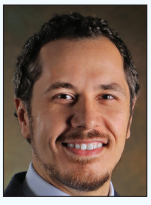
PANEL DISCUSSION

Carotid Stenting Decision-Making: From Workup to Follow-Up

Key considerations that shape carotid revascularization, including patient selection, treatment strategy, surveillance, and more.

With J. Antonio Gutierrez, MD, MHS, and Sameh Sayfo, MD, MBA, FSCAI, FACC

J. Antonio Gutierrez, MD, MHS
Associate Professor of Medicine
Duke University School of Medicine
Durham, North Carolina
antonio.gutierrez@duke.edu



Sameh Sayfo, MD, MBA, FSCAI, FACC
Program Director, Endovascular Fellowship Program
PERT Program Director
Baylor Scott & White The Heart Hospital
Plano, Texas
sameh.sayfo@bswhealth.org

With multiple modalities supported by data and available for a variety of patients, what factors most guide your decision on which patients are best suited for transfemoral carotid artery stenting (TF-CAS), transcarotid artery revascularization (TCAR), carotid endarterectomy (CEA), or medical management alone?

Dr. Gutierrez: Patient selection for carotid revascularization truly begins with assessment of symptoms and surgical risk. Patients with symptomatic atherosclerotic carotid artery stenosis of 50% to 99% benefit from revascularization. In asymptomatic patients with stable plaque, considerable comorbidities, or limited life expectancy, medical management should be given strong consideration.

The revascularization strategy for patients with carotid stenosis is best determined in a multidisciplinary conference with representatives from an interventional subspecialty, vascular surgery, and neurology. CEA should still be considered first line for standard-risk surgical patients. TCAR is often preferred for high-risk surgical patients with highly accessible anatomy. When TCAR is not feasible or in certain anatomic scenarios, TF-CAS should be considered.

Dr. Sayfo: Selecting the optimal modality requires a comprehensive evaluation of landmark clinical trial data balanced against patient-specific factors. Decisions are guided by three primary pillars: clinical factors, anatomic considerations, and symptomatic status.

Key clinical factors include age, life expectancy, and surgical comorbidities (eg, recent myocardial infarction, ischemic cardiomyopathy, advanced chronic obstructive pulmonary disease, or severe chronic kidney disease). Hostile neck anatomy due to prior radiation therapy or radical neck surgery also heavily shifts the decision away from open surgery.

Anatomic considerations include lesion location (eg, surgically inaccessible high or low lesions), presence of

contralateral occlusion, severe vascular tortuosity, or short common carotid artery (CCA), which may preclude certain endovascular approaches like TCAR.

Last is symptomatic status—differentiating between symptomatic and asymptomatic carotid disease remains paramount.

These three pillars heavily inform our modality selection. CEA remains the standard of care for younger, lower-surgical-risk patients. It is highly favored in cases of extremely calcified internal carotid arteries, as endovascular calcium modification techniques are not yet deeply studied or widely approved for carotid applications. It is also favored in patients with unstable neurologic status, regular intraluminal mobile thrombi, or a "string sign" to minimize distal embolization risks.

TCAR is highly valuable for patients with hostile necks (prior radiation or surgery) or those at high risk for TF access complications. While frequently performed under general anesthesia, it can sometimes be performed under local or regional blocks, making it an alternative for patients who are borderline candidates for general anesthesia. TF-CAS is preferred in patients with favorable aortic/arch anatomy who are high-surgical-risk candidates for CEA or where anatomic constraints (eg, a short CCA) make TCAR unfeasible. Lastly, guideline-directed medical therapy is essential for all patients, regardless of if they undergo an invasive revascularization procedure. Medical therapy alone is best reserved for asymptomatic patients who carry a prohibitively high risk for any invasive intervention.

For which patients or lesions is it most challenging to determine an ideal course?

Dr. Gutierrez: It is important to note that anatomically and physiologically suitable surgical candidates who have an accessible bifurcation, no hostile neck, and an acceptable cardiac risk should be considered for CEA.

A hostile neck refers to anatomic conditions that increase the technical difficulty and risk for a successful CEA. Widely considered criteria for this include a prior ipsilateral CEA, prior neck radiation, prior radical neck dissection, or tracheostomy. Key anatomic factors that increase the difficulty and risk of CEA include a high bifurcation, lesions that extend below the clavicle, prior cervical fusion, contralateral laryngeal nerve palsy, and obese patients with short necks.

Dr. Sayfo: The most clinically demanding scenarios typically involve a combination of hostile anatomy and volatile patient physiology:

- Severe tortuosity and calcification: Highly tortuous aortic arches or supra-aortic vessels complicate catheter delivery during TF-CAS. Heavily calcified lesions resist uniform stent expansion and lack robust clinical data regarding dedicated calcium modification therapies.
- Recurrent stenosis: Lesions that have failed prior surgical or stenting interventions are exceptionally complex due to the lack of clear consensus data surrounding the efficacy of drug-coated balloons or repeat stenting in the carotid circulation.
- Hemodynamic instability: Patients with poorly controlled or labile hypertension face a significantly elevated risk of hyperperfusion syndrome or severe postprocedural hypotension/bradycardia due to carotid baroreceptor stimulation.
- Octogenarians: Patients aged ≥ 80 years present a dual challenge; they often have increased vascular calcification and tortuosity, coupled with a higher baseline risk of periprocedural stroke during traditional TF stenting.

How can a carotid intervention algorithm remain individualized and flexible while still accounting for operator familiarity and institutional expertise?

Dr. Sayfo: An individualized algorithm must blend evidence-based guidelines with realistic assessments of local expertise. Institutional algorithms should use validated risk-stratification models to objectively categorize patients by surgical and endovascular risk. Cross-specialty collaboration is also necessary. Operators must possess a deep understanding of all modalities; however, it's crucial that they maintain the professional flexibility to refer patients to colleagues or other subspecialties when an alternative modality offers superior safety. True patient-centric care requires removing the fear of "losing" a patient to another specialty.

Dr. Gutierrez: A carotid intervention algorithm should integrate a layered framework that first stratifies patients by clinical and anatomic risks, and then matches these factors to a particular revascularization strategy and a specific operator based on their competency. No single procedure is mandated for all patients.

At the foundation of this algorithm is patient risk stratification. Factors such as symptom status, degree of stenosis, timing of index event, age, comorbidities, life expectancy, and plaque morphology should be assessed first. Such an algorithm promotes individual adaptation prior to revascularization strategy selection. The carotid intervention of choice can then be further tailored based on the presence or absence of high-risk criteria specific to each revascularization strategy. For example,

a patient with prior neck radiation, high carotid bifurcation, or contralateral occlusion is considered to be at high surgical risk for CEA and would thereby be better served by TCAR or CAS, whereas a patient with an unfavorable aortic arch may be better suited for CEA. Lastly, operator and institutional expertise can be taken into consideration. Major surgical and cardiovascular societies recommend clear performance benchmarks for asymptomatic and symptomatic patients. In this manner, an algorithm funnels specific patients to the best procedure and the subspecialty best suited to execute the revascularization.

In what ways does a multidisciplinary carotid program improve procedural selection, and how does that collaboration evolve as carotid intervention becomes more complex?

Dr. Sayfo: Historically, conflicting consensus guidelines between different medical societies have hindered standard multispecialty approaches. However, modeling carotid programs after established multidisciplinary frameworks—such as the heart team for transcatheter aortic valve replacement, complex aortic teams, or pulmonary embolism response teams (PERTs)—yields substantial clinical benefits. Joint reviews ensure that patients receive a tailored strategy rather than a default, suboptimal therapy based purely on whichever clinic they happened to walk into first. Regular peer interaction facilitates the rapid sharing of clinical experiences, complex complication management, and emerging technical advancements. Lastly, standardized multidisciplinary protocols minimize unwarranted practice variations, eliminate diagnostic delays, and ensure the institution rapidly adopts proven technologic innovations.

Dr. Gutierrez: A multidisciplinary carotid program will improve procedural selection first and foremost by matching each patient to their lowest-risk revascularization strategy. This occurs by ensuring societal guidelines are adhered to and incorporating specialty-specific expertise into a patient's risk stratification.

The benefit of a multidisciplinary procedure selection is that treatment strategies are developed integrating key patient characteristics such as symptoms and comorbidities, vascular imaging, and brain imaging—all elements that no single subspecialty fully commands. This ensures a nuanced risk-benefit assessment that mitigates specialty bias.

How do you incorporate the patient into a shared decision on the ideal therapy? What factors are today's patients weighing most significantly, and how does that translate into the decisions being made?

Dr. Gutierrez: It is important to translate clinical decision-making into a concept that resonates with how patients perceive risk, recovery, and quality of life. The conversation begins with ensuring patients understand their baseline risk in the setting of medical management versus revascularization. From there, it is important to be honest about the potential risks of each mode of revascularization.

In my opinion, today's population has two factors that immediately dominate the weighing process: (1) recovery time and (2) the invasiveness of the procedure. After this, fear of stroke remains a strong concern, particularly in symptomatic patients who have already experienced a transient ischemic attack or minor stroke. This patient population is usually more concerned with intervention timing than the modality itself.

Dr. Sayfo: In alignment with updated Centers for Medicare & Medicaid Services (CMS) National Coverage Determinations, structured shared decision-making is a formal mandate. This process requires presenting all viable, evidence-based choices to the patient in an easily digestible format. Today's patients heavily weigh distinct lifestyle and psychological factors. These include anesthesia anxiety, as patients may have strong preferences regarding general anesthesia versus conscious sedation, or implant apprehension, where patients are reluctant or anxious regarding permanent stents left in the vasculature. We should also not underestimate prior clinical events, as past negative experiences like severe hematoma or pain from prior TF access interventions can heavily bias a patient toward alternative options like TCAR or CEA.

How does your group approach adoption of new technologies, including emerging TF-CAS and TCAR platforms?

Dr. Gutierrez: Our group adopts new technologies through the following: Any new platform is evaluated first at the evidence level. Next, the incremental benefit of the new modality is balanced with the learning curve risk. If this new modality demonstrates a meaningful clinical differentiation, it is then considered for adoption.

For new technology implementation, this most often involves proctored cases prior to independent use, followed by internal tracking of early outcomes against our own institutional benchmarks. For TCAR for example, patient selection has been a topic that we closely follow. For CAS on the other hand, we may look at arch navigation risk or embolic burden during sheath exchanges.

Dr. Sayfo: We are lucky to have true partnership between interventional cardiology and vascular surgery teams, as we work together on projects such as the PERT and chronic limb-threatening ischemia patients. New algorithmic advances in technologies, outcomes, and complications are discussed in a bimonthly meeting to ensure the best quality of care is provided. Strict quality benchmarking is a cornerstone of our group via a mandate that all carotid interventions are meticulously tracked via national databases (eg, Vascular Quality Initiative) to ensure local outcomes meet or exceed national safety benchmarks.

What is the ideal postprocedural surveillance and follow-up pathway after carotid stenting? Is there a role for same-day discharge after carotid stenting?

Dr. Sayfo: Currently, all carotid interventions require the patient to stay as inpatient in the intensive care unit setting. With more advancement in carotid stenting, same-day discharge might be possible in selective cases. Our institution's postprocedural surveillance and follow-up include a carotid ultrasound and clinical visit at 4 weeks and then at 6 months and annually afterward.

Dr. Gutierrez: Postprocedural surveillance after carotid stenting is important to identify early neurologic complications, monitor hemodynamic instability, identify access site issues, and establish a long-term imaging baseline for restenosis. Neurologic checks should occur immediately in the postprocedural period, with close attention paid to new deficits, changes in mental status, or hemodynamic instability. Note that during the first 12 to 24 hours, blood pressure management is critical in the setting of baroreceptor stimulation. As such, overnight observation is often the case.

Long-term surveillance often centers on imaging—specifically, duplex ultrasound. Most providers will obtain a baseline study at 30 days to establish the post-revascularization hemodynamic parameters, and then again at 6 and 12 months. If no issues arise, then these often become an annual event.

With the CMS National Coverage Determination expanded coverage for carotid stenting, as well as the recent CREST-2 trial data,[1] what do you think will be the volumetric trajectory for this therapy in the years to come?

Dr. Gutierrez: The 2023 CMS coverage expansion removed regulatory barriers by expanding coverage to "standard-risk" patients, and the late-2025 CREST-2 trial results found that CAS with intensive medical management significantly mitigated the 4-year risk of stroke or death compared to medical management alone (2.8% vs 6%; $P = .02$). I believe the combination of both events will lead to a significant increase in this therapy.

Dr. Sayfo: We have not seen the uptick in volume of carotid stenting that we expected post-CMS approval and CREST-2. This lag is primarily driven by a shortage of qualified, high-volume endovascular operators who routinely perform carotid interventions. Looking ahead, the volumetric trajectory is expected to steadily rise as dedicated educational fellowships, proctorship programs, and simulation-based training models mature. These pathways will allow dormant operators to safely refresh their skill sets and enable a new generation of clinicians to master modern embolic protection and stenting platforms. ■

1. Brott TG, Howard G, Lal BK, et al; CREST-2 Investigators. Medical management and revascularization for asymptomatic carotid stenosis. N Engl J Med. 2026;394:219-231. doi: 10.1056/NEJMoa2508800

Disclosures
Dr. Gutierrez: None.
Dr. Sayfo: Advisory board for Cordis, BSCI, Medtronic; speakers bureau for Terumo and Abbott.