

Occlusive Cerebrovascular Disease

Risk

- Worldwide, 15 million people suffer a stroke each year.
- Prevalence of stroke in USA: Approximately 3%.
- Incidence of stroke in USA: 795,000 annually, including 600,000 new cases and 115,000 recurrences.
- China has the highest rates of mortality (19.9%), followed by Africa and South America.

Perioperative Risks

- Risks for stroke:
 - Cardiac and carotid surgery: CABG = 1–5%; CEA < 3%
 - Noncardiac surgery: Major general surgery 0.08–0.7%; orthopedic 0.2–0.9%; major peripheral vascular reconstruction = 0.3–3%

Worry About

- Cerebral ischemia
- Myocardial ischemia (CAD, the leading cause of morbidity following CEA)
- Cognitive decline (long-term effects of poor perfusion)
- Control of coexisting Htn, DM, CAD, and OSA

Overview

- Two main clinical presentations:
 - Pts with known occlusive CVD undergoing carotid or cerebral revascularization; risk factors include CAD/CHF; stroke in evolution, frequent TIAs; severe Htn; stenosis; COPD; OSA, diabetes, and poor cerebral collateral flow; age >70 y; and intraluminal thrombus. Criteria for pt selection and acceptable periop morbidity and mortality rates are now well established for CEA and carotid stenting.
 - Pts with known or possible CVD presenting for other surgery; risk factors vary with age and type of surgery. The peak incidence of periop stroke is on postop d 2, and the median is between 2–9 d. Periop stroke carries higher mortality than stroke does in nonsurgical settings (26% vs. 12.2%). In pts with previous stroke, mortality rate after periop stroke is around 87%.

Etiology

- Most common cause of occlusive CVD is atherosclerosis that can be divided into three main categories

of conditions: extracranial carotid artery (15–20%), intracranial cerebral arteries (10%), and vertebral-basilar arteries (8%).

- Nonatherosclerotic causes of occlusive CVD include fibromuscular dysplasia, cervical artery dissection, moyamoya disease, and vasospasm.
- Risk factors incl age, Htn, DM, smoking, and OSA.
- High incidence of concomitant CAD, PVD, and OSA.
- Two main mechanisms of ischemia are thromboembolism and hemodynamic.

Usual Treatment

- Medical treatment: Smoking cessation, BP control (target is <140/90 mm Hg), statins (LDL <100 mg/dL), and antiplatelet drugs (especially ASA, clopidogrel)
- Interventional:
 - Surgical: CEA, vessel-to-vessel bypass for intracranial stenosis
 - Endovascular: Intraarterial thrombolysis with or without mechanical thrombectomy, angioplasty with or without stenting

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Possible positional cerebral ischemia	Sx of cerebral ischemia with head movements	Neck ROM	
CV	Htn Vasculopathy LV dysfunction and CHF	Exercise tolerance Angina, MI, CHF Claudication	Arterial BP S ₃ Peripheral pulses	ECG, CXR ECHO Stress test
RESP	COPD caused by smoking Irritable airway OSA	Dyspnea Chronic cough Smoker	Wheezing Accessory muscles	CXR? ABG? PFTs, sleep studies
ENDO	Possible diabetes			Glucose
RENAL	Possible nephropathy	Diabetes, Htn		Cr, urea
CNS	Cerebral ischemia	TIA, stroke	Neurologic deficits	Duplex US Angiogram (CT, MR, or conventional), PET, or CT perfusion study

Key References: O'Brien M, Chandra A: Carotid revascularization: risks and benefits. *Vasc Health Risk Manag* 10:403–416, 2014; Chui J, Manninen P, Sacho RH, et al.: Anesthetic management of patients undergoing intracranial bypass procedures. *Anesth Analg* 120(1):193–203, 2015.

Perioperative Implications

Preoperative Preparation

- Neurologic assessment.
- Optimized control of coexisting Htn, CAD, diabetes, and COPD.
- Establish pt's normal BP range.
- Preop antiplatelet therapy for pts undergoing endovascular treatment.

Monitoring

- Arterial catheter and ST-segment monitoring.
- Consider neurologic monitor for CEA or intracranial bypasses: EEG, SSEP, transcranial Doppler, cerebral oximetry, or regional anesthetic (CEA) with the awake pt (if practical).
- Carotid angioplasty with stent is usually performed with the pt awake, whereas intracranial angioplasty is performed under GA.
- Conscious sedation has better outcomes than GA for intraarterial thrombolysis and mechanical thrombectomy for acute stroke.

Induction/Maintenance

- Maintain hemodynamic stability based on preop BP range.
- Maintain normocapnia based on preop pH and PaCO₂.
- Intraop anticoagulation and neuroprotection if indicated.
- Light IV sedation often administered during angioplasty.
- Embolic stroke or severe, vagal-mediated bradycardia can accompany carotid dilation during angioplasty.

Extubation

- Smooth emergence: avoid straining on ETT.
- Be prepared to manage hemodynamic instability and airway during emergency neuro assessment.

Postoperative Period

- Adequate analgesia and supplemental O₂.
- Awake pt allows early and frequent neurologic evaluation.
- Monitor airway/neck circumference.
- Avoid postop cerebral hyperperfusion; treat hypertension aggressively.

Anticipated Problems/Concerns

- Most pts with CVD also at high risk for CAD and often need CABG: hence, the controversy on the combined versus staged approach to CABG and CEA. Recent evidence suggests that the combined approach remains an option.
- Timing of surgery after TIA or stroke: Impaired cerebral autoregulation and vasomotor reactivity to CO₂ usually persists up to 6 mo after acute stroke. Nonurgent surgeries should be delayed for 3–6 mo after ischemic stroke. For urgent surgeries, meticulous BP management with monitoring for cerebral ischemia is indicated.
- Carotid revascularization can be performed within 2 wk of an ischemic event except in pts with large hemispheric infarction who are at risk for reperfusion injury or hemorrhagic conversion. These procedures should be delayed for a period of 6 wk or longer.
- Caution regarding use of succinylcholine in pts with previous parietic CVA.