Vascular Quality Initiative: Transcarotid Stenting Project Update

BY MARC SCHERMERHORN, MD, AND PATRIC LIANG, MD

Since the introduction of transcarotid artery revascularization (TCAR), we have seen nationwide adoption of this technique. Starting in October 2018, over 50% of all carotid stenting procedures performed in the Vascular Quality Initiative TCAR Surveillance Project (VQI-TSP) are now via TCAR instead of the transfemoral carotid artery stenting (TF-CAS) approach (Figure 1). With over 5,250 TCAR procedures registered in the VQI-TSP, we recently evaluated the outcomes following TCAR compared to TF-CAS and carotid endarterectomy (CEA).

Propensity-matched analysis of patients undergoing TCAR and patients undergoing TF-CAS resulted in 3,286 matched pairs of patients, with outcomes favoring TCAR (Table 1). We found that TCAR was associated with lower rates of in-hospital stroke or death (1.6% vs 3.1%; $P < .001$) as well as the individual rates of stroke (1.3% vs 2.4%; $P = .001$) and death (0.4% vs 1%; $P = .008$). There were no differences in in-hospital myocardial infarction between the two procedures (0.2% vs 0.3%; $P = .47$). TCAR procedures were also associated with less radiation (total fluoroscopy time, 6.1 vs 19 min; $P < .001$) and contrast use (37 mL vs 94 mL; $P < .001$). The benefits from TCAR extended out to 1 year on Kaplan-Meier analysis, with a higher rate of stroke-/death-free survival with TCAR compared to TF-CAS (94.9% vs 90.5%; $P < .001$).

Compared to TF-CAS, TCAR was associated with higher rates of bleeding complications that resulted in reintervention or thrombin injection (1.3% vs 0.8%; $P = .041$). However, not all patients received protamine following TCAR procedures. In a separate propensity matched analysis comparing patients undergoing TCAR with and without protamine use in the VQI-TSP, we found that protamine use was associated with significantly lower rates of bleeding complications (1% vs 3.6%; $P < .001$), without an increase in stroke or myocardial infarction. In fact, protamine use was associated with a trend toward lower rates of stroke (1.1 vs 2%; $P = .09$).

The hesitancy in using protamine following carotid revascularization stems from early studies showing an increased risk of carotid thrombosis after protamine use. However, larger studies, including one utilizing data from the Vascular Study Group of Northern New England, a subsidiary of the VQI, found no significant difference in perioperative stroke with and without protamine use in CEA (0.8% vs 1.2%; $P = .2$).[1] These unsubstantiated concerns for protamine use in CEA have undoubtedly permeated into carotid stenting, as the trial investigators for CREST strongly discouraged the use of protamine in carotid stenting. Because perioperative bleeding following carotid revascularization has a known association with increased stroke risk, and we found that protamine use

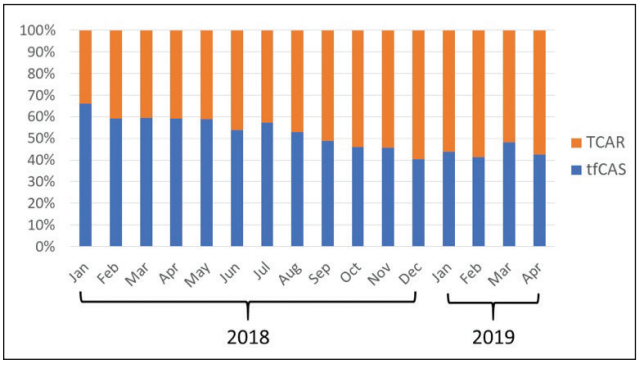

Figure 1. Proportion of carotid stents placed via the transcarotid (TCAR) and transfemoral (tfCAS) approach.

TABLE 1. VQI-TSP PROPENSITY-MATCHED IN-HOSPITAL OUTCOMES OF PATIENTS UNDERGOING TCAR AND TF-CAS FROM SEPTEMBER 2016 TO APRIL 2019

Endpoint	TCAR	TF-CAS	*P* Value
Stroke/death	1.6%	3.1%	< .001
Stroke	1.3%	2.4%	.001
Death	0.4%	1%	.008
Myocardial infarction	0.2%	0.3%	.47
Fluoroscopy time	6.1 min	19 min	< .001
Contrast volume	37 mL	94 mL	< .001

is associated with lower bleeding complication in TCAR without an increase in thrombotic events, we recommend that all patients undergoing TCAR receive protamine.

The gold standard method for carotid revascularization is CEA. Using data from the VQI, we compared outcomes between patients undergoing TCAR to CEA. On unadjusted analysis, patients undergoing TCAR had higher rates of death (0.5% vs 0.3%; *P* = .03) and similar rates of stroke (1.4 vs 1.2; *P* = .37). However, because carotid stenting—including TCAR—is reserved for high-surgical-risk patients, TCAR patients were older and had more medical comorbidities. A propensity-matched analysis was performed to account for these baseline differences for patients undergoing TCAR and CEA, and 5,160 pairs of patients were identified. Following matching, we found that TCAR was actually associated with a trend in lower odds of in-hospital stroke or death (odds ratio [OR], 0.77; 95% confidence interval [CI], 0.57–1.04; *P* = .09). However, TCAR was associated with lower odds of both myocardial infarction (OR, 0.41; 95% CI, 0.26–0.66; *P* < .001) and cranial nerve injury (OR, 0.13; 95% CI, 0.07–0.22; *P* < .001).

This updated analysis of the VQI-TSP continues to support the use of TCAR over TF-CAS given its improved safety profile with lower rates of stroke and death. Furthermore, TCAR has continued to show its equivalence to CEA. TCAR is currently restricted to high surgical risk patients. However, given the overall low stroke and death rates following TCAR (despite the majority of VQI-TSP cases [81%] have been within the surgeon's first 20 performed TCAR procedures), it is possible that TCAR will soon be expanded to patients at normal risk. If TCAR becomes approved to standard-risk patients, the VQI-TSP will again be integral in monitoring the safety of TCAR compared to CEA in this new patient subset. ■

1. Stone DH, Nolan BW, Schanzer A, et al. Protamine reduces bleeding complications associated with carotid endarterectomy without increasing the risk of stroke. J Vasc Surg. 2010;51:559-564, 564.e1.

Marc Schermerhorn, MD
George H.A. Clowes Jr. Professor of Surgery
Harvard Medical School
Chief, Vascular and Endovascular Surgery Department
Beth Israel Deaconess Medical Center
Boston, Massachusetts
Disclosures: Consultant for Silk Road Medical, Abbott Vascular, Cook Medical, Endologix, and Medtronic.

Patric Liang, MD
Vascular Surgery Resident
Beth Israel Deaconess Medical Center
Fellow
T32 Harvard-Longwood Vascular Surgery Research Training Program
Boston, Massachusetts
Disclosures: None.