Step 1: The consultant should determine the urgency of noncardiac surgery. In many instances, patient- or surgery-specific factors dictate an obvious strategy (eg, emergency surgery) that may not allow for further cardiac assessment or treatment. In such cases, the consultant may function best by providing recommendations for perioperative medical management and surveillance. Selected postoperative risk stratification is often appropriate in patients with elevated risk for long-term coronary events who have never had such an assessment before. This is usually initiated after the patient has recovered from blood loss, deconditioning, and other postoperative complications that might confound interpretation of noninvasive test results.

Step 2: Does the patient have 1 of the active cardiac conditions in Table 2? If not, proceed to step 3. In patients being considered for elective noncardiac surgery, the presence of unstable coronary disease, decompensated HF, or severe arrhythmia or valvular heart disease usually leads to cancellation or delay of surgery until the cardiac problem has been clarified and treated appropriately. Examples of unstable coronary syndromes include previous MI with evidence of important ischemic risk by clinical symptoms or noninvasive study, unstable or severe angina, and new or poorly controlled ischemia-mediated HF. Many patients in these circumstances are referred for coronary angiography to assess further therapeutic options. Depending on the results
of the test or interventions and the risk of delaying surgery, it may be appropriate to proceed to the planned surgery with maximal medical therapy.

Step 3: Is the patient undergoing low-risk surgery? Many procedures are associated with a combined morbidity and mortality rate less than 1% (see Section 4), even in high-risk patients. Additionally, mortality on the day of surgery, for most ambulatory surgical procedures, is actually lower than mortality on day 30, which suggests that the incremental risk of ambulatory surgery is negligible or may be protective (51). Therefore, interventions based on cardiovascular testing in stable patients would rarely result in a change in management, and it would be appropriate to proceed with the planned surgical procedure.

Step 4: Does the patient have a functional capacity greater than or equal to 4 METs, without symptoms? Functional status has been shown to be reliable for perioperative and long-term prediction of cardiac events (52–56). In highly functional asymptomatic patients, management will rarely be changed based on the results of any further cardiovascular testing. It is therefore appropriate to proceed with the planned surgery. In patients with known cardiovascular disease or at least 1 clinical risk factor, perioperative heart rate control with beta blockade appears appropriate as outlined in Section 7.2.

If the patient has not had a recent exercise test, functional status can usually be estimated from the ability to perform activities of daily living (55). Functional capacity can be expressed as metabolic equivalents (METs); the resting or basal oxygen consumption ($V_o_2$) of a 70-kg, 40-year-old man in a resting state is 3.5 mL per kg per min, or 1 MET. For this purpose, functional capacity has been classified as excellent (greater than 10 METs), good (7 to 10 METs), moderate (4 to 6 METs), poor (less than 4 METs), or unknown. Multiples of the baseline MET values provide a uniform terminology across different exercise protocols to express aerobic demands for specific activities. Maximum and submaximum levels of work differ per unit of time according to the exercise protocol used. Thus, 6 minutes of a Naughton protocol is not equivalent to 6 minutes on a standard Bruce protocol in terms of work performed and energy expended. The predicted MET level for a certain activity is influenced by the degree of conditioning and genetic predisposition. Perioperative cardiac and long-term risks are increased in patients unable to meet a 4-MET demand during most normal daily activities (55). In 1 series of 600 consecutive
patients undergoing major noncardiac procedures, perioperative myocardial ischemia and cardiovascular events were more common in patients who reported poor exercise tolerance (inability to walk 4 blocks or climb 2 flights of stairs), even after adjustment for baseline characteristics known to be associated with increased risk (55). The likelihood of a serious complication occurring was inversely related to the number of blocks that could be walked ($P=0.006$) or flights of stairs that could be climbed ($P=0.01$). Examples of leisure activities associated with less than 4 METs are slow ballroom dancing, golfing with a cart, playing a musical instrument, and walking at a speed of approximately 2 to 3 mph. Activities that require more than 4 METs include moderate cycling, climbing hills, ice skating, roller blading, skiing, singles tennis, and jogging. The Duke Activity Status Index contains questions that can be used to estimate the patient's functional capacity (11,52). Use of the Duke Activity Status Index or other activity scales (53) and knowledge of the METs levels required for physical activities, as listed above and described in Table 3, provide the clinician with a relatively easy set of questions to estimate whether a patient's functional capacity will be less than or greater than 4 METs. At activity levels less than 4 METs, specific questions to establish risk gradients are less reliable. Furthermore, a clinical questionnaire only estimates functional capacity and does not provide as objective a measurement as exercise treadmill testing or arm ergometry. Other activity scales have been advocated, including the Specific Activity Scale (57).

Step 5: If the patient has poor functional capacity, is symptomatic, or has unknown functional capacity, then the presence of clinical risk factors will determine the need for further evaluation. If the patient has no clinical risk factors, then it is appropriate to proceed with the planned surgery, and no further change in management is indicated.

If the patient has 1 or 2 clinical risk factors, then it is reasonable to either proceed with the planned surgery, with heart rate control with beta blockade, or consider testing if it will change management. Two studies in vascular surgery patients with 1 to 2 clinical risk factors were unable to demonstrate any difference in outcome in the group who proceeded with the planned surgery with good medical management or tight heart rate control, but there are circumstances in which the clinician may change aspects of care based on the results of the test (58,59).
In patients with 3 or more clinical risk factors, the surgery-specific cardiac risk is important. The surgery-specific cardiac risk (Table 4) of noncardiac surgery is related to 2 important factors. First, the type of surgery itself may identify a patient with a greater likelihood of underlying heart disease and higher perioperative morbidity and mortality. Perhaps the most extensively studied example is vascular surgery, in which underlying CAD is present in a substantial portion of patients. If the patient is undergoing vascular surgery, testing should only be considered if it will change management. Other types of surgery may be associated with similar risk to vascular surgery but have not been studied extensively. For nonvascular surgery, the degree of hemodynamic cardiac stress dictates the surgery-specific risk. Depending on the noncardiac surgical procedure, it may be associated with profound alterations in heart rate, blood pressure, vascular volume, pain, bleeding, clotting tendencies, oxygenation, neurohumoral activation, and other perturbations. The intensity of these coronary and myocardial stressors helps determine the likelihood of perioperative cardiac events. The perioperative morbidity related to the procedures ranges from 1% to 5%. In these patients who are considered ready to undergo intermediate-risk surgery, there are insufficient data to determine the best strategy (proceeding with the planned surgery with tight heart rate control with beta blockade or further cardiovascular testing if it will change management).