CHAPTER 15

GUIDELINES FOR PREOPERATIVE LABORATORY TESTING

Jenna Song, DPM

INTRODUCTION

The preoperative assessment is designed to assess risks relevant to the perioperative period, where the goals are to evaluate patient readiness for anesthesia and surgery, optimize patient health before surgery, enhance the quality of perioperative care, reduce the morbidity of surgery and length of stay, and return the patient to normal functioning (1,2). Preoperative laboratory testing is a major component of the assessment that helps to discover or identify a disease or disorder that may affect perioperative anesthetic care, and to verify or assess an already known disease or disorder that may affect perioperative anesthetic care (3).

ROUTINE VERSUS INDICATED LABORATORY TESTING

What tests are indicated for each specific patient? For more than a decade, it was common practice to use routine screening tests for all surgical patients, but routine preoperative testing of all patients before elective surgery is unjustified. Little evidence exists that test result abnormalities are associated with perioperative morbidity and a number of articles demonstrated that routine preoperative testing was not cost-effective and did not benefit the patient. Kaplan and colleagues, in a retrospective study of 2,000 patients undergoing elective surgery, demonstrated that 60% of routinely ordered tests would not have been performed if testing had only been done for recognizable indications, and that only 0.22% of the abnormal results influenced perioperative management (4).

Benarroch-Gampel et al, reviewed 73,596 patients undergoing elective surgery and found that preoperative tests were performed in 63.8% of patients; 61.6% of these patients had at least one abnormal test result but underwent surgery despite abnormal results. After adjusting for patient and procedure characteristics, neither preoperative testing nor the abnormal test results were associated with adverse postoperative outcomes and they concluded that preoperative testing is overused in patients undergoing low risk, ambulatory surgery (5).

While preoperative laboratory testing is not routinely indicated because it is neither cost-effective nor beneficial to the outcome (6), selective laboratory testing, as indicated by a complete history and physical, is appropriate in specific circumstances, including patients with known underlying diseases or risk factors that would affect operative management or increase risk, and for specific high-risk surgical procedures (7, 8).

LABORATORY STUDIES

So then, what laboratory studies should we order? Several standardized guidelines exist for determining the appropriateness of testing including the American Heart Association/American College of Cardiology guidelines as well as those of the American Society of Anesthesiology (3, 9). Also, each group, institute, or system within which the perioperative system resides should have its own explicit guidelines for testing and process. Table 1 is a generalized guideline from DeKalb Medical Center to determine the appropriate preoperative laboratory studies for each individual. This guide will be referenced throughout this article. Specific laboratory studies commonly ordered for preoperative evaluations include a complete blood count, electrolytes, renal function, blood glucose, hemostasis evaluation, and electrocardiogram. These tests will be discussed and indications for their use in specific populations and surgeries will be presented.

Complete Blood Count (CBC)

The CBC is one of the most common laboratory tests performed today. It gives information about the production of all blood cells and identifies the patient's oxygen-carrying capacity through the evaluation of red blood cell indices, hemoglobin, and hematocrit. It also provides information about the immune system through the evaluation of the white blood cell count with differential, and indicates how fast blood can clot through platelet counts (10). Clinical characteristics to consider as indications for CBC include history suggesting underlying anemia, bleeding, and other hematologic disorders, patients with liver disease, extremes of age, and/or if a significant blood loss is anticipated during the surgery (2, 3, 10) (Table 1). Decreased levels of red blood counts, hemoglobin, and hematocrit are associated with hemodilution and anemia from chronic diseases or blood loss. Anemia is reported in approximately 1% of asymptomatic patients, and surgically significant anemia has an even lower prevalence (4). But one study showed that mild degrees of preoperative anemia were associated

with an increase in 30-day postoperative mortality in older veterans undergoing major noncardiac surgery even without significant blood loss (11). So, it is reasonable to check a baseline hemoglobin measurement for all patients 65 years of age or older and for younger patients undergoing surgery with expected major blood loss (Table 1). Transfusion is indicated for hemoglobin <6 g/dl and severe anemia causes postponement or cancelation of a surgical procedure for further evaluation (10).

An elevated white blood count (leukocytosis) can result from conditions such as bacterial infections, inflammations, leukemia, or stress and a decrease in the count (leukopenia) can result from immune system disease or chemotherapy (10). The surgeon and anesthesiologist will be notified for elevations in the white blood count >11,000, or decreases <4,500. Increased platelet counts (thrombocytosis) may be seen as a physiologic response to physical stress, exercise, trauma, and infection when there is no significant medical problem, but persistent increases may be a sign of a blood disorder. Decreased platelet counts (thrombocytopenia) occur with bleeding abnormalities, bone marrow disease, immune disorders, and chemotherapy. Bleeding usually does not occur until counts fall below 50,000 μ/l where increased viscosity and inappropriate clotting may occur in severe thrombocytosis (greater than 1,000,000 μ/l) (10). The frequency of significant unsuspected white blood cell or platelet abnormalities is low (3, 4).

Serum Chemistries

Clinical characteristics to consider before ordering serum chemistries include extremes of age, endocrine disorders, risk of renal and liver dysfunction, and use of certain medications that may cause electrolyte imbalance (e.g., diuretics, digoxin, angiotensin convertin enzyme inhibitors, or angiotensin receptor blockers) (2, 3) (Table 1). Unanticipated electrolyte abnormalities were reported in a range from 0.2-16.0%, where changes in clinical management were not reported (3, 8, 12). In one large study by Leung et al, preoperative hypernatremia is associated with increased perioperative 30-day morbidity and mortality (13).

The prevalence of elevated creatinine levels is reported only in 0.2-2.4% of asymptomatic or nonselected patients, and the level increases with age (4, 14, 15). Patients with mild to moderate renal insufficiency have an increased risk of perioperative morbidity and mortality where a serum creatinine >2.0 mg/dl predicts postoperative cardiac complications (16, 17). For these reasons, it is appropriate to obtain a serum creatinine concentration in patients more than 50 years old, especially if hypotension or the use of nephrotoxic medications is anticipated (2).

The frequency of abnormal glucose concentrations were reported in 0.9-40.4% of patients (3) and the frequency of abnormalities increases with age (15, 18). Significant increases of serum glucose puts patients at risk for increased infection but asymptomatic hyperglycemia is unlikely to contribute to postoperative complications (18).

Coagulation Studies

A potential rationale for obtaining a prothrombin time/international normalized ratio before surgery would be to identify patients at risk for postoperative bleeding. Clinical characteristics to consider for ordering selected coagulation studies include bleeding disorders, liver dysfunction, and patients taking anticoagulant medications (2, 3) (Table 1). The liver plays a crucial role in synthesizing most of the clotting and fibrinolytic proteins, so it is important to check the patient's coagulation function prior to surgery. Surgeons will be notified if the INR is >1.5 to give them an option of whether to postpone or to proceed with the surgery. In one study in asymptomatic or nonselected patients, coagulation abnormalities were reported in 2.7% of the patients where only 0.2% might have benefited from the test result (19). Certainly, preoperative coagulation studies should not be ordered unless they are definitely indicated.

Electrocardiogram (ECG)

The rationale for obtaining a preoperative ECG is to identify high-risk patients with previous myocardial infarction or arrhythmia. Clinical characteristics to consider include history of heart failure, myocardial infarction, or any age patient with angina or diabetes mellitus (2, 3) (Table 1). Detecting any abnormalities including ischemic changes, arrhythmic changes, or heart block is crucial, because a study has shown an association between preoperative abnormal ECG and surgical mortality (20). However, according to the 2014 American College of Cardiology/American Heart Association Guidelines on perioperative cardiovascular evaluation as well as the European Society of Cardiology 2014 preoperative guidelines, an ECG is not recommended in patients without risk factors who are undergoing lower risk procedures (21, 22). Typically, ECG results are valid for one year if they are normal and/or there are no changes in comparison with the prior ECG, or in patients without any cardiac symptoms/complaints. A proper consultation with specialists after identifying abnormal findings may reduce a surgical mortality.

CONCLUSION

Preoperative laboratory testing is a major component of preanesthesia evaluation that helps to discover or identify a disease or disorder. However, some routine preoperative laboratory tests have been proven to be neither cost-effective nor beneficial in improving patient outcomes among health patients undergoing surgery. The

Table 1. Guideline for preoperative laboratory studies at DeKalb Medical Center

TEST	TYPE OF PATIENT
CBC Valid 30 days if normal	• Male patients age 65 and older • Menstruating female patients age 12 and over • Patients that fit the following criteria: Recent autologous blood donation History of: anemia, cancer, abnormal bleeding, renal disease or use of anticoagulants, known CAD • Patients having any of the following procedures: Hysterectomy, Myomectomy, Hip Replacement, Major Abdominal Surgery, Vascular Surgery, C-section and other procedures with potential for significant blood loss
EKG Valid for 1 year if normal and or no change	• Age 60+ • Any age with chest pain • H/o cardiac disease, CHF, Arrhythmia • Treated for HTN • DM • Morbid Obesity (BMI > 40)
BMP Valid 30 days if normal	• Age 65+ • DM • Dialysis patient • Patient on diuretics/digoxin
PT	• Patient is on Coumadin

prevalence of abnormal findings among asymptomatic or nonselected patients is infrequent and the low incidence of influencing preoperative or perioperative management and postoperative complications are rare. Therefore, instead of routinely ordered laboratory tests, more selective preoperative laboratory tests are recommended based on a complete history and physical examination and based on the available evidence.

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