

Coronary Artery Disease (Left Main and Non-Left Main Disease)

Risk

- Incidence in USA: 15.5 million.
- Approximately 735,000 pts per y with CAD will have an acute MI and approximately 15% of these will die.
- CAD is responsible for approximately 1 of every 7 deaths in USA.
- Male predominance in pts <55 y old, but M = F in >55 y old.
- Risk factors include Htn, diabetes, smoking, familial incidence, hyperlipidemia, and high cholesterol.

Perioperative Risks

- Presence of disease by coronary anatomy is a good predictor of survival with CAD.
- Presence of left main disease with a high degree of stenosis is life threatening.
- Recent MI increases risk, but revascularization interventions protect pt.
- Impaired ventricular function, unstable anginal pattern, major surgery, and emergency surgery all increase risk.
- Pts at increased risk if undergoing reoperation for bypass surgery.
- Presence of a bare metal stent or drug eluting stent places pts at risk for a MI secondary to in-stent thrombosis (especially <1 mo after bare metal stent and <12 mo after drug eluting stent).

Worry About

- Myocardial ischemia, which can lead to MI
- Postop MI, which carries very high mortality (>50%) in noncardiac surgical pts
- Atherosclerosis in other vascular beds (CNS, renal, and mesentery)
- Increased bleeding during and after surgery if pt is taking an anticoagulant for the prevention of MI
- In-stent thrombosis with associated MI if pt discontinued antiplatelet medications (with up to 50% mortality)

Overview

- Atherosclerosis of vessels supplying blood to the heart results in decreased blood flow by limitation of flow due to anatomy or vasoactive dysfunction (e.g., spasm)
- Single greatest cause of death in USA population (approximately 370,000 deaths/y)
- Most prevalent form of CV disease; approximately 15.5 million pts in the USA population have CAD
- Leading cause of death in major noncardiac surgery

Etiology

- Atherosclerosis and obstructive deposits occur in the coronary artery.
- Involves the interaction of genetics, diet, and environment: Htn, cigarette smoking, and diabetes are three common predisposing factors.

- Myocardial O₂ delivery does not meet myocardial O₂ demands, and thus causes myocardial ischemia.
- Myocardial O₂ supply does not reach the myocardium after thrombosis of coronary artery, which causes MI.

Usual Treatment

- Medical: Nitroglycerin, beta-blockers, calcium-channel blockers (low dose and in vasospastic component), diet, antihyperlipidemia drugs, antiplatelet therapy, exercise, weight loss, and antioxidants
- Catheter-based interventional cardiology (indicated in ≤2-vessel CAD: PTCA has a 30% 3-mo closure rate), intracoronary stent (has good angiographic results and lower closure rates, but event-free survival is little different from PTCA)
- CABG surgery (indicated in ≥2-vessel CAD, left main disease, and diabetics)
- Coronary revascularization: indicated in pts with stable angina before noncardiac surgery in left main disease or three-vessel disease and in pts with high-risk unstable angina
- Surgery delay (if possible) of 1 mo after bare metal stent implantation and 12 mo after drug eluting stent implantation; during the periop period, continue antiplatelet therapy (if possible)

Assessment Points

Concern	Effect	Assessment by Hx	PE	Test
Noncardiac Surgery				
Ischemia	Causes ventricular dysfunction and arrhythmias Can herald and/or cause MI	Angina Dyspnea on exertion		Holter monitor, ECG exercise radionuclide, treadmill stress ECHO
Infarction	Indicates severe CAD Causes death	Unstable angina		ECG, isoenzyme of CK creatine kinase with muscle and brain subunits, and troponin enzyme release
Impaired function	Heart failure, shock	Activity Hx Stair climbing Orthopnea	Orthopnea gallop Neck veins Rales Peripheral edema	EF (cath, ECHO, and radionuclide)
Stent thrombosis	Cardiogenic shock, death; increased risk if bare metal stent implanted <1 mo or drug eluting stent <12 mo	Antiplatelet regimen Type of stent (bare metal vs. drug eluting) Stent(s) location and date implanted		
Cardiac Surgery				
Cardiac function	Best predictor of outcome	Activity Hx, stair climbing		Ventricular angiogram (EF >50% = good risk)
Coronary anatomy	Extent of disease and overall long-term survival			Coronary angiography
Renal function	Increased risk if impaired			Cr ≥1.4 mg/dL denotes increased risk
CNS	Increased risk of stroke Aortic atheromatous disease and prior stroke increase risk	Hx of TIA Amaurosis fugax	Carotid bruit	Carotid Doppler study and epiaortic ultrasound

Key References: Mozaffarian D, Benjamin EJ, Go AS, et al.: Heart disease and stroke statistics—2015 update: a report from the American Heart Association, *Circulation* 131:e29-322, 2015; Fleisher LA, Fleischmann KE, Auerbach AD, et al.: 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, *Circulation* 130:2215–2245, 2014.

Perioperative Implications

Preoperative Preparation

- Supportive preop interview to decrease stress and anxiety.
- Consider analgesics (opioid) for pain, or the likelihood of pain, before anesthesia.
- Give morning cardiac medications (especially beta-blockers and statins) and antiplatelets if pt has an intracoronary stent.
- Nitroglycerin at pt's bedside.

Monitoring

- Consider systemic arterial BP (invasive and continuous in unstable pts or in cases where BP swings are anticipated).
- Consider CVP and/or PA cath; in cardiac surgical pts, EF ≤30% should trigger consideration of central line or use of TEE.
- Consider TEE if pt is hemodynamically unstable.

Anesthesia

- Principle is to maintain O₂ supply and minimize myocardial O₂ consumption.
 - Maintain cardiac output, O₂ sat, and Hgb concentration (O₂ delivery).
 - Maintain diastolic BP (perfusion pressure).
 - Decrease HR, contractility, and wall tension (O₂ consumption).
- No outcome difference demonstrated among general anesthetics.
- Regional and conduction anesthesia with postop analgesia may be beneficial.
- Beware of neuraxial blocks in pts on anticoagulants.
- Transient periods of Htn are well tolerated; however, prolonged periods of hypotension, tachycardia, and anemia are not well tolerated.
- Maintenance of normothermia during noncardiac surgery may be beneficial.

Adjuvants

- Nitroglycerin, sublingual or (preferably) by continuous infusion (0.5–2 mcg/kg per min), can treat myocardial ischemia.
- Beta-blockers by bolus or infusion decrease HR and myocardial contractility and can prevent and treat ischemia.
- RBCs to maintain Hgb ≥8 g/dL.

Postoperative Period

- Second and third postop days are most common time for MI in noncardiac surgical pts; there is a high risk of ischemia intraop and in postop periods.
- Maintain good analgesia to decrease pt's stress response.
- Maintain cardiac medications (especially beta-blockers and statins).
- Consider use of aspirin or other medications to decrease coronary thrombosis in high-risk noncardiac surgical pts (especially pts with intracoronary stents).