



Carotid endarterectomy vs. carotid artery stenting: the quest for the holy grail continues

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In this issue of *Annals of Palliative Medicine*, Cho *et al.* compared outcomes after carotid endarterectomy (CEA) and carotid artery stenting (CAS) performed electively in their institute between January 2012 and December 2020 (1). Of the 235 patients who underwent an elective procedure for carotid stenosis, 107 underwent CEA and 128 received CAS (1). Overall, 4 patients undergoing CAS suffered a 30-day cerebral infarction *vs.* 1 patient undergoing CEA, but the difference was not statistically significant (3.1% *vs.* 0.9%, respectively; $P=0.247$). Three of the 4 CAS patients, as well as the single CEA patient suffering a 30-day cerebral infarction were symptomatic. Carotid restenosis developed in more patients after CAS than after CEA; however, once again, this difference was not statistically significant (1.6% *vs.* 0.0%, respectively; $P=0.194$). Finally, no differences were observed between the two groups in terms of percentage of symptomatic patients, 30-day postoperative myocardial infarction or death rates (1). The authors concluded that CEA and CAS had the same effect on preventing cerebral infarction with no difference in postoperative complications (1).

The introduction of the less invasive percutaneous carotid angioplasty with/without stenting in the mid- to late-1990s revolutionized the treatment of carotid artery stenosis (2-5). The early results of CAS appeared very promising and suggested that the future of CAS was bright (2-5). Nevertheless, the initial promising results for CAS were not replicated outside centres of CAS Excellence. An early randomized controlled trial (RCT) comparing CAS

vs. CEA, the Leicester trial, had to be abandoned after recruiting just 17 patients. While all 10 CEA procedures were carried out without complications, five of the 7 patients undergoing CAS suffered a stroke ($P=0.0034$), three of which were disabling at 30 days (6). The Ethics and Data Monitoring Committee subsequently decided to stop the trial for obvious ethical reasons (6).

Although subsequent studies demonstrated better results for CAS than those reported in the Leicester trial, CAS has been consistently associated with considerably higher stroke and death rates compared with CEA both in symptomatic, as well as in asymptomatic patients. A systematic review of 21 administrative dataset registries reporting outcomes involving more than 1,500,000 CEA and CAS procedures showed that stroke and death rates after CAS were significantly higher when compared with CEA in 11 of 21 registries (52%) involving 'average risk for CEA' asymptomatic patients, as well as in 11 of 18 registries (61%) involving 'average risk for CEA' symptomatic patients (7). Importantly stroke and death rates after CAS exceeded the 3% risk threshold recommended by the American Heart Association for asymptomatic patients in 9 of 21 registries (43%) and exceeded the 6% recommended risk threshold for symptomatic patients in 13 of 18 registries (72%). Additionally, in more than a quarter of these registries (28%; 5 of 18), the stroke and death rates after CAS for symptomatic patients exceeded 10% (7). These results suggest that stroke and death rates after CAS in 'real-world' are not only significantly higher than those of CEA, but also

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that these stroke rates often exceed the accepted American Heart Association thresholds (7). Such prohibitively high stroke and death rates after CAS raised several concerns about the appropriateness of offering CAS routinely to all patients (8-10). These results also suggested that the CAS outcomes from centres of CAS Excellence (2-5) may not be reproduced in other institutes (10). Thus, centralization of CAS procedures may be required to achieve optimal outcomes.

In the last few years, a novel CAS procedure has been introduced and is quickly gaining ground in the management of patients with carotid artery stenosis (11-13). This novel procedure involves transcatheter/transcervical (instead of transfemoral) access and employs cerebral blood flow reversal thereby minimizing the embolic risk to the brain during CAS (11-13). Several reports have demonstrated that transcatheter artery revascularization (TCAR) is superior in term of outcomes compared with transfemoral CAS and is similar in term of stroke and death rates compared with the gold-standard CEA (14-16). Although the initial positive results for TCAR need to be confirmed in larger studies, this novel method appears to have a more promising future than transfemoral CAS.

With increasing CAS expertise and improved CAS equipment, it is expected that CAS will have an increasing role in the management of patients with carotid artery stenosis. When deciding about the optimal therapeutic modality for patients with carotid artery stenosis, it is often crucial to individualize the approach based not only on local expertise, but also taking into consideration individual patient needs, preferences and choices, patient compliance with best medical treatment, patient sex, culture, race/ethnicity, age and comorbidities (17). A “One-Size-Fits-All” approach is neither desirable nor acceptable. Each individual has his/her own opinion and views about his/her disease and may prefer a more (or less) aggressive treatment option. The study by Cho *et al.* (1) demonstrates that in many institutes, CAS is similar in terms of outcomes with CEA and both can be performed with low stroke, death and complication rates. This is particularly good news for patients, since it allows them to have an increasing role in the selection of the treatment modality they prefer.

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