

they are at substantial cardiac risk over the subsequent 5 to 10 years. Noninvasive testing to assess left ventricular function and inducible ischemia should be undertaken to identify patients who may benefit from revascularization or optimization of medical therapy. Postoperative heart failure and pulmonary edema should be treated similar to pulmonary edema in the non-operative setting.

NONCARDIAC SURGERY IN PATIENTS WITH SPECIFIC CARDIOVASCULAR CONDITIONS

Valvular Heart Disease

Special consideration has to be given in preoperative risk assessment for patients with valvular heart disease. All patients undergoing noncardiac surgery should be assessed especially for aortic stenosis by physical examination and by two-dimensional echocardiography for any suspicious murmur. One recent study demonstrated that patients with aortic stenosis have a fivefold increased risk for perioperative mortality and nonfatal MI compared to patients without aortic stenosis. Symptomatic severe represents an active cardiovascular condition that should be evaluated and managed before elective surgery is undertaken. Appropriately selected cases can be managed with valve replacement or valvuloplasty as a bridge to noncardiac surgery.

Less is known about the perioperative risks associated with mitral stenosis and mitral regurgitation in patients undergoing noncardiac surgery. Usually, a preoperative history and physical examination, chest radiograph, or ECG provides clues to the diagnosis, which can be confirmed by echocardiography. Accurate diagnosis may help optimize intraoperative anesthetic strategies, choice of pharmacologic interventions and invasive monitoring, and postoperative medical management. Heart rate should be controlled to ensure a sufficient diastolic filling period and to avoid pulmonary congestion in patients with mild to moderate mitral stenosis. Patients with severe mitral stenosis are likely to benefit from balloon mitral valvuloplasty or surgical intervention before high-risk surgery.

Patients with aortic or mitral valvular regurgitation benefit from volume control and afterload reduction. In aortic insufficiency, it is thought that faster heart rates are better tolerated than slow ones because slow heart rates lead to increased diastolic filling and can exacerbate left ventricular volume overload.

Except for perioperative antibiotic prophylaxis to prevent bacterial endocarditis and the need for effective anticoagulation strategies, perioperative complications in patients with prosthetic heart valves are probably similar to those in patients with comparable degrees of native valvular heart disease. In patients with a mechanical valve prosthesis, the recommendations for anticoagulation are as follows. For patients requiring minimally invasive procedures (i.e., dental procedures, superficial plastic surgery, and biopsies), the international normalized ratio (INR) should be reduced briefly to the low or subtherapeutic range, with the normal dose of oral anticoagulation resumed promptly after the procedure. For those patients in whom the risk of bleeding with oral anticoagulation is high and the risk for thromboembolism without anticoagulation is also high (e.g., mechanical valve in the mitral position, history of thromboembolism while not on anticoagulation, Bjork-Shiley or Starr-Edwards valve, known

hypercoagulability, atrial fibrillation), perioperative unfractionated heparin is recommended. Patients between these two extremes should undergo individual assessment for the risk and benefit of reduced anticoagulation with warfarin versus perioperative heparin initiation and brief interruption perioperatively. The use of low-molecular-weight heparin may be a feasible alternative in appropriately selected patients who require heparin conversion, although there is still controversy about its use for this indication.

Arrhythmias and Conduction Defects

Ventricular and atrial arrhythmias historically are recognized as predictors of perioperative cardiac complications. Therefore, identification of a preoperative arrhythmia warrants a careful evaluation for the presence and severity of underlying ischemic heart disease, cardiomyopathy, or other conditions that may contribute to perioperative complications. In general, asymptomatic arrhythmias or conduction defects warrant only observation and maintenance of an optimal metabolic state. Although new-onset atrial fibrillation raises embolic risk, most cases of postoperative atrial fibrillation resolve within 36 to 48 hours. Short-term rhythm management and anticoagulation may be justified for postoperative atrial fibrillation. Electrical cardioversion is the procedure of choice for supraventricular tachycardia associated with hemodynamic compromise.

Congestive Heart Failure and Left Ventricular Dysfunction

CHF has been identified as a significant marker of cardiac risk in noncardiac surgery. Every effort should be made to identify the etiology of CHF and optimally control it preoperatively because it is a known risk factor for postoperative cardiac complications. However, there are no evidence-based recommendations for optimal perioperative strategy in patients with heart failure undergoing intermediate- to high-risk noncardiac surgery other than making sure that they are taking medications known to improve heart failure in the long-term. Because proper treatment of heart failure depends greatly on its underlying etiology (especially systolic dysfunction versus diastolic dysfunction), characterization of this etiology before elective noncardiac surgery can help in tailoring therapy to each patient. Close monitoring of volume status is needed to avoid perioperative decompensation. Intravenous inotropic agents, vasodilators, or both may be useful for a short duration in the perioperative period to prevent or treat CHF, depending on the situation.

Hypertrophic Cardiomyopathy

Patients with echocardiographically documented hypertrophic cardiomyopathy (HCM) are at risk for exacerbation of dynamic left ventricular outflow tract (LVOT) obstruction during periods of tachycardia, hypotension, or increased inotropy. General anesthesia or neuraxial block can lead to peripheral vasodilation and sympathetic autonomic blockade that may decrease venous return and further exacerbate LVOT obstruction. Observational studies of patients with HCM undergoing noncardiac surgery suggest that for most operations, patients with compensated HCM tolerate the perioperative period well. Perioperative cardiac risk reduction strategies should include avoidance of