Evaluation and Management of a Patient with Cerebrovascular Disease

Description of the Activity	Vascular surgeons evaluate and treat both asymptomatic and symptomatic cerebrovascular disease. These surgeons should have a comprehensive understanding of screening recommendations, diagnostic techniques, and medical and surgical management of this disease process, including selection criteria for intervention and timing of intervention. Additionally, surgeons should understand perioperative management, including recognition and treatment of complications of surgical intervention, needed follow-up, and surveillance strategies.
Functions	❖ Nonoperative/Preoperative ➢ Synthesize essential information from a patient's referring providers, records, history, physical examination, and initial diagnostic evaluation to develop a differential diagnosis. ➢ Perform an evidence-based, cost-effective diagnostic evaluation, including selective screening. ➢ Determine whether intervention is indicated. ➢ Synthesize an optimal medical management and surveillance plan for a patient for whom intervention is not indicated. ➢ Recognize complications of cerebrovascular disease requiring emergency operative intervention. ➢ Select a surgical approach consistent with a patient's anatomy, comorbidities, and acuity of presentation. ➢ Obtain informed consent. Describe the indications, risks, benefits, alternatives, and potential complications of the planned operation, and ensure patient/caregiver understanding. ➢ Synthesize an operative plan that demonstrates understanding of the operative anatomy, physiology, indications, contraindications, risks, benefits, alternatives, and potential complications of: ▪ Carotid artery bypass ▪ Carotid endarterectomy ▪ Transcarotid artery revascularization (TCAR) ▪ Transfemoral carotid artery stent (TFCAS) ❖ Intraoperative ➢ Perform the procedures required to manage cerebrovascular disease. ▪ Carotid artery bypass ▪ Carotid endarterectomy ▪ TCAR ▪ TFCAS ➢ Integrate new information discovered intraoperatively that requires modification of the surgical plan or technique, such as: ▪ Aberrant cranial nerve anatomy ▪ Carotid tortuosity ▪ Hostile aortic arch ➢ Work with the anesthesia and nursing teams and other perioperative health care professionals to create and maintain an intraoperative environment that promotes patient-centered care. ❖ Postoperative

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	➢ Initiate and oversee postoperative care, including monitoring for neurologic examinations and blood pressure control, prescribing evidence-based medical therapy, and determining follow-up imaging and care. ➢ Communicate with the patient/caregiver(s) and members of the health care team to ensure understanding of postprocedure instructions and the ability of the patient to carry out the resultant plan within the context of their life (eg, transportation, living situation, insurance, access to a pharmacy). ➢ Recognize, evaluate, and manage early and late complications following cerebrovascular intervention. ➢ Identify a surveillance plan and indications for reintervention.

Scope	❖ In scope
	  ➢ Acute stroke, amaurosis fugax, transient ischemic attack
	  ➢ Carotid artery aneurysm or pseudoaneurysm
	  ➢ Carotid artery stenosis or occlusion
	  ➢ Carotid artery thrombus
	
	❖ Out of scope
	  ➢ Acute cardioembolic stroke
	  ➢ Carotid body tumor
	  ➢ Intracranial occlusive disease
	  ➢ Trauma
	  ➢ Vertebral artery stenosis or occlusion
	  ➢ Vertebrobasilar insufficiency
	
	❖ Special Population
	  ➢ Patients with:
	    ▪ Concomitant coronary artery disease requiring coronary artery bypass grafting and carotid artery stenosis
	    ▪ Radiation-induced carotid disease
	    ▪ Reoperative fields
	    ▪ Tandem carotid lesions

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1 **Limited Participation** Demonstrates understanding of information and has very basic skills **Framework:** What a learner directly out of medical school should know The attending can show and tell.	• Elicits a history and performs a relevant vascular exam (eg, cranial nerves, carotid bruit) • Demonstrates understanding of basic risk factor modification (impact of smoking, cholesterol, HTN, DM) • Identifies available imaging modalities (carotid duplex, CTA, MRA, angiography) • Identifies the need for intervention in a straightforward case of symptomatic carotid disease • Demonstrates understanding of the indications for intervention in an asymptomatic carotid patient • Identifies the need for intervention over medical management for symptomatic and asymptomatic disease • Recognizes the diagnosis of carotid occlusive disease and identifies guidelines for its treatment	• Describes landmarks for CEA incision and the relationship of the artery to the SCM and IJ and facial veins, needing assistance to identify them • Identifies the procedure to be performed, alternative options (TCAR, TFCAS), and the indications for CEA relative to other options • Describes potential crises that could occur during CEA (bradycardia, stroke)	• Uses US to identify femoral or carotid anatomy; recognizes the importance of maintaining wire position • Identifies the procedure to be performed, alternative options (CEA), and the indications for TCAR or TFCAS relative to other options	• Identifies a basic postop problem (incisional pain, BP instability, hematoma, headache) and initiates management with supervision • Recognizes the need for long-term surveillance and risk factor modification

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2 **Direct Supervision** Demonstrates understanding of the steps of the operation but requires direction through principles and does not know the nuances of a basic case **Framework:** The learner can use the tools but may not know exactly what, where, or how to do it. The attending gives active help throughout the case to maintain forward progression.	• Orders and interprets duplex and axial imaging, including identification of duplex criteria for stenosis • Describes methods for risk factor modification in cerebrovascular disease, including smoking cessation, statin therapy, antiplatelet agents, and BP control • Uses imaging to support a decision for operative management of carotid disease • Synthesizes patient-specific clinical data to recommend CEA, TCAR, or TFCAS • Elicits a discussion of patient preferences regarding medical treatment or intervention for carotid disease	• Demonstrates care while handling tissue adjacent to nerves and arteries, particularly at the level of the carotid sheath • Identifies most steps of the procedure (inflow/outflow control) and the equipment required (neuroprotection, shunt, neuromonitoring); requires prompting to advance the procedure • Describes expected findings for an intraprocedural CVA, including changes in an EEG or a change in the neurologic status of an awake patient • Describes expected findings for inadequate	• Uses US to obtain vascular access; demonstrates basic catheter and wire-handling techniques • Identifies most steps of the procedure and equipment required; requires prompting to advance the procedure • Describes expected findings for an intraprocedural CVA, including a change in the neurologic status of an awake patient • Describes expected findings for inadequate anticoagulation with thrombus formation	• Manages a common postop problem (eg, chest pain, headache), including ordering and interpreting additional workup (ECG, CT head) • Describes evidence-based surveillance imaging and risk factor modification based on SVS guidelines

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		anticoagulation with thrombus formation		
3 **Indirect Supervision** Can do a basic operation but will not recognize abnormalities and does not understand the nuances of an advanced case **Framework:** The learner can perform the operation in straightforward circumstances. The attending gives passive help. This help may be given while scrubbed for more complex cases or during a check-in for more routine cases.	• Interprets US results and patient risk factors and formulates a rationale for medical or surgical management of carotid stenosis • Recognizes the need for continued surveillance of carotid lesions and the potential need for intervention despite best medical management • Uses imaging findings to support a decision for CEA vs TCAR vs TFCAS • Demonstrates thorough understanding of all operative options, rationalizing their choice for a patient (eg, anatomic criteria, patient comorbidities) • Develops a plan for TCAR vs TFCAS based on the current clinical situation and patient anatomy	• Dissects the carotid artery with appropriate instruments; performs an arteriotomy and sews a patch with limited assistance; moves fluidly throughout a routine operation; requires guidance for a difficult case • Identifies all critical steps of the procedure (order of clamping, endarterectomy, patch) and the equipment required; advances the procedure with minimal prompting • Requires guidance for unanticipated findings or variants (difficult endpoint, high lesion); recognizes the need	• Demonstrates understanding of the procedural sequence of TCAR and TFCAS and their critical steps (TCAR flow reversal, placement of protection device) • Obtains an initial carotid angiogram safely and efficiently; establishes flow reversal, performing the steps in the correct order • Requires guidance for unanticipated findings or variants (tortuosity, spasm) • Requires guidance for unanticipated findings or variants (difficult to traverse lesion); recognizes the need for a completion study and interprets and responds to it	• Identifies a disease-specific complication in a complex carotid patient (acute stroke/thrombosis, cerebral hyperperfusion syndrome, postop bleed, nerve injury) and recognizes the impact of these on longitudinal care • Customizes postop instructions • Recognizes and manages a complex periop problem (stroke, cerebral hyperperfusion), including identifying the need to return to the OR

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	● Identifies duplex criteria for carotid disease; independently applies guidelines for accurate decision-making regarding the type of intervention for a patient with carotid disease	for neuromonitoring and interprets and responds to it; recognizes the need for a completion study and interprets and responds to it ● Leads intraop communication with anesthesia, nursing, and perioperative staff (eg, BP management at the time of clamping/neuromonitoring)	● Leads intraop communication with anesthesia, nursing, and perioperative staff (eg, TCAR timeout/clamp/heparinization/neuromonitoring)	
4 **Practice Ready** Can manage more complex patient presentations and operations and take care of most cases **Framework:** The learner can treat all straightforward cerebrovascular disease	● Synthesizes results of imaging with complex findings (contralateral occlusions, anatomically difficult lesions) for a medically challenging patient and establishes an appropriate treatment plan ● Oversees the care of a complex patient with cerebrovascular disease, including medication requirements, imaging, and risk management	● Performs and guides the operation in a complex situation (scarring, inflammation, infection); troubleshoots issues with a shunt, clotting, and exposure ● Performs and interprets completion imaging ● Identifies all critical steps of the procedure	● Selects the great vessels from a transfemoral approach, advances a sheath, and places an embolic protection device; establishes flow reversal in TCAR, obtains a roadmap, and safely crosses the lesion ● Describes the procedural sequence for TCAR and TFCAS for a complex case (tortuosity, lesion that is difficult to cross)	● Leads the team and provides supervision in the management of a complex complication (acute stroke/thrombosis, cerebral hyperperfusion syndrome, postop bleed, nerve injury)

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cases and has a strong understanding of surgical options and techniques for less common scenarios. The attending is available at the request of the learner but is not routinely needed for common presentations, though input may be needed for more complex presentations.	• Independently initiates cross-sectional and duplex imaging and 3D reformatting to identify abnormal findings and plan an intervention • Adjusts the operative plan based on a change in the clinical situation (new/evolving neurologic symptoms or medical comorbidities), including conversion between open and endo approaches • Adapts the management plan based on a change in a patient's neurologic symptoms or medical comorbidities, including from endo to open • Interprets imaging studies, demonstrates thorough understanding of all relevant trials, and applies evidence-based medicine to treatment selection; recognizes the benefits/limitations of medical vs open vs endo treatment and selects appropriately	and the equipment required; advances the procedure without prompting in a complex case (eg, high lesion) • Recognizes when operative plan deviation is needed; adapts and implements a plan, including the need for conversion from open to endo • Anticipates patient-specific risk for a crisis during an open approach (contralateral occlusion, difficult endpoint, redo operative field) and describes an appropriate treatment algorithm and potential outcomes, including conversion to an endo or hybrid procedure	and identifies equipment needs; recognizes critical decision points (aborting the difficult arch or if unable to cross the lesion) • Alters the plan during carotid stenting or TCAR or TFCAS when needed, including using different catheters and wires to cross the carotid lesion • Anticipates patient-specific risk for a crisis during TCAR or TFCAS (inability to cross a lesion, failure of stenosis to respond to a balloon, access issues) and describes an appropriate treatment algorithm and potential outcomes, including conversion to an open or hybrid procedure • Recognizes when operative plan deviation is needed; adapts and implements a plan, including the need for	

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			conversion from endo to open	

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