

**TABLE 9-3 CLINICAL MARKERS INCLUDED IN THE REVISED CARDIAC RISK INDEX**

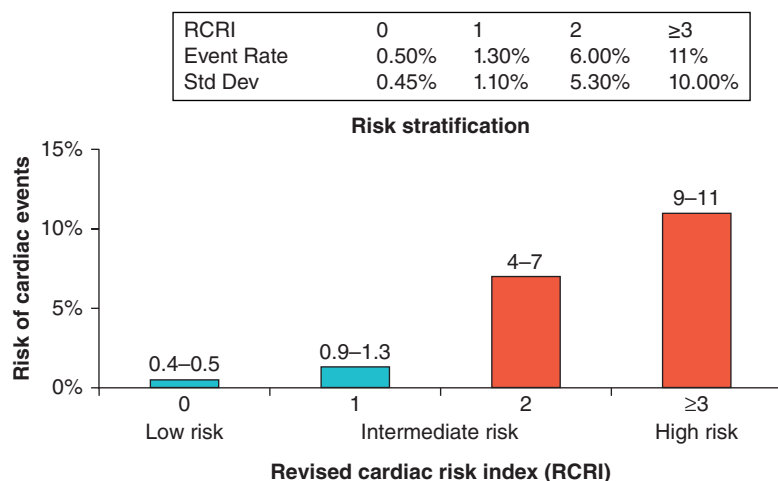
High-Risk Surgical Procedures
Vascular surgery
Major intraperitoneal or intrathoracic procedures
Ischemic Heart Disease
History of myocardial infarction
Current angina considered to be ischemic
Requirement for sublingual nitroglycerin
Positive exercise test
Pathological Q-waves on ECG
History of PCI and/or CABG with current angina considered to be ischemic
Congestive Heart Failure
Left ventricular failure by physical examination
History of paroxysmal nocturnal dyspnea
History of pulmonary edema
S <sub>3</sub> gallop on cardiac auscultation
Bilateral rales on pulmonary auscultation
Pulmonary edema on chest x-ray
Cerebrovascular Disease
History of transient ischemic attack
History of cerebrovascular accident
Diabetes Mellitus
Treatment with insulin
Chronic Renal Insufficiency
Serum creatinine >2 mg/dL

**Abbreviations:** CABG, coronary artery bypass grafting; ECG, electrocardiogram; PCI, percutaneous coronary interventions.

**Source:** Adapted from TH Lee et al: *Circulation* 100:1043, 1999.

### PREOPERATIVE NONINVASIVE CARDIAC TESTING FOR RISK STRATIFICATION

There is little evidence to support widespread application of preoperative noninvasive cardiac testing for all patients undergoing major surgery. Rather, a discriminative approach based on clinical risk categorization appears to be both clinically useful and cost-effective. There is potential benefit in identifying asymptomatic but high-risk patients, such as those with left main or left main–equivalent CAD or those with three-vessel CAD and poor left ventricular function, who may benefit from coronary revascularization (Chap. 293). However, evidence does not support aggressive attempts to identify patients at intermediate risk who have asymptomatic but advanced coronary artery disease, in whom coronary revascularization appears to offer little advantage over medical therapy.



**FIGURE 9-2 Risk stratification based on the RCRI:** derivation and prospective validation of a simple index for prediction of cardiac risk in patients undergoing major noncardiac surgery. Cardiac events include myocardial infarction, pulmonary edema, ventricular fibrillation, cardiac asystole, and complete heart block. (Adapted from TH Lee et al: *Circulation* 100:1043, 1999.)

An RCRI score  $\geq 3$  in patients with severe myocardial ischemia on stress testing should lead to consideration of coronary revascularization prior to noncardiac surgery. Noninvasive cardiac testing is most appropriate if it is anticipated that, in the event of a strongly positive test, a patient will meet guidelines for coronary angiography and coronary revascularization. Pharmacologic stress tests are more useful than exercise testing in patients with functional limitations. Dobutamine echocardiography and persantine, adenosine, or dobutamine nuclear perfusion testing (Chap. 270e) have excellent negative predictive values (near 100%) but poor positive predictive values (<20%) in the identification of patients at risk for perioperative MI or death. Thus, a negative study is reassuring, but a positive study is a relatively weak predictor of a “hard” perioperative cardiac event.

### RISK MODIFICATION: PREVENTIVE STRATEGIES TO REDUCE CARDIAC RISK

**Perioperative Coronary Revascularization** Currently, potential options for reducing perioperative cardiovascular risk include coronary artery revascularization and/or perioperative preventive medical therapies (Chap. 293). *Prophylactic* coronary revascularization with either coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) provides no short- or midterm survival benefit for patients *without* left main CAD or three-vessel CAD in the presence of poor left ventricular systolic function and is *not recommended* for patients with stable CAD before noncardiac surgery. Although PCI is associated with lower procedural risk than is CABG in the perioperative setting, the placement of a coronary artery stent soon before noncardiac surgery may increase the risk of bleeding during surgery if dual antiplatelet therapy (aspirin and thienopyridine) is administered; moreover, stent placement shortly before noncardiac surgery increases the perioperative risk of MI and cardiac death due to stent thrombosis if such therapy is withdrawn prematurely (Chap. 296e). It is recommended that, if possible, noncardiac surgery be delayed 30–45 days after placement of a bare metal coronary stent and for 365 days after a drug-eluting stent. For patients who *must* undergo noncardiac surgery early (>14 days) after PCI, balloon angioplasty without stent placement appears to be a reasonable alternative because dual antiplatelet therapy is not necessary in such patients. One recent clinical trial further suggests that after 6 months, bare metal and drug eluting stents may not pose a threat.

**PERIOPERATIVE PREVENTIVE MEDICAL THERAPIES** The goal of perioperative preventive medical therapies with  $\beta$ -adrenergic antagonists, HMG-CoA reductase inhibitors (statins), antiplatelet agents, and  $\alpha_2$  agonists is to reduce perioperative adrenergic stimulation, ischemia, and inflammation, which are triggered during the perioperative period.

**$\beta$ -ADRENERGIC ANTAGONISTS** The use of perioperative beta blockade should be based on a thorough assessment of a patient’s perioperative clinical and surgery-specific cardiac risk (RCRI  $\geq 2$ ). For patients with or without mild to moderate reactive airway disease, the cardioselective beta blocker of choice should be used and titrated to maintain a target heart rate of 60–80 beats/min in the absence of hypotension in the operative and perioperative period. In RCRI  $\geq 2$  patients without a long-term indication for beta blockers, the medications can be administered IV as a preoperative medication on the day of surgery, with a targeted heart rate of 60–80 beats/min without hypotension, and continued for >7 days (preferably 30 days) postoperatively. Abrupt perioperative beta blocker withdrawal should be avoided unless necessary because of the associated increase in risk of MI and angina. IV preparations should be substituted for oral medications if patients are unable to swallow or absorb pills in the perioperative period. The results from the Perioperative Ischemic Evaluation (POISE) trial showed that, although cardiac death, nonfatal myocardial infarction, or cardiac arrest was reduced among patients who received metoprolol rather than placebo, there was an increased incidence of death and stroke among metoprolol recipients because of a high and rapidly loading dose of this drug.