Carotid endarterectomy or stenting?

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ABSTRACT

The relative role of surgical or endovascular treatment in carotid stenosis remains controversial. Results of recent studies add even more confusion to the debate. Major clinical trials so far have shown a wide range of complication rates for carotid endarterectomy and carotid stenting. Only surgeons or interventionists who can maintain a complication rate of 3% or below should consider treating patients with asymptomatic disease.

The relative role of surgical or endovascular treatment in carotid stenosis remains controversial. Results of recent studies add even more confusion to the debate. This article represents a simplified view from a surgeon who performs both surgery and endovascular treatment for carotid disease.

The role of carotid endarterectomy in symptomatic carotid stenosis has been well established by randomised control trials. For patients with symptomatic atherosclerotic carotid stenosis greater than 70%, as defined using the North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria, the value of carotid endarterectomy (CEA) has been clearly established from the results of the NASCET and the European Carotid Surgery Trial (ECST).[1 2] In NASCET, the estimate of any ipsilateral stroke at 2 years for this group of patients with high-grade stenosis was 26% in the medical arm and 9% in the surgical arm. For symptomatic carotid stenosis in the moderate category (50% to 69% stenosis), NASCET and ECST demonstrated significant benefits for CEA compared with medical therapy. In NASCET, the 5-year risk of ipsilateral stroke over the 5-year period was 22.2% in the medically treated group and 15.7% in patients treated surgically.[3] The surgical complication rate was kept below 6% in these trials. For patients with carotid stenosis below 50%, these trials showed that there was no significant benefit with surgery.

For asymptomatic carotid stenosis greater than 60%, the margin of benefit for CEA compared with best medical therapy was statistically significant in two large randomised trials, although it was highly dependent on the low surgical complication rate of <3%. The Asymptomatic Carotid Atherosclerosis Study (ACAS) and Asymptomatic Carotid Surgery Trial (ACST) are the largest randomised control trials to evaluate the efficacy of endarterectomy for patients who have asymptomatic disease.[4 5] In ACAS, the aggregate risk over 5 years for ipsilateral stroke and any perioperative stroke or death was 11.0% in the medical arm and 5.1% in the surgical arm. In ACST, the surgical group had a net 5-year risk of combined perioperative events and non-operative strokes of 6.4%, and the medical group had a net 5-year risk of 11.8% for the same outcome.

At least in the setting of NASCET, ECST, ACAS and ACST where the perioperative complication rate was kept below 6% for symptomatic disease and 3% for asymptomatic disease, surgery was better than best medical therapy for symptomatic stenosis >50% and asymptomatic stenosis >60%. But is it reasonable to assume that all surgeons can produce these results?

The data for carotid stenting (CAS) were interesting. The first major randomised control trial for direct comparison of CEA versus CAS was the Carotid and Vertebral Artery Transluminal Angioplasty Study (CAVATAS).[6] In this study, three-quarters of the cases in endovascular group received balloon angioplasty alone without stenting. The rates of major outcome (stroke or death) events within 30 days of first treatment did not differ significantly between endovascular treatment (10%) and surgery (9.9%). The authors concluded that endovascular treatment had similar major risks and effectiveness at prevention of stroke during 3 years compared with carotid surgery but, with wide confidence intervals and endovascular treatment, had the advantage of avoiding minor complications. The study was criticised for having too high a complication rate for surgical arm.

The Stenting and Angioplasty with Protection in Patients at High Risk for Endarterectomy (SAPPHIRE) trial attempted to define the role of CAS and CEA in a group of high-risk patients.[7] Patients were eligible for randomisation to either surgery or CAS with distal protection if they had at least one coexisting condition believed potentially to increase the risk posed by endarterectomy and if a study surgeon and interventionalist agreed patients could undergo either procedure safely. Inclusion criteria were the presence of one or more criteria for high surgical risk and a stenosis of more than 50% of the luminal diameter in patients with symptoms or a stenosis of more than 80% in those without symptoms. The criteria for high surgical risk were clinically significant cardiac disease (congestive heart failure, abnormal stress test or need for open-heart surgery), severe pulmonary disease, contralateral carotid occlusion, contralateral laryngeal-nerve palsy, recurrent stenosis after carotid endarterectomy, previous radical neck surgery or radiation therapy to the neck and an age of more than 80 years. Stenting was performed with the use of a self-expanding, nitinol stent (Smart or Precise, Cordis) and an emboli-protection device (Angioguard or Angioguard XP Embolic Capture Guidewire, Cordis). The 30-day major event (stroke, death, myocardia infarct) rate was 5.8% for the stenting group compared with 12.6%

in the surgical group. The investigators concluded that stenting was not inferior to CEA. Durability of carotid stenting was also shown in this study. The 3-year follow-up results showed that the prespecified end point (stroke, death, myocardia infarct) occurred in 41 patients in the stenting group (cumulative incidence, 24.6%; Kaplan–Meier estimate, 26.2%) and 45 patients in the endarterectomy group (cumulative incidence, 26.9%; Kaplan–Meier estimate, 30.3%).[8] The investigators concluded that no significant difference could be shown in long-term outcomes between patients who underwent carotid artery stenting with an emboli-protection device and those who underwent endarterectomy.

The Stent-Supported Percutaneous Angioplasty of the Carotid Artery versus Endarterectomy (SPACE) trial compared CAS versus CEA for patients with symptomatic carotid stenosis >70%.[9] For SPACE, surgeons must submit results for 25 consecutive CEA procedures. Interventionist must have performed 25 stenting or angioplasty procedures. The use or omission of distal protection devices was left to the discretion of the interventionist. The rate of death or ipsilateral ischaemic stroke from randomisation to 30 days after the procedure was 6.84% with carotid-artery stenting and 6.34% with carotid endarterectomy. The trial was terminated prematurely after enrolling 1200 patients, and the investigators concluded that SPACE failed to prove the non-inferiority of CAS compared with CEA.

In the Endarterectomy Versus Angioplasty in Patients with Symptomatic Severe Carotid Stenosis (EVA-3S) trial, the 30-day incidence of any stroke or death was 3.9% after endarterectomy and 9.6% after stenting.[10] The 30-day incidence of stroke or deaths was 25% for stenting without distal protection compared with 7.9% with protection device. In fact, the study was temporarily stopped at one stage due to the excessive complication rate of stenting without distal protection. It is worth mentioning that in the EVA-3S trial, stents could be placed by physicians who had performed as few as five previous carotid-stent procedures or, if working under the direction of a tutor, no previous procedures. There were five different stents and seven different distal protection devices used in various stages of the study. The cumulative probability of periprocedural stroke or death and non-procedural ipsilateral stroke after 4 years of follow-up was higher with stenting than with endarterectomy (11.1% vs 6.2%). A hazard function analysis showed that the 4-year differences in the cumulative probabilities of outcomes between stenting and endarterectomy were largely accounted for by the higher periprocedural (within 30 days of the procedure) risk of stenting compared with endarterectomy. After the periprocedural period, the risk of ipsilateral stroke was low and similar in both treatment groups.

Without going into complex statistical analysis, it is quite obvious that in objective clinical trial settings, the complication rates in CEA or CAS ranged roughly from around 3% to 12%. With a large enough sample size, the treatment arm with a lower complication rate will emerge as the better treatment option. There will always be criticisms for any randomised trial designs, and the proponents of either treatment options will not be satisfied when the results go against their expectation. No one can deny the fact that both therapeutic options require proper training and experience to achieve low complication rates. There are as much nuances in CAS as in CEA to avoid perioperative morbidity. While the technique of CEA is well established over the years, and the technology of CAS continues to evolve, the effect of "learning curve" will remain as a bias for the trials comparing CAS versus CEA.

In conclusion, the major clinical trials so far have shown a wide range of complication rates for CEA and CAS. Even when the CREST trial is completed, the issue of whether CEA or CAS is superior may not be resolved. How should patients be treated then? In some clear cut situation such as contralateral vocal cord palsy or high distal stenosis CAS obviously will be the treatment of choice. Likewise, for patients with contrast allergy or difficult vascular access, CEA should be chosen. For the majority of the other cases, as the risk versus benefit ratio of CAS and CEA in each individual patient will be heavily dependent on the complication rate of the operator, a reasonable approach for the physician (interventionist or surgeon) is to balance their outcome with the potential risk/benefit ratio of the indication. For example, a surgeon with complication rate in the higher end should select patients with high-grade stenosis and hemispheric symptoms. Only surgeons or interventionists who can maintain a complication rate of 3% or below should consider treating patients with asymptomatic disease.

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