Guidelines for Perioperative Cardiovascular Evaluation for Noncardiac Surgery

Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Perioperative Cardiovascular Evaluation for Noncardiac Surgery)

COMMITTEE MEMBERS

KIM A. EAGLE, MD, FACC, *CHAIR*, BRUCE H. BRUNDAGE, MD, FACC, BERNARD R. CHAITMAN, MD, FACC, GORDON A. EWY, MD, FACC, LEE A. FLEISHER, MD, FACC, NORMAN R. HERTZER, MD, FACC, JEFFREY A. LEPPO, MD, FACC, THOMAS J. RYAN, MD, FACC, ROBERT C. SCHLANT, MD, FACC, WILLIAM H. SPENCER III, MD, FACC, JOHN A. SPITTELL, JR., MD, FACC, RICHARD D. TWISS, MD, FACC

TASK FORCE MEMBERS

JAMES L. RITCHIE, MD, FACC, *CHAIR*, MELVIN D. CHEITLIN, MD, FACC, KIM A. EAGLE, MD, FACC, TIMOTHY J. GARDNER, MD, FACC, ARTHUR GARSON, JR., MD, MPH, FACC, RAYMOND J. GIBBONS, MD, FACC, ROBERT A. O'ROURKE, MD, FACC, THOMAS J. RYAN, MD, FACC

Preamble

Clearly it is important that the medical profession play a significant role in critically evaluating the use of diagnostic procedures and therapies in the management or prevention of disease states. Rigorous and expert analysis of the available data documenting relative benefits and risks of those procedures and therapies can produce helpful guidelines that improve the effectiveness of care, optimize patient outcomes, andimpact the overall cost of care favorably by focusing resources on the most effective strategies.

The American College of Cardiology (ACC) and the American Heart Association (AHA) have produced such guidelines in the area of cardiovascular disease jointly since 1980. This report was directed by the ACC/AHA Task Force on Practice Guidelines, which has as its charge to develop and revise practice guidelines for important cardiovascular diseases and procedures. Experts in a given field are selected from both organizations to examine subject-specific data and write guidelines. Additional representatives from other medical practitioner and specialty groups are included in the writing process when appropriate. Each writing group is specifically charged to perform a formal literature review, weigh the strength of evidence for or against a particular treatment or procedure, and include estimates of expected health outcomes where data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that might influence the choice of particular tests or therapies are considered along with frequency of follow-up and cost-effectiveness.

These practice guidelines are intended to assist physicians in clinical decision making by describing a range of generally acceptable approaches for the diagnosis, management, or prevention of specific diseases or conditions. These guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the physician and patient in light of all of the circumstances presented by that patient.

The ACC/AHA classifications I, II, and III are used in this report to summarize indications for a particular therapy or treatment as follows:

Class I: Conditions for which there is evidence for and/or general agreement that a procedure be performed or a treatment is of benefit.

Class II: Conditions for which there is a divergence of evidence and/or opinion about the treatment.

Class III: Conditions for which there is evidence and/or general agreement that the procedure/treatment is not necessary.

The Committee to Develop Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery was chaired by Kim A. Eagle, MD, and included the following members: Bruce H. Brundage, MD, Bernard R. Chaitman, MD, Gordon A. Ewy, MD, Lee A. Fleisher, MD, Norman R. Hertzer, MD, Jeffrey A. Leppo, MD, Thomas J. Ryan, MD, Robert C. Schlant, MD, William H. Spencer III, MD, John A. Spittell, Jr, MD, and Richard D. Twiss, MD. This document was approved by the ACC Board of Trustees and the AHA SACC/Steering Committee and is being published simultaneously in the *Journal of the American College of Cardiology* and *Circulation* in March 1996. The document was also endorsed by the Society for Cardiovascular Anesthesiologists, the Society for Vascular Surgery, and the North American Chapter of the International Society for Cardiovascular Surgery.

This document was reviewed by three outside reviewers nominated by the ACC and by three outside reviewers nominated by the AHA, as well as reviewers nominated by the American Academy of Family Physicians, the Society for Vascular Surgery, the American Society of Anesthesiologists, and the Society of Cardiovascular Anesthesiologists. The document will be reviewed 2 years after the date of publication and yearly thereafter and considered current unless the Task Force publishes a revision or withdrawal.

James L. Ritchie, MD, FACC
Chair, ACC/AHA Task Force on Practice Guidelines

Executive Summary

Purpose of These Guidelines

These guidelines are intended for physicians involved in the preoperative, operative, and postoperative care of patients undergoing noncardiac surgery. They provide a framework for considering cardiac risk of noncardiac surgery in a variety of patient and operative situations. The overriding theme of these guidelines is that intervention is rarely necessary to lower the risk of surgery. The goal of the task force is the rational use of testing in an era of cost containment.

General Approach

Successful perioperative evaluation and treatment of cardiac patients undergoing noncardiac surgery requires careful teamwork and communication between patient, primary care physician, anesthesiologist, and surgeon. In general, indications for further cardiac testing and treatments are the same as those in the nonoperative setting, but their timing is dependent on such factors as the urgency of noncardiac surgery, the patient's risk factors, and specific surgical considerations. Coronary revascularization before noncardiac surgery to enable the patient to "get through" the noncardiac procedure is appropriate only for a small subset of patients at very high risk. Preoperative testing should be limited to circumstances in which the results will affect patient treatment and outcomes. A conservative approach to use of expensive tests and treatments is recommended.

Preoperative Clinical Evaluation

The initial history, physical examination, and electrocardiographic (ECG) assessment should focus on identification of potentially serious cardiac disorders, including coronary artery disease (CAD) (eg, prior myocardial infarction [MI], angina pectoris), congestive heart failure (CHF), and electrical instability (eg, symptomatic arrhythmias).

In addition to identifying the *presence* of preexisting manifested heart disease, it is essential to define disease *severity*, *stability*, and prior *treatment*. Other factors that help determine cardiac risk include

functional capacity, age, comorbid conditions (eg, diabetes mellitus, peripheral vascular disease, renal dysfunction, chronic pulmonary disease), and type of surgery (vascular procedures and prolonged, complicated thoracic, abdominal, and head and neck procedures considered higher risk).

Further Preoperative Testing to Assess Coronary Risk

Which patients are most likely to benefit from preoperative coronary assessment and treatment? The lack of adequately controlled or randomized clinical trials to define the optimal evaluation strategy has led to the proposed algorithm based on collected observational data and expert opinion. A step-wise Bayesian strategy that relies on assessment of clinical markers, prior coronary evaluation and treatment, functional capacity, and surgery-specific risk is outlined below. A framework for determining which patients are candidates for cardiac testing is presented in algorithmic form. Successful use of the algorithm requires an appreciation for different levels of risk attributable to certain clinical circumstances, levels of functional capacity, and types of surgery. These are defined below, after which the step-by-step algorithm is reviewed.

Clinical Markers. The *major clinical predictors* of increased perioperative cardiovascular risk are unstable coronary syndromes such as recent MI with evidence of important ischemic risk and unstable or severe angina; decompensated CHF, significant arrhythmias (high-grade atrioventricular block, symptomatic arrhythmias in the presence of underlying heart disease, supraventricular arrhythmias with uncontrolled ventricular rate), and severe valvular disease.

Intermediate predictors of increased risk are mild angina pectoris, prior MI, compensated or prior CHF, and diabetes mellitus. *Minor predictors* of risk are advanced age, abnormal electrocardiogram, rhythm other than sinus, low functional capacity, history of stroke, and uncontrolled systemic hypertension.

Functional Capacity. This measurement can be expressed in metabolic equivalent (MET) levels. Multiples of the baseline MET value can be used to express aerobic demands for specific activities. Perioperative cardiac and long-term risk is increased in patients unable to meet a 4-MET demand during most normal daily activities. The Duke Activity Status Index and other activity scales provide the clinician with a set of questions to determine a patient's functional capacity. Energy expenditure for activities such as eating, dressing, walking around the house, and dishwashing can range from 1 to 4 METs. Climbing a flight of stairs, walking on level ground at 6.4 km/h, running a short distance, scrubbing floors, or playing a game of golf equals 4 to 10 METs. Strenuous sports such as swimming, singles tennis, and football exceed 10 METS.

Surgery-Specific Risk. Surgery-specific cardiac risk of noncardiac surgery is related to two important factors: the type of surgery itself and the degree of hemodynamic stress associated with surgery-specific procedures. The duration and intensity of coronary and myocardial stressors can be helpful in estimating the likelihood of perioperative cardiac events, particularly for emergency surgery. Surgery-specific risk for noncardiac surgery can be stratified as high, intermediate, and low. *High-risk* surgery includes major emergency surgery, particularly in the elderly; aortic and other major vascular surgery; peripheral vascular surgery; and anticipated prolonged procedures associated with large fluid shifts and/or blood loss. *Intermediate-risk* procedures include carotid endarterectomy, head and neck surgery, intraperitoneal and intrathoracic, orthopedic, and prostate surgery. *Low-risk* procedures include endoscopic and superficial procedures, cataract surgery, and breast surgery.

Indications for Angiography. Indications for coronary angiography are designated as Class I, conditions for which there is evidence for and/or general agreement that a procedure be performed or a treatment is of benefit; Class II, conditions for which there is a divergence of evidence and/or opinion about the treatment; and Class III, conditions for which there is evidence and/or general agreement that the procedure is not necessary.

Class I indications (helpful), for patients with suspected or proven CAD, are high-risk results during

noninvasive testing; angina pectoris unresponsive to medical therapy; unstable angina pectoris in most patients; and nondiagnostic or equivocal noninvasive test in a high-risk patient undergoing a high-risk procedure.

Class II indications (may be helpful) are intermediate-risk results during noninvasive testing; nondiagnostic or equivocal noninvasive test in a patient at lower risk undergoing a higher risk procedure; urgent noncardiac surgery in a patient recovering from acute MI; and perioperative MI.

Class III indications (not necessary) are low-risk noncardiac surgery in patients with known CAD and low-risk results on noninvasive testing; screening for CAD without appropriate noninvasive testing; patients who are asymptomatic after coronary vascularization and have excellent exercise capacity; mild, stable angina in patients with good left ventricular function and low-risk noninvasive test results; patients who are not candidates for revascularization because of concomitant illness; prior technically adequate normal coronary angiogram within 5 years; severe left ventricular dysfunction in patients not considered candidates for revascularization; and patients unwilling to undergo revascularization.

The following steps correspond to the algorithm presented in Fig 1, page 921.

Step 1. What is the urgency of noncardiac surgery? Certain emergencies do not allow time for preoperative cardiac evaluation. Postoperative risk stratification may be appropriate for some patients who have not had such an assessment before.

Step 2. Has the patient undergone coronary revascularization in the past 5 years? If so, and if clinical status has remained stable without recurrent symptoms/signs of ischemia, further cardiac testing is generally not necessary.

Step 3. Has the patient had a coronary evaluation in the past 2 years? If coronary risk was adequately assessed and the findings were favorable, it is usually not necessary to repeat testing unless the patient has experienced a change or new symptoms of coronary ischemia since the previous evaluation.

Step 4. Does the patient have an unstable coronary syndrome or a major clinical predictor of risk? When elective noncardiac surgery is being considered, the presence of unstable coronary disease, decompensated CHF, symptomatic arrhythmias, and/or severe valvular heart disease usually leads to cancellation or delay of surgery until the problem has been identified and treated.

Step 5. Does the patient have *intermediate clinical predictors of risk*? The presence or absence of prior MI by history or ECG, angina pectoris, compensated or prior CHF, and/or diabetes mellitus helps further stratify clinical risk for perioperative coronary events. Consideration of *functional capacity* and level of *surgery-specific risk* allows a rational approach to identifying patients most likely to benefit from further noninvasive testing.

Step 6. Patients without major but with intermediate predictors of clinical risk and moderate or excellent functional capacity can generally undergo intermediate-risk surgery with little likelihood of perioperative death or MI. Conversely, further noninvasive testing is often considered for patients with poor functional capacity or moderate functional capacity but higher-risk surgery and especially for patients with two or more intermediate predictors.

Step 7. Noncardiac surgery is generally safe for patients with neither major nor intermediate predictors of clinical risk and moderate or excellent functional capacity (4 METs or greater). Further testing may be considered on an individual basis for patients without clinical markers but poor functional capacity who are facing higher-risk operations, particularly those with several minor clinical predictors of risk who are to undergo vascular surgery.

Step 8. The results of noninvasive testing can be used to determine further preoperative management.

Alternatively, the results may lead to a recommendation to proceed with surgery. In some patients, the risk of coronary intervention or corrective cardiac surgery may approach or even exceed the risk of the proposed noncardiac surgery. This approach may be appropriate, however, if it also significantly improves the patient's long-term prognosis.

For some patients, a careful consideration of clinical, surgery-specific, and functional status attributes leads to a decision to proceed to coronary angiography.

Management of Specific Preoperative Cardiovascular Conditions

Hypertension: Severe hypertension should be controlled before surgery when possible. The decision to delay surgery because of elevated blood pressure should take into account the urgency of surgery and potential benefit of more intensive medical therapy. Continuation of preoperative antihypertensive treatment through the perioperative period is critical.

Valvular heart disease: Indications for evaluation and treatment of valvular heart disease are identical to those in the nonoperative setting. Symptomatic stenotic lesions are associated with risk of perioperative severe CHF or shock and often require percutaneous valvotomy or valve replacement before noncardiac surgery to lower cardiac risk. Symptomatic regurgitant valve disease is usually better tolerated perioperatively and may be stabilized preoperatively with intensive medical therapy and monitoring. Regurgitant valve disease is then treated definitively with valve repair or replacement after noncardiac surgery. This is appropriate when a wait of several weeks or months before noncardiac surgery may have severe consequences. Exceptions may include severe valvular regurgitation *with* reduced left ventricular function, in which overall hemodynamic reserve is so limited that destabilization during perioperative stresses is very likely.

Myocardial disease: Dilated and hypertrophic cardiomyopathy are associated with increased incidence of perioperative CHF. Management is aimed at maximizing preoperative hemodynamic status and providing intensive postoperative medical therapy and surveillance. An estimate of hemodynamic reserve is useful for anticipating potential complications from intraoperative and/or postoperative stress.

Arrhythmias and conduction abnormalities: The presence of an arrhythmia or cardiac conduction disturbance should provoke a careful evaluation for underlying cardiopulmonary disease, drug toxicity, or metabolic abnormality. Therapy should be initiated for symptomatic or hemodynamically significant arrhythmias, first to reverse an underlying cause and second to treat the arrhythmia. Indications for antiarrhythmic therapy and cardiac pacing are identical to the nonoperative setting.

Supplemental Preoperative Evaluation

No specific recommendations can be made for individual patients. The following should be considered appropriate as indicated in specific situations: resting left ventricular function, exercise stress testing, pharmacological stress testing, ambulatory ECG monitoring and coronary angiography. In most ambulatory patients the test of choice is exercise ECG testing, which can both provide an estimate of functional capacity and detect myocardial ischemia through changes in the ECG and hemodynamic response. In patients with important abnormalities on their resting ECG (left bundle branch block, left ventricular hypertrophy with strain pattern, digitalis effect, etc), other techniques such as exercise echocardiography or exercise myocardial perfusion imaging should be considered.

Implications of Risk Assessment Strategies on Costs

The degree of variation surrounding preoperative testing before noncardiac surgery is substantial. Cost-effectiveness analyses of various methods of preoperative testing and treatments have also yielded highly varied results. It is important for the clinician to consider the cost implications of screening strategies and, when possible, to rely on generally accepted strategies for treating patients in the nonoperative setting.