



Carotid stenting versus carotid endarterectomy: how relevant are quality of life and individual adverse events?

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KEYWORDS: carotid endarterectomy ■ carotid stenosis ■ carotid stenting ■ quality of life

For more than two decades, carotid endarterectomy (CEA) and the medical management of risk factors for stroke have been the standard of care for managing patients with carotid stenosis [1]. However, given the higher rates of adverse outcomes noted in patients with more complex carotid anatomy or significant medical comorbidities, such patients may benefit from less invasive approaches to carotid revascularization [2]. Although carotid stenting has been performed for more than 15 years with progressive improvements in outcomes, the acceptance of carotid artery stenting (CAS) as an alternative to CEA has been controversial, as several clinical trials of CAS have demonstrated acceptable rates of safety and efficacy [3–8], while other studies have noted worse outcomes when compared with CEA [9–11]. Recently, the NIH-sponsored CREST trial – the largest randomized clinical trial evaluating carotid revascularization – reported that for patients with symptomatic or asymptomatic carotid stenosis and standard surgical risk, there was no difference between CAS and CEA for reducing the primary composite end point of periprocedural stroke, myocardial infarction (MI), death or ipsilateral stroke during the subsequent 4 years [12]. Small absolute differences were noted in some of the component end points, however, which have continued to fuel the ongoing debate as to whether CAS or CEA is the optimal strategy for carotid revascularization [13,14].

With this background in mind, we recently studied other patient-centered outcomes beyond the composite clinical outcome reported in CREST. Specifically, we evaluated patient-reported health-related quality of life (HRQOL) at multiple time points during the year after randomization to CAS or CEA [15]. In addition

to the prespecified direct comparison of the two treatment strategies, we also performed an exploratory analysis of the impact of specific periprocedural complications on long-term HRQOL in the study population. The primary result of this study was that patients undergoing CAS had better HRQOL during the first month after revascularization, particularly for measures of overall physical function and pain, with some specific differences related to the revascularization procedure itself. Specifically, limitations related to ambulation and leg discomfort were more common after CAS, whereas limitations related to eating and neck discomfort were more common after CEA. These differences were modest in magnitude, however, and were no longer present by 1-year follow-up. Similar findings were noted in a prior study of higher-risk patients undergoing carotid revascularization [16].

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When studying the impact of periprocedural events on HRQOL, we found that 1-year health status was consistently impaired among patients who experienced a periprocedural stroke, whereas there was minimal impairment in 1-year HRQOL among patients experiencing other complications including periprocedural MI or cranial nerve palsy. These findings are not particularly surprising, as multiple studies of patients experiencing stroke have demonstrated significant permanent disability [17,18], whereas MI generally is not associated with



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long-term decrements in HRQOL unless the MI is large and associated with other complications [19,20]. Cranial nerve palsy was expected to adversely impact HRQOL, but injuries to cranial nerves may be highly variable (ranging from complete facial palsy to mild paresthesias of the tongue). Moreover, the HRQOL metrics used in CREST (mainly the Medical Outcomes Study Short Form-36 [SF-36] health status instrument) may not adequately measure these symptoms. Given these findings, it may seem counterintuitive that there were no differences in HRQOL at 1 year between the CAS and CEA groups, despite the fact that CAS had a higher incidence of stroke. On further review, these results are readily understood, since more than 95% of patients in both treatment groups did not experience a stroke, the absolute difference in stroke rates was small (~1.5%) and this difference was driven largely by minor (i.e., less debilitating) strokes.

So where do these findings leave us as we counsel our patients about the ‘best option’ for revascularizing a carotid artery? Certainly, many physicians will continue to use the results of CREST and related studies of CAS and CEA to support their personal biases regarding the importance of clinical end points measured in these trials. For example, the neutral results of CREST with respect to the primary composite end point should be reassuring to physicians who believe that the less invasive nature of CAS is an important advantage for their patients. On the other hand, advocates of CEA may focus on its lower stroke rate compared with CAS, in addition to the relatively modest and short-term nature of the observed differences in HRQOL between the two procedures. Other physicians may rely more heavily on clinical subgroup analyses to help guide therapeutic choices (e.g., younger or asymptomatic patients at very low risk of periprocedural stroke may undergo elective CAS due to more rapid recovery and minimal difference in stroke risk between CAS and CEA) [21]. Still others may focus on the learning curve for performing CAS, as adverse outcomes related to CAS are significantly less likely when performed by operators with extensive CAS experience [22].

In light of the overall CREST results, we believe that the most important consideration in the selection of a carotid revascularization strategy should be the patient’s own values, goals and preferences. Given recent data demonstrating better HRQOL among CAS patients early after revascularization [15,16], some patients may prefer CAS in order to

avoid the discomfort associated with the early postoperative recovery period after CEA. Other patients may be more concerned about long-term quality of life or avoiding stroke (which is, after all, the primary objective of carotid revascularization). Although CREST demonstrated that 1-year HRQOL was similar with CAS or CEA, the persistent reduction in physical function associated with even a small excess risk of stroke may outweigh other potential benefits for such individuals. Still others with prior MI or tenuous cardiac function may wish to minimize the risk of recurrent MI, understanding that the risk of periprocedural MI is lower with CAS than with CEA (1.1 vs 2.3% in CREST; $p = 0.03$). These factors may be particularly relevant when choosing between lower-risk procedures such as CAS and CEA, where overall rates of adverse events are low. Under such conditions, health status data (for patients and their providers) and cost comparisons (for patients, payors and health systems) are likely to play increasingly important roles in both individual decision-making, as well as guideline development. Finally, in light of data demonstrating the importance of physician experience in the outcomes of both CAS and CEA [22], one cannot discount the importance of considering the local environment in which the procedure will be performed.

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In summary, based on the results of CREST and related studies, we believe that both CAS and CEA have important roles in properly selected patients with adequate counseling provided by treating physicians regarding the potential risks and benefits of each mode of carotid revascularization. Because clinical events and HRQOL are relatively similar at a population level between patients undergoing CAS versus CEA, we recommend patient-centered decision-making based on an unbiased assessment of potential outcomes and each individual patient’s personal preferences regarding adverse events and quality of life during recovery. In this way, we as physicians may truly act as patient advocates who focus on minimizing risk of adverse clinical outcomes while also maximizing HRQOL during recovery after carotid revascularization.

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