the incident that

causes the decreased survival; potentially, they might still benefit from the carotid repair if we can improve their medical therapy. Can you comment?

**Dr Wallaert**. I agree. I don't believe that operation itself is responsible for reduced long-term survival in these high-risk patients. I do believe, however, that it is our responsibility as surgeons to take into consideration patient characteristics that may make an individual less likely to benefit from an operation because he or she has medical comorbidities that will reduce his or her lifespan and thus their opportunity to benefit from stroke prevention provided by an endarterectomy.

We recognize that our definition of poor long-term survival or "inappropriate" is somewhat arbitrary, and many would argue that a 50% 5-year survival is perfectly reasonable. I think that definition of appropriateness is going to vary based on the individual patient and his or her surgeon. Ultimately, it's going to come down to you, your patient, and a discussion about that individual's risk of postoperative mortality or stroke, as well as their long-term chance of surviving to benefit from a durable repair.

**Dr Jordan**. Can your group then improve on the medical therapy afterwards? Potentially, if we did a better job of taking care of heart disease or lung disease, then they might have better long-term survival.

**Dr Wallaert**. That's certainly a consideration and I agree that optimizing medical management of patients' comorbidities, preoperatively and postoperatively, is critical. Unfortunately, we don't have data to suggest whether we are doing a good job of this or not, so I can't comment on the effect improved medical management on our result. I suspect it would have little impact.

## INVITED COMMENTARY

**Caron B. Rockman, MD, RVT, New York, NY**

There has been recent renewed scrutiny into the appropriateness of performing prophylactic interventions on patients with severe asymptomatic carotid artery atherosclerotic plaque to prevent future strokes. Prophylactic carotid endarterectomy (CEA) has been demonstrated in several randomized, prospective trials to provide superior stroke prevention compared with contemporaneous medical therapies in patients with severe carotid artery stenosis. However, ongoing current discussions have focused on the premise that the incidence of ischemic stroke may be decreasing and the hypothesis that improved pharmacologic therapies, such as statin medications, may be responsible for the decreasing stroke rate. If one were a proponent of these hypotheses, it would be natural to conclude that the risk-benefit balance with regard to surgical treatment of asymptomatic severe carotid artery atherosclerosis might have indeed tipped toward the medical therapy side of the seesaw.

Nevertheless, stroke remains the fourth leading cause of death in the United States and the leading cause of long-term disability and institutionalization. Stroke represents a major worldwide patient and economic burden. The treatment of stroke, once it has occurred, is generally unsuccessful. Clearly, all physicians would be eager for improved tools to designate those patients at highest risk for stroke as well as for enriched stroke-prevention strategies and methods. With regard to prophylactic carotid endarterectomy (CEA) in asymptomatic patients, knowledge about the patient's long-term survival is critical to properly evaluate whether a patient will derive potential benefit from prophylactic surgical intervention.

In this regard, the current study from the Vascular Study Group of New England provides important data for the clinician who evaluates patients with carotid artery disease. A large cohort of asymptomatic patients who underwent CEA was evaluated, and the perioperative stroke and mortality rates were extremely low. More than 80% of the patients who underwent CEA achieved 5-year survival after their surgery. On the basis of randomized, prospective data, this should theoretically be long enough to attain

stroke-prevention benefit in appropriately selected asymptomatic patients. A patient should probably not be considered for prophylactic CEA if his or her individual life expectancy is felt to be <3 years.

However, 5% of the patient cohort was deemed to be at "high risk" for early death because of comorbid conditions; only 51% of patients in this category would be expected to achieve 5-year survival. In addition, 68% of patients who underwent CEA were deemed "moderate risk," and only 80% of the patients in this category would be expected to achieve 5-year survival. Clearly, there is room for improvement in patient selection in this regard.

The major risk factors for early mortality included advanced age  $\geq 80$  years (hazard ratio, 3.94) and dialysis-dependent renal failure (hazard ratio, 3.41); these are not unexpected findings. Unfortunately, the current report is somewhat less successful in discriminating the relative contribution of more "minor" risk factors for death, including congestive heart failure, chronic obstructive pulmonary disease, insulin-dependent diabetes, and the degree of contralateral carotid artery stenosis. Most patients who are evaluated for asymptomatic carotid artery disease will be aged <80 years and not in dialysis-dependent failure; most will also likely have at least one "minor" risk for early mortality, placing them in the "moderate-risk" category according to the risk stratification system derived by the authors.

Nevertheless, the current data do provide a valid framework for clinicians to contemplate when choosing appropriate asymptomatic patients for CEA. In addition to considering the degree of stenosis, other anatomic and morphologic characteristics, and the individual patient's risk of perioperative complications after surgery, it is critical for the surgeon to weigh the patient's long-term survival in order to achieve an appropriate stroke-prevention benefit. Certainly, patients deemed at "high risk" for early mortality should probably not be considered for prophylactic CEA, and patients at "moderate risk" need to be carefully considered.