CME CREDIT

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The preoperative evaluation: Use the history and physical rather than routine testing

ABSTRACT

The history and physical examination, rather than routine laboratory, cardiovascular, and pulmonary testing, are the most important components of the preoperative evaluation. The history should include a complete review of systems (especially cardiovascular and pulmonary), medication history, allergies, surgical and anesthetic history, and functional status.

KEY POINTS

Laboratory testing should be selective and justified by specific findings on the history or physical examination.

Lee et al (*Circulation* 1999; 100:1043–1049) devised a simple index of cardiac risk based on the presence or absence of six factors: high-risk surgery, ischemic heart disease, congestive heart failure, stroke or transient ischemic attack, insulin-dependent diabetes mellitus, and serum creatinine concentration greater than 2 mg/dL.

All patients at risk undergoing surgery should receive a selective beta-blocker such as metoprolol 50 mg twice daily, starting 1 week before surgery.

Noninvasive cardiac stress testing is reserved for patients at uncertain or high risk.

PATIENTS UNDERGOING SURGERY today are older, have more chronic medical conditions, and are taking more medications than patients a decade ago.[1–4] Complications are frequent, and cardiovascular events remain the leading cause of perioperative death.[5] The annual cost of perioperative cardiovascular morbidity in the United States alone is more than $20 billion.[6]

The preoperative evaluation holds the potential to reduce complications and health care costs. Yet a standard preoperative evaluation has not been defined, and routine laboratory, cardiovascular, and pulmonary tests are often performed without justification. The Joint Commission for the Accreditation of Hospitals requires all surgical patients to have a history and physical examination documented in the medical record within 30 days before surgery, but it does not define the components of the history or physical examination.

In this paper we discuss the essential elements of the preoperative evaluation, noting that many tests should not be routinely performed, but should be guided by the findings of the history and physical examination.

THE BASICS OF THE PREOPERATIVE EVALUATION

The basics of the preoperative evaluation are a comprehensive history, a detailed physical examination, and selected laboratory tests.

The history

The history is the most important component of the preoperative evaluation. In conducting

The Preoperative Evaluation Center

Many hospitals now have preoperative evaluation centers through which multidisciplinary health care providers with clinical experience in perioperative care can apply a uniform and consistent preoperative evaluation to all surgical patients. These centers have demonstrated reductions in surgery cancellation rates, the use of preoperative laboratory tests and medical consultations, and improved adherence to perioperative practice guidelines.[7–11]

The structure of the preoperative evaluation center varies from hospital to hospital, and there is no evidence that one structure is better than another, nor is their evidence to suggest a specific physician specialty should perform the preoperative evaluation.

At The Cleveland Clinic, all surgical patients are reviewed by the anesthesiology department either on the day of surgery or before. Medically complex patients are also referred to an internal medicine consultation clinic, called the IMPACT Center, before being seen by an anesthesiologist.

Communication with the surgical team is the cornerstone of perioperative medical consultation. The specific role of the medical consultant in the preoperative evaluation is to:

- Make precise medical diagnoses
- Evaluate the extent of organ disease
- Optimize all medical conditions
- Assess and describe physiologic limitations
- Ensure adequate postoperative follow-up.

A thorough preoperative evaluation optimizes outcome

the interview, the physician needs adequate time and interviewing skills. The history should include:

A complete review of systems to look for undiagnosed disease or inadequately controlled chronic disease. The review of systems, in conjunction with the medical history, can also identify risk factors for perioperative complications, such as alcohol or tobacco use, recent chest pain, history of deep venous thrombosis, or prior hospitalization for asthma.

An extensive medication history. This should include over-the-counter medications and herbal supplements. Recent use of anticoagulants, aspirin, and nonselective nonsteroidal anti-inflammatory drugs (NSAIDs) must be specifically sought.

Allergies, particularly allergies to rubber products and to foods associated with latex reactions, such as bananas, avocados, kiwis, apricots, and chestnuts.

Surgical and anesthetic history. Patients with a history of bleeding complications should be carefully assessed for coagulation disorders. Reactions to anesthetics by the patient or family members should raise concerns about susceptibility to malignant hyperthermia. Patients with malignant hyperthermia susceptibility require an anesthesia consultation, appropriate preparation of the operating room, and adequate equipment and expertise in the event of a malignant hyperthermic reaction.

Functional status. In addition to identified risk factors, self-reported exercise tolerance is the foundation of cardiovascular risk stratification (see discussion below) and is an independent predictor for postoperative cardiovascular complications.[12] Activity scales such as the Duke Activity Status Index[13] can help quantify the estimated metabolic equivalents generated with daily activities. For example, in formal cardiac testing, the ability to perform greater than 4 metabolic equivalents has been associated with a lower cardiovascular risk.[14] Questions about and discussion of daily activities can also help determine functional status.

The physical examination

The physical examination should build on the information gathered during the history.

For example, patients with identified chronic organ diseases such as congestive heart failure or chronic obstructive lung disease should be evaluated for uncompensated disease. Patients with a history of heavy alcohol use should be assessed for stigmata of chronic liver disease with concomitant concern for postoperative alcohol withdrawal syndromes and delirium.

Anything found in the review of systems should be addressed, particularly a new cough, fever, or symptoms of infection.

All patients should receive a thorough cardiovascular and pulmonary examination and should be asked about chronic or recent infections. Unexpected abnormal findings on the physical examination should be fully characterized and investigated before elective surgery.

LABORATORY TESTING

Although laboratory testing is part of the preoperative evaluation, it should be recognized as optional.

Preoperative testing accounts for about $30 billion in health care costs each year.[15] The value of routine testing before elective surgery is unclear,[16] as most abnormalities in laboratory values can be predicted from the patient's history and findings of the physical examination. In addition, abnormalities discovered on laboratory testing often do not lead to changes in perioperative care.[17]

Preoperative testing should therefore be viewed as selective and not routine. It cannot replace a comprehensive history and review of systems. All tests should be justified by a specific symptom, sign, or diagnosis identified during the history or physical examination.

ASSESSING CARDIOVASCULAR RISK

Cardiac risk assessment is a critical component of the preoperative evaluation. Yet, although a great deal of research has gone into how to identify patients at risk,[18–24] little has been done to compare the various methods of risk assessment, and their overall accuracy has been questioned.[25]

Many risk assessment methods use complicated algorithms and point scoring systems that can be challenging to use clinically. In addition, very little is known about strategies that may improve outcomes for patients identified at risk.

In actual practice, physicians should apply an overall risk equation defined by the patient's disease (patient risk) and the degree of surgical stress (procedural risk). How patient risk is evaluated and to what extent noninvasive cardiac stress testing is employed can be strongly affected by local factors and institutional practice.

TABLE 1

The Lee index for assessing perioperative cardiovascular risk

One point for each of the following:

- High-risk surgery
- History of ischemic heart disease
- Congestive heart failure
- Cerebrovascular disease
- Insulin-dependent diabetes mellitus
- Serum creatinine > 2.0 mg/dL

TOTAL POINTS	COMPLICATION RATE*
0	0.4%
1	1%
2	7%
≥ 3	11%

*Myocardial infarction, pulmonary edema, ventricular fibrillation or primary cardiac arrest, complete heart block.

DATA FROM LEE TH, MARCANTONIO ER, MANGIONE CM, ET AL. DERIVATION AND PROSPECTIVE VALIDATION OF A SIMPLE INDEX FOR PREDICTION OF CARDIAC RISK OF MAJOR NONCARDIAC SURGERY. CIRCULATION 1999; 100:1043–1049.

Lab testing has a limited role in preoperative evaluation

The Lee risk index

Lee et al[26] performed a prospective cohort study to try to simplify the preoperative assessment of cardiac risk. Major cardiac complications were defined as myocardial infarction, pulmonary edema, ventricular fibrillation, primary cardiac arrest, or complete heart block. Six independent correlates of major cardiac complications were identified (TABLE 1):

- High-risk surgery (intrathoracic, suprainguinal vascular, or intraperitoneal procedure)
- History of ischemic heart disease
- History of congestive heart failure
- History of stroke or transient ischemic attack
- Insulin-dependent diabetes mellitus
- A serum creatinine concentration greater than 2 mg/dL.

TABLE 2

Indications for preoperative noninvasive cardiac testing: The ACC/AHA guidelines

Testing is indicated if any two of the following factors are present:

1 Intermediate clinical predictor
- Canadian class 1 or 2 angina
- Prior myocardial infarction based on history or pathologic Q waves
- Compensated or prior heart failure
- Diabetes

2 Poor functional capacity (less than 4 metabolic equivalents)

3 Procedure with high surgical risk
- Emergency surgery
- Aortic repair or peripheral vascular surgery
- Prolonged surgical procedure with large fluid shifts or blood loss

MODIFIED WITH PERMISSION FROM: LEPPO JA, DAHLBERG ST. THE QUESTION: TO TEST OR NOT TO TEST IN PREOPERATIVE CARDIAC RISK EVALUATION. JNUCL CARDIOL 1998; 5:332–342.

The investigators found that simply assigning 1 point for each factor present and adding up the points was as accurate in predicting cardiac risk as a complicated weighting system derived by logistic regression analysis. Compared with the Goldman, Detsky, and American Society of Anesthesiology methods of preoperative risk assessment,[26] the new Lee risk index was statistically more accurate.

Noninvasive cardiac stress testing has not been shown to improve perioperative care

Noninvasive cardiac stress testing questioned

Much like the situation with laboratory testing, there is no convincing evidence that routine noninvasive cardiac stress testing improves perioperative care.[16,27,28]

Practice guidelines recommend that noninvasive cardiac stress testing be reserved for patients with poor functional class or whose clinical risk is unclear,[22,24] despite a history, physical, and electrocardiographic evaluation. Moreover, a growing body of literature demonstrates that beta-blockers are cardioprotective when given perioperatively to patients undergoing noncardiac surgery,[5,6,29–33] further bringing into question the need for noninvasive cardiac stress testing (see below).

Boersma et al[34] retrospectively evaluated the relationships among the findings on dobutamine stress echocardiography, a modified Lee risk index (age over 70, current angina, history of myocardial infarction, cerebrovascular accident, diabetes mellitus, chronic renal failure), and beta-blocker therapy in vascular surgery patients. The main outcomes assessed were cardiac death and nonfatal myocardial infarction. Findings:

- Patients with 0 to 2 points who received beta-blockers had a low rate of cardiac complications (< 1%), irrespective of the findings on dobutamine stress echocardiography.
- Patients with a modified Lee risk index of 3 or higher who received beta-blockers also had a low rate of cardiac complications (< 1.2%)—if the dobutamine study was normal or showed fewer than four segments with new wall-motion abnormalities. However, the rate of cardiac complications was significant (> 6%) in patients with a profoundly abnormal dobutamine stress echocardiographic study, irrespective of whether they took beta-blockers.

This study suggests that patients with a Lee risk index of 0 to 2 can be given a beta-blocker and can proceed directly to surgery, with a low risk of complications. Patients with a score of 3 or more should be considered for further risk stratification via noninvasive cardiac stress testing but may still be at an acceptable risk level to undergo surgery while on beta-blockers if the stress test is normal.

ACC/AHA guidelines

The American College of Cardiology (ACC) and the American Heart Association (AHA) recently updated their joint guidelines on

perioperative cardiovascular evaluation in patients undergoing noncardiac surgery.[35]

As in past guidelines, cardiac stress testing and optimization of cardiac function are recommended for patients with acute symptoms such as unstable coronary syndromes, uncompensated heart failure, or symptomatic arrhythmias. However, most patients do not have acute symptoms at the time of the preoperative evaluation.

The new ACC/AHA guidelines offer a shortcut to the decision regarding noninvasive cardiac stress testing that emphasizes the patient's functional status (TABLE 2). In general, the history and physical examination usually determine the patient's risk profile. If the risk profile is unclear, then noninvasive cardiac stress testing should be performed. Noninvasive cardiac stress testing should also be performed if the patient is thought to be at high risk, to further stratify the risk.

Most patients whose risk profile is unclear will need a pharmacologic stress test. In many instances, either stress perfusion or stress echocardiography is appropriate, as their predictive values are similar.[36]

All patients with cardiovascular risk factors should receive beta-blockers perioperatively unless strongly contraindicated.

PULMONARY RISK

Postoperative pulmonary complications such as pneumonia, atelectasis, and bronchospasm increase patient morbidity and mortality and prolong the length of hospital stay after surgery.[37,38]

Pulmonary risk factors

Pulmonary risk factors have been identified (TABLE 3),[39] but there has been no well-accepted tool to predict the risk of perioperative pulmonary complications as there is for predicting cardiac risk.

Arozullah et al[40] developed a risk-prediction tool for postoperative pneumonia in a Veterans Administration patient population. Variables included the type of surgery scheduled (abdominal aortic aneurysm repair; thoracic, upper abdominal, neck, or vascular surgery; and neurosurgery), age, functional status, weight loss, chronic obstructive pulmonary disease, general anesthesia, impaired sensorium, cerebral vascular accident, blood urea nitrogen level, transfusion, emergency surgery, long-term steroid use, smoking, and alcohol use.

TABLE 3

Risk factors for postoperative pulmonary complications

- Smoking
- Poor exercise tolerance
- Chronic obstructive pulmonary disease
- Surgical site
  - Upper abdominal, thoracic
  - Lower abdominal
- Surgery longer than 3 hours
- General anesthesia*

*Most studies have identified regional anesthesia as safer in regard to postoperative pulmonary complications, but there are conflicting data.

Unfortunately, the clinical usefulness of this index is uncertain, since its predictor variables include specific surgical procedures not found in many presurgical referral populations.

The most important predictor of pulmonary risk is the surgical site, and that risk increases as the incision approaches the diaphragm.

Pulmonary risk increases as the surgical incision approaches the diaphragm

The most important modifiable risk factor is smoking. Although smoking cessation leads to beneficial physiologic effects in only 48 hours, the risk for postoperative pulmonary complications declines only after 8 weeks of preoperative cessation.[41]

The role for preoperative pulmonary function testing remains uncertain. No data suggest that spirometry identifies a high-risk group that would not otherwise be predicted by the history and physical examination.

Steps to reduce pulmonary risk

Preoperative measures to reduce the risk of perioperative pulmonary complications include smoking cessation and aggressive treatment of active lung disease. Combinations of bronchodilators, physical therapy, antibiotics, and corticosteroids have been shown to reduce the risk of postoperative pulmonary complications

TABLE 4

Preoperative pulmonary risk-reduction strategies

Encourage smoking cessation for at least 8 weeks preoperatively
Treat airflow obstruction in patients with chronic obstructive pulmonary disease or asthma
Give antibiotics and delay surgery if pulmonary infection is present
Begin patient education regarding lung-expansion maneuvers

in patients with chronic obstructive pulmonary disease. Asthma patients should be free of wheezing, and short courses of oral steroids do not increase the incidence of infection.[42]

The mainstay of postoperative pulmonary risk reduction is lung expansion. Lung-expansion techniques include deep-breathing exercises, incentive spirometry, and continuous positive airway pressure. Preoperative education in lung-expansion maneuvers reduces pulmonary complications to a greater degree than instruction that begins after surgery.[39,43]

Preoperative pulmonary risk-reduction strategies are summarized in TABLE 4.

MEDICATION RECOMMENDATIONS

All patients at risk for cardiovascular events should receive a selective beta-blocker

Which medications should be continued perioperatively and which should be held? Instructions for preoperative medication use are an integral part of the preoperative evaluation, but there is little evidence to guide clinicians in this regard.

In one study, Devereaux et al[44] demonstrated that perioperative recommendations for cardiac medication use varied significantly among medical consultants. The investigators concluded that these differences may affect patient outcomes and highlight the need for randomized clinical trials to determine the impact of perioperative drug administration on surgical outcomes.

As a general principle, most prescription medications should be continued on the morning of surgery with small sips of water, unless specifically contraindicated.

Cardiovascular drugs

As mentioned above, all patients at risk for cardiovascular events should receive a selective beta-blocker. The optimum dose and length of preoperative beta-blocker therapy is not known, but metoprolol 50 mg twice daily, starting 1 week before surgery, closely mirrors research experience.[35]

By convention, diuretics and angiotensin-converting enzyme (ACE) inhibitors are usually withheld the day of surgery, although we have no convincing data supporting the safety or efficacy of this practice.

Diabetic medications

Patients with diabetes should generally not take medications such as metformin or oral hypoglycemics on the day of surgery. In most cases involving diabetic patients, elective surgery is performed as a "first morning case," and patients who take insulin are advised not to take their morning insulin until they arrive at the surgery center, depending of course on the time of surgery and the patient's diabetic history. It may be appropriate to instruct patients to take half of their total insulin requirement in a long-acting insulin preparation (eg, Humulin NPH).

Herbal supplements

Recently, the American Society of Anesthesiology examined the use of herbal supplements and the potentially harmful drug interactions that may occur with continued use of these products preoperatively.[45,46] These supplements include ginkgo biloba, St. John's wort, ginseng, saw palmetto, kava, and Echinacea. All patients are requested to discontinue their herbal supplements at least 2 weeks prior to surgery.

Drugs that potentiate bleeding

The use of medications that potentiate bleeding needs to be evaluated closely, with a risk-benefit analysis for each drug, and with a recommended time frame for discontinuation based on drug clearance and half-life charac-

teristics. Typically, patients whose risk of bleeding exceeds their risk of thrombosis should refrain from preoperative use of aspirin for 7 to 10 days, nonselective nonsteroidal anti-inflammatory drugs for 3 to 5 days, and thienopyridines (such as clopidogrel) for a full 2 weeks before surgery.

Selective cyclooxygenase-2 (COX-2) inhibitors do not potentiate bleeding and may be continued until surgery. However, caution should be exercised after surgery because of a theoretical increase in risk of cardiovascular events.

The perioperative management of patients taking warfarin is beyond the scope of this article. However, as a general rule, the patient may have surgery as long as the international normalized ratio is less than 1.5.[48]

ADDITIONAL RECOMMENDATIONS

Each surgical patient should be assessed for risk for surgical site infections, bacterial endocarditis, and venous thromboembolism. Depending on the findings, recommendations should be made regarding appropriate prophylaxis against these conditions. Practice guidelines for each of these topics are reviewed elsewhere.[48–50]

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