The preoperative evaluation and use of laboratory testing

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A thorough preoperative evaluation requires a medical consultant's time and skill. The primary elements of the evaluation are a comprehensive history, a focused physical examination, and effective communication with the surgical team.

Preoperative laboratory testing can be a valuable tool in the preparation of the evaluation, but should be conducted on a selective rather than routine basis. When laboratory testing is ordered without being justified by a specific sign, symptom, or indication, the clinical benefits are minimal and the costs are high.

This article outlines the specific components of the preoperative evaluation and offers guidelines for the use of laboratory testing.

ROLE OF THE MEDICAL CONSULTANT

Contrary to dogma, the role of the medical consultant is not to "clear" the patient for surgery, which would suggest that no problems will occur. Instead, it is to make a precise medical diagnosis, evaluate the extent of organ disease, optimize medications, assess and describe physiologic limitations, and ensure adequate postoperative care and follow-up care. Recommendations for anesthesia should be left to the anesthesiologist.

PREOPERATIVE EVALUATION

The purpose of the preoperative evaluation is to provide information for the surgeon, anesthesiologist, or perioperative team that will assist in determining the best plan of action for the patient. The preoperative evaluation entails a thorough review and documentation of the patient's history as well as a complete review of systems. The evaluation should incorporate drug history, surgical and anesthetic history, alcohol and tobacco use, allergies to drugs and latex, bleeding history, functional class, and physical examination.

Drug history

Ask patients which medications they are taking, including all prescription medications, over-the-counter drugs, and alternative or herbal therapies. Unless specifically asked, patients often do not mention herbal therapies.

Herbal therapies. Tsen et al[1] found that 22% of patients were taking herbal therapies at the preoperative visit, most commonly echinacea, ginkgo biloba, St. John's wort, garlic, or ginseng. Additionally, Harnack et al[2] reported that 61% of 376 adults surveyed in a large metropolitan area had used herbal products within the past 12 months.

All herbal therapies have properties that may affect surgical outcome (Table 1). Herbal therapies to be avoided preoperatively are the "three Gs": ginseng, garlic, and ginkgo biloba. Each of these herbs inhibits platelet activity, which increases the potential for bleeding. Patients should therefore be advised to not take any of these three therapies close to the time of surgery (see article on perioperative medication management, page S82 of this supplement, for specific recommendations on when to stop these therapies).

Latex allergy

Although latex allergy is uncommon in the general population, it occurs in about 5% to 10% of patients in high-risk groups. High-risk groups for latex allergy include patients with spina bifida, those with chronic urologic problems who frequently undergo bladder catheterization, patients with a history of atopic dermatitis, and health care workers.

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Functional class

The Duke Activity Status Index, a brief self-administered questionnaire, is a useful tool for determining and documenting the degree of physiologic stress that patients can handle.[3] The index includes a number of common physical activities ranging from running to being bedbound, and places the patient into one of four functional classes based on the single most difficult activity that he or she can perform (Table 2). A metabolic equivalent is listed for each functional classification.

The risk of perioperative cardiovascular complications is low for patients reporting that they can tolerate 4 or more metabolic equivalents of activity, but most patients do not participate in regular physical activity.

Occasionally, further questioning or observation will reveal a discrepancy between the patient's reported level of activity and actual level of activity. For instance, a patient who reports mowing the lawn every week may be riding a lawn tractor rather than pushing a mower. Another patient may say that he plays tennis three times a week but is observed to have trouble getting out of a chair and onto the examining table.

In a study of 600 consecutive outpatients undergoing preoperative evaluation for 612 major noncardiac procedures, Reilly et al[4] confirmed the validity of self-reported exercise tolerance in predicting perioperative risk.

Physical examination

The physical examination should be focused and should constitute less than 15% of the preoperative medical evaluation, since little that is uncovered during the physical examination would not have already been predicted by talking with the patient and learning about active symptoms.

Nevertheless, important information can be gleaned from the physical examination. One of the most obvious tasks is visual examination of the planned incision site for abnormalities. Other signs not to be missed are lack of range of motion in the neck, poor teeth, gum abscesses, irregular pulses or bruits, signs of edema, petechiae, hemorrhage, clubbing of fingers, and organomegaly.

Communicating findings with the clinical team

An important part of the preoperative evaluation is communication with the surgeon, anesthesiologist, and overall perioperative team.

Summarize your preoperative evaluation by listing the diagnoses and functional class in a quantitative way and by outlining the perceived risks for perioperative complications. This information should be the basis for determining whether to proceed with surgery or perhaps to do a less invasive procedure with shorter operating time.

The preoperative evaluation should include general recommendations in relation to further cardiac risk stratification, medications, prophylaxis for venous thromboembolism or subacute bacterial endocarditis, and postoperative care issues.

TABLE 1
Potential effects of preoperative use of common herbal therapies

Echinacea	Immunostimulant; hepatotoxicity
Ginseng	Platelet inhibitor; hypoglycemia
Garlic	Platelet inhibitor; preload reduction
Ginkgo	Platelet inhibitor; alters vasoregulation
St. John's wort	Upregulates P450; drug-drug reactions
Ephedra	Alters vasoregulation; hypertension; ventricular arrhythmias
Kava	Potentiates sedation; drug-drug reactions

ROLE OF LABORATORY TESTING

Preoperative laboratory testing should be selective, not routine. A routine test is a screening test for which an abnormality would be unexpected.[5–10] All preoperative testing should be justified based on a specific sign, symptom, or diagnosis.

Normal laboratory test results obtained 4 to 6 months before surgery may be used as preoperative tests, provided there has been no change in the clinical status of the patient, according to MacPherson et al.[11] They found that less than 2% of test results conducted 4 months before surgery had changed at the time of the clinical evaluation.

Abnormal test results

Two standard deviations from the mean, or 2.5% above or below the cutoff point for the reference range of a particular preoperative test, is considered abnormal for continuous variables. When a single laboratory test is conducted in a population without known disease, 5% of subjects can be expected to have an abnormal value; when a chemistry panel of 20 tests is ordered, the likelihood of one abnormal result rises to 64%.[9]

Remarkably, clinicians ignore 30% to 60% of

TABLE 2
Functional class: Duke Activity Status Index

Functional class	Metabolic equivalents	Activity
I	> 8	Run, swim, play tennis, ski
II	4–5	Yardwork, climb stairs, walk up a hill
III	< 4	Light housework, grocery shopping, walking
IV	< 4	Bedbound, limited activities of daily living

Adapted from reference 3.

abnormalities found on routine preoperative tests.[12] Ignoring abnormal test results can have legal ramifications, so reviewing the results of tests ordered is obviously important.

Diagnostic abilities of tests

The true diagnostic abilities of the tests ordered should be understood. For example, the sensitivity of an electrocardiogram for detection of coronary artery disease (CAD) is 0.27, and its specificity is 0.81. Assuming a prevalence of CAD of 20% would yield 162 positives in 2,000 patients being screened, of which 108 would be false, leading to possible subsequent unnecessary testing. On the other hand, the diagnosis would be missed in 146 patients who would be sent off to surgery despite having occult CAD.

Clinical value of testing: More is usually not better

A mistaken belief exists that voluminous information obtained from preoperative laboratory testing, regardless of how extraneous, enhances the safety of care. In reality, considerable data suggest that these tests are not needed. Additionally, the cost for preoperative evaluation is great: 10% of the more than $30 billion spent on laboratory testing each year is for preoperative evaluation.[8]

The clinical benefits of laboratory tests have been evaluated in several studies. Korvin et al[13] reviewed the test results of 1,000 patients who each underwent 20 chemical and hematologic tests during admissions screening, for a total of almost 20,000 tests. Of the 2,223 abnormal results found, 675 had been predicted on clinical assessment, 1,325 abnormalities did not yield new diagnoses, and 223 led to 83 new diagnoses in 77 patients. None of the diagnoses, however, was found to be unequivocally beneficial.

Kaplan et al[7] studied randomly selected test result samples of 2,000 patients who had undergone routine laboratory screening before having elective surgery. Of 2,785 preoperative admissions tests studied (1,828 not indicated), 96 were abnormal, 10 were unanticipated, and only 4 were clinically significant.

Turnbull and Buck[14] also reviewed the results of routine tests conducted before elective surgery. Of 5,003 tests ordered, 225 had abnormal results, 104 were judged clinically relevant, and only 4 may have resulted in clinical benefit. A similar analysis by Rucker et al[15] of 905 surgical admissions, 872 of whom had chest radiographs, who were screened for the presence of clinical risk factors revealed that 368 had no risk factors, and only one serious abnormality was found in these 368 patients. Of the 504 patients with identifiable risk factors, 22% had serious abnormalities, all of which had been predicted previously by the history and physical examination.

Lawrence et al[16] conducted a cost analysis of routine urinalysis before total knee replacement surgery. Assuming the incidence of wound infection to be approximately 1%, that 10% of urinalysis results reveal infection, and that each positive urinalysis result increases the risk of total knee replacement wound infection by about 1%, routine urinalysis was found to potentially prevent wound infection in 0.001% of patients annually at a cost of $1.5 million.

TESTING GUIDELINES

Recommendations for tests should be based on a sign, symptom, or diagnosis for which abnormalities would likely be expected. Tests to consider include a chemistry profile, complete blood count, coagulation profile, aspartate transaminase/alanine transaminase (AST/ALT), and urinalysis (Table 3).

Chemistry profile. Some clinicians have advocated a chemistry profile to check renal function before major surgery in all patients older than 50 years[9] because renal insufficiency is a potent predictor of postoperative complications in both cardiac and noncardiac surgery.[17,18]

Coagulation profile. A coagulation profile (including prothrombin time and partial thromboplastin time) is generally ordered because we believe it is safer to know whether or not a patient has proper clotting ability. Yet most scientific evidence shows that ordering these tests does not add clinical value unless the patient has a history of abnormal bleeding. Abnormal coagulation times in asymptomatic patients usually lead to additional testing that does not change the operative management or outcome.

Liver function tests. Signs of chronic liver dis-

ease or alcohol use are obvious indications for AST/ALT tests. Albumin may be measured because we believe that it is a potent predictor of perioperative complications in older patients having major surgery. This laboratory value, however, probably is not often found to be abnormal in an unanticipated fashion.

Electrocardiography. Some clinicians have also advocated ordering an electrocardiogram before major surgery for all patients older than 50 years. Yet electrocardiographic results do not generally alter the perioperative plan, except for patients with a history of cardiac problems.

Pulmonary function tests. The American College of Physicians promulgates guidelines for the use of pulmonary function tests, but these tests (like radiographs) are probably of little clinical utility except for patients being assessed prior to coronary artery bypass graft surgery or lung resection. Order these tests infrequently unless the patient has signs of pulmonary disease.

TABLE 3
Guidelines for preoperative laboratory testing

Test	Indications
Chemistry profile	History of hypertension, diuretic use, COPD or obstructive sleep apnea, diabetes, renal disease, chemotherapy
Complete blood count	History of fatigue, dyspnea on exertion, liver disease, blood loss, signs of coagulopathy, tachycardia
Coagulation profile	History of VTE, warfarin use, signs of coagulopathy, chronic liver disease
AST/ALT	Signs of chronic liver disease, hepatitis, alcohol abuse
Urinalysis	Signs of cystitis, genito-urologic procedure
Electrocardiogram	History of hypertension, diabetes, tobacco use, hyperlipidemia, CAD, arrhythmia, CHF, family history or signs of heart disease, syncope
Echocardiogram	Uncharacterized murmurs, signs of cor pulmonale, decompensated CHF
Chest radiograph	Signs of pulmonary disease
Pulmonary function tests	Signs of pulmonary disease, lung resection, CABG
Carotid duplex ultrasound	Carotid bruits, signs of stroke or transient ischemic events

COPD = chronic obstructive pulmonary disease; VTE = venous thromboembolism; AST/ALT = asparate aminotransferase/alanine aminotransferase; CAD = coronary artery disease; CHF = congestive heart failure; CABG = coronary artery bypass graft surgery

CONCLUSIONS

A thorough preoperative evaluation is an important first step in achieving a good perioperative outcome. The evaluation should concentrate on a comprehensive history and a focused physical examination. Laboratory tests should not be "routine" but should instead be selected based on a specific sign, symptom, or diagnosis.

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