TCAR Pearls and Pitfalls

BY MICHAEL C. STONER, MD, RVT, FACS, AND JEFFREY JIM, MD, MPHS, FACS

Transcarotid artery revascularization (TCAR) represents a novel, minimal-access technique indicated for revascularization of the internal carotid artery (ICA) in patients with clinically or hemodynamically significant lesions. TCAR maintains the benefit of a minimally invasive procedure while mitigating much of the procedural embolization risk of traditional transfemoral-based stenting. The results of this procedure have been exceptional in both clinical trials and real-world registry studies.[1,2] With over 12,000 cases completed to date, a robust evolving training program, and a culture of continuous improvement, the procedure continues to be optimized and improved. The following learning points were recognized to aid novice users as well as experienced practitioners to achieve the excellent results seen in TCAR.

▸ Realize the Short, but Real, Learning Curve

TCAR leverages current skills of most endovascular surgeons (eg, carotid exposure, angioplasty with 0.014-inch platforms, and stenting). TCAR procedure times have consistently been shown to be almost 40 minutes less than standard carotid endarterectomy. However, this is a still a new procedure for novel users. Meticulous procedural techniques are required to realize the efficiency and achieve the safety of TCAR.

▸ Take Time for Preoperative Case Planning

Attention to the common carotid access site, lesion characteristics, distal ICA anatomy, and intracranial atherosclerotic burden is paramount to the success of this procedure. Careful adherence to adequate anatomic requirements is necessary to ensure safe arterial sheath placement without engaging the lesion. Heavily calcified lesions should be avoided because of the known long-term adverse outcomes (eg, recurrence, thrombosis) with stent placements in these types of lesions.

▸ Medical Therapy Is the Cornerstone of Safety

Violation of the drug regimen is one of the most common causes of the rare adverse events seen in TCAR. Angioplasty and stenting disrupts the intimal-medial interface, exposing blood flow to a thrombogenic surface. All patients should be on dual antiplatelet therapy to prevent platelet aggregation. Statin therapy has also been shown to have plaque-stabilizing properties. The beneficial use of these agents has been well-described in the literature and is considered as standard of care.

▸ Meticulous Angiographic Technique

Use a low-and-slow technique to avoid high-pressure injection next to the carotid lesion. Syringes for injection should be loaded at the beginning of the case to allow the bubbles of air to leave the solution. Keep in mind that angiography requires antegrade flow, and this is a potential source of distal embolization. Avoid unnecessary imaging, especially after the lesion has been treated.

▸ Minimize Postdilation

The authors advocate for a more generous predilation strategy, approaching a nominal internal carotid artery diameter. This allows for better stent apposition and reduces this risk of prolapsing atheromatous material through the stent during postdilation. Furthermore, disruption of the plaque earlier during the flow reversal duration may be more protective for the patients.

▸ Always Use Protamine

The intra-arterial manipulation during TCAR mandates a therapeutically heparinized patient. However, as previously mentioned, the procedure time is quite short and the patient is likely to be fully anticoagulated during incision closure. Cervical hematoma is a risk that can be mitigated by both careful dissection and heparin reversal. Furthermore, the use of protamine has been shown to eliminate the risk of bleeding complications, but it was not associated with increased stroke risk or other complications.[3]

▸ Diligent Intraoperative and Postoperative Blood Pressure Management

The protective nature of TCAR is generating retrograde flow in the internal carotid artery during treatment. Flow reversal and ipsilateral cerebral blood flow are both predicated on maintaining adequate arterial pressure and relative hypertension during the procedure. Proactive use

of anti-bradyarrhythmia agents should be applied, and clear communication with the anesthesia team regarding flow reversal parameters is critical. Postoperatively, hyper- and hypotension are to be avoided to prevent hyperperfusion syndromes or stent thrombosis.

CONCLUSION

TCAR is an excellent procedure that has low periprocedural stroke rates in high-risk patients. However, it should be remembered that this is a relatively new procedure in which we continue to gain insights from expanding experience. In order to maintain excellent results, practitioners should keep themselves updated on the evolving best practices to ensure the best clinical outcomes for their patients. ■

1. Kwolek CJ, Jaff MR, Leal JI, et al. Results of the ROADSTER multicenter trial of transcarotid stenting with dynamic flow reversal. J Vasc Surg. 2015;62:1227-1234.
2. Malas MB, Dakour-Aridi H, Wang GJ, et al. Transcarotid artery revascularization versus transfemoral carotid artery stenting in the Society for Vascular Surgery Vascular Quality Initiative. J Vasc Surg. 2019;69:92-103.e2.
3. Schermerhorn M. Transcarotid artery revascularization. Presented at: the Society of Vascular Surgery Vascular Annual Meeting; June 2019.

Michael C. Stoner, MD, RVT, FACS
Chief, Division of Vascular Surgery
University of Rochester Medical Center
Rochester, New York
michael_stoner@urmc.rochester.edu
Disclosures: Case proctor and educational consultant for Silk Road Medical.

Jeffrey Jim, MD, MPHS, FACS
Associate Professor, Section of Vascular Surgery
Program Director, Vascular Surgery Fellowship/Residency
Washington University School of Medicine
St. Louis, Missouri
jimj@wustl.edu
Disclosures: Co-Director National TEST Drive Program, education consultant, and case proctor for Silk Road Medical.