

Avoiding Unnecessary Preoperative Testing



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KEYWORDS

- Preoperative testing • Preoperative ECGs • Cataract surgery

KEY POINTS

- Preoperative laboratory testing is not indicated before cataract surgery.
- Routine urinalysis is not needed before surgery.
- Routine electrocardiograms are indicated preoperatively in selected patients only.
- Routine coagulation studies are not necessary before surgery.

INTRODUCTION

In general, preoperative testing is ordered with the hope of identifying potential unforeseen issues that may lead to complications from surgery. Enormous medical resources are used in the pursuit of this goal, yet there is little evidence indicating that such routine testing is of any real usefulness. All medical testing has an inherent rate of false positives that can lead to many difficulties for the testing physician and, more importantly, for patients. When tests are applied to an asymptomatic population, the rate of false-positive tests automatically goes up, which may lead to further testing. Many physicians inherently understand this but think that foregoing testing will expose them to medicolegal risks. Interestingly, many of these abnormal preoperative tests are not even followed up,¹ which paradoxically may expose the physician to more legal risk than if the studies had never been ordered in the first place. This article examines the utility of preoperative laboratory testing before cataract surgery, as well as the utility of the routine preoperative urinalysis, electrocardiogram (ECG), and coagulation studies.

PREOPERATIVE TESTING BEFORE CATARACT SURGERY

The risks involved in any operation depend on both the risk of the procedure and the patient's overall health. If the patient's health is excellent, the risk depends largely on

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the nature of the procedure. If the procedural risk is extremely low, then the patient's overall health does not have much bearing on the outcome. Such is the case with cataract surgery. This surgery does not require general anesthesia and does not typically cause blood loss or hemodynamic challenges. Complications are generally limited to the eye itself. Nonetheless, cost estimates in the United States for preoperative testing before 2000 have suggested more than 150 million dollars yearly was spent on this dubious endeavor.²

Cataract surgery is the most commonly performed elective operation for Medicare beneficiaries in the United States³ and, as a consequence, it generates a large number of preoperative consultations ordered by ophthalmologists. The procedure typically takes about 20 minutes and the risk of cardiac complications is less than 1%.³ Solid evidence suggests that routine laboratory testing does not affect patient outcomes. As a result, such testing may not be justified and could be considered a misuse of medical resources.

The most convincing study analyzing the outcomes of preoperative testing before cataract surgery demonstrated no benefit to doing a standard battery of tests that included ECG and basic laboratory analysis (eg, complete blood count and serum electrolytes).⁴ This trial randomized 18,189 subjects at 9 centers to a testing or nontesting strategy using an intention-to-treat analysis. Operative complications were measured and included both serious and nonserious events. Serious events included myocardial infarction or ischemia, congestive heart failure, hypertension or hypotension, arrhythmia, stroke or transient ischemic attack, respiratory failure or desaturation, or blood sugar excursions, including diabetic ketoacidosis or nonketotic hyperosmolar syndrome. Operative complications were assessed using a standardized form filled out by the anesthesiologist or nurse anesthetist. In addition, a study coordinator, using a standardized telephone interview, contacted the subject or the subject's family 1 week postoperative to ask about further postoperative complications.

The results revealed that cataract surgery was a very low-risk procedure in both groups of subjects, whether or not they underwent preoperative testing. Both groups had the same total event rate of 31.3 events per 1000 operations, with no intraoperative deaths reported. The rate of hospitalization per 1000 operations was 0.3 per 1000 operations in the tested group and 0.5 per 1000 operations in the nontested group. This small difference, however, was not statistically significant. The most commonly reported complications were hypertension and arrhythmia (mainly bradycardia), which accounted for 68% of the events in the testing group and 61% in the nontesting group. It should also be noted that these subjects were older (mean age of just under 75 years in both groups), with a fairly representative list of medical problems that would be expected in this age group.

In summary, this well-designed, large trial showed no benefit to preoperative testing for cataract surgery. Because cataract surgery is such a common operation, the cessation of routine testing would result in substantial cost savings without an increase in complications.

ROUTINE URINALYSIS IN THE PREOPERATIVE PERIOD

Routine urinalyses are commonly ordered before surgery in the hope that identifying asymptomatic urinary tract infections or urinary colonization, and treating them, will reduce the rate of perioperative infection. Nowhere is this more true than in orthopedics, and it is in this setting for which the most data are available. Prosthetic joint infections can be a devastating complication of joint replacement surgery and it seems

logical that treating asymptomatic urinary tract infections might lower the rate of bacteremia and subsequent seeding of the prosthetic joint. As logical as it seems, the available studies to date have shown no benefit to a screen and treat strategy before orthopedic surgery.

The largest study in this regard prospectively evaluated nearly 2500 subjects undergoing elective hip or knee replacement surgery in 3 different sites in Europe.⁵ All subjects had a routine urine culture sent before surgery. The prevalence of asymptomatic bacteriuria was 12.1%, with a 2 to 1 predominance in women. Subjects were then assigned to antimicrobial therapy at the discretion of their physician in a nonrandomized fashion. Although the rate of joint infection in those with asymptomatic bacteriuria was higher than in those with sterile urine cultures (4.3% vs 1.4%, odds ratio 3.23, 95% confidence interval 1.67–6.27, $P = .001$), those who had treatment of their bacteriuria did not have fewer joint infections than those who did not have treatment. It is very important to point out that the pathogens isolated from prosthetic joint infections did not match any of those from the urine in those subjects who had antecedent asymptomatic bacteria. Although the trial was limited by the nonrandomization of antimicrobial therapy in those subjects with asymptomatic bacteriuria, the lack of correspondence between the urine isolate and the pathogen isolated from the prosthetic joint infection suggests there is no direct link. The investigators surmised that asymptomatic bacteriuria is more likely a marker of risk for infection than a direct cause of infection. Currently no consensus panels recommend routine urine cultures before surgery.

PREOPERATIVE ELECTROCARDIOGRAMS IN PATIENTS UNDERGOING SURGERY

There are no randomized controlled trials demonstrating that the use of ECGs as preoperative tests reduces operative complications or mortality. Nonetheless, there is evidence that an abnormal ECG predicts an increased rate of serious cardiac events. Expert consensus suggests that the ECG is useful in certain categories of patients or in those undergoing high-risk surgical procedures.

In a prospective observational cohort study of 345 subjects undergoing major surgery, an abnormal ECG was found in roughly 40% of those studied.⁶ In this relatively small, nonrandomized trial, a major adverse cardiac event (MACE) was defined as a nonfatal myocardial infarction or death related to cardiac causes. The study noted a relatively high event rate of 13.3%. The rate of MACE in subjects with an abnormal ECG was 21.6% versus 8.3% in those with a normal ECG. In particular, left ventricular strain and a prolonged QTc were predictive of an adverse event.

Other ECG changes also predict adverse events in patients with known coronary artery disease undergoing major noncardiac surgery. In a prospective cohort study of 172 subjects having such surgery, preoperative ST segment changes and an elevated heart rate were both found to be independent risk factors for mortality.⁷

Although the preoperative ECG may have predictive power with respect to outcomes, there is no randomized controlled trial showing that the use of ECG led to a reduction in the overall event rate even if it is predictive of a higher risk. It is this predictive power, however, that gets the preoperative ECG a positive recommendation in various guidelines for certain patients. The most widely accepted guidelines come from the 2014 American College of Cardiology/American Heart Association (ACC/AHA).⁸ These give clear recommendations for the selected use of preoperative ECGs. The guidelines use a rating system in which interventions are categorized as class I, class IIa, class IIb, or class III. Class I interventions should be performed, class IIb interventions are reasonable to be performed, and class III interventions may be

considered. Class III interventions are not recommended and have either no benefit or may actually cause harm. The guidelines rate the quality of evidence for these recommendations as either A, B, or C. Interventions with an A rating have the highest quality evidence and are generally based on the results of multiple randomized trials in different populations. Level B ratings are in limited populations and the data are derived from a single randomized controlled trial or nonrandomized trials. Level C evidence comes from very limited populations with only consensus opinion or case studies backing that recommendation.

According to these guidelines, preoperative ECGs are not recommended for procedures that are considered low-risk. This recommendation stands even if the patient has antecedent cardiac disease or cardiac risk factors that would put him or her at higher risk. The guidelines give the intervention a class III rating, which means no benefit based on evidence that is rated as B in quality.

The guidelines do, however, recommend preoperative ECGs in patients undergoing higher risk surgeries. The guidelines state that "Preoperative resting 12-lead electrocardiogram (ECG) is reasonable for patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease, cerebrovascular disease, or other significant structural heart disease." They give the strength of this recommendation a class IIa rating, which means that (1) the benefits largely outweigh the risks but additional studies with focused objectives are needed and (2) it is reasonable to perform procedure. The evidence on which this is based is rated B in quality. For patients who do not have known cardiac risk factors and are not undergoing low-risk surgery, the recommendations are more ambiguous and state "preoperative resting 12-lead ECG may be considered for asymptomatic patients without known coronary heart disease." This is given a weaker IIb recommendation based on B quality evidence.

To summarize the recommendations, those patients undergoing low-risk surgery do not require a preoperative ECG. When the surgery is not low-risk, patients with cardiovascular disease should get an ECG. For those who are neither high-risk patients nor getting a low-risk operation, ECG can be considered. The guidelines from the European Society of Cardiology and the European Society of Anaesthesiology are quite similar. They also recommend against routine ECGs in patients undergoing low-risk procedures but do recommend ECGs for patients with known cardiac risk factors undergoing surgeries other than low-risk with less firm recommendations for those patients who are less at risk. What differs from the ACC/AHA recommendations is that the European Society gives less weight to the evidence supporting the use of preoperative ECG for surgery that is not low-risk.

ROUTINE PREOPERATIVE COAGULATION STUDIES

The most common tests ordered preoperatively to assess bleeding risk are the prothrombin time (PT), partial thromboplastin time (PTT), and platelet count. It is uncommon to find true significant abnormalities of the PT and PTT,⁹ and these tests should not be ordered in an unselected way. Although it may seem intuitive that an elevation in any of these tests would predict an increased risk of bleeding during surgery, there is no evidence that they have any value in predicting operative bleeding in a patient with no history of bleeding or liver disease. Taking an accurate bleeding history is much more important than unselected blood work. This history should consist of reviewing medications that might affect hemostasis and the patient's personal and family bleeding history. Most significant bleeding disorders will be picked up by an appropriate line of questioning. Bleeding disorders like hemophilia are rare and will likely be known to the physician long before the adult patient requires surgery.

Other bleeding disorders, such as von Willebrand disease, may not be revealed by routine coagulation studies and are more likely going to be discovered by taking a thorough bleeding history. When the history does reveal a personal or family history of unusual bleeding, further testing is indicated.

Patient undergoing neurosurgical procedures are at particularly high risk of bleeding complications; however, a study in the *Journal of Neurosurgery* suggests that coagulation studies have little power to predict complications for these high-risk patients.¹⁰ In this 2012 analysis, the records of almost 12,000 neurosurgery patients in the 2006 to 2009 American College of Surgeons National Surgical Quality Improvement Program database were retrospectively reviewed. They found that more than 90% of patients had coagulation studies performed before neurosurgical procedures. Multivariate logistic regression models were then used to examine how accurately abnormalities in routine coagulation studies predicted the need for transfusion, return to the operating room, or 30-day mortality. Researchers found that the bleeding history was more predictive of bleeding complications and had a higher sensitivity for predicting those operative outcomes than did routine blood tests. The investigators concluded that routine coagulation studies should not be done in patients without a history of bleeding and further calculated that doing away with this testing before neurosurgery procedures would save more than 81 million dollars annually in the United States alone.

Even when the PT and PTT are abnormal, they do not necessarily predict an increased risk of bleeding. In a meta-analysis of 9 studies looking at the predictive value of preoperative coagulation studies, a committee of the British Haematology Society calculated the positive predictive value and likelihood ratios for an abnormal test predicting bleeding.¹¹ The positive predictive value for an abnormal clotting study to predict postoperative bleeding ranged from 0.03 to 0.22 with a likelihood ratio ranging from 0.99 to 5.10. Although the studies were not randomized, these numbers suggest that preoperative coagulation studies have little power to predict operative bleeding if used in unselected patients. Consequently, the British Committee for Standards in Haematology recommends against routine preoperative studies of bleeding.

SUMMARY

Given the low-risk nature of cataract surgery, no preoperative testing is indicated unless the patient needs such testing for another reason. Although ECGs may have a role in preoperative testing in patients who are at high risk of (or have) cardiovascular disease or if the procedure carries with it significant operative risks, they are often not necessary for many patients or procedures. In addition, urinalysis and coagulation studies should not routinely be obtained on patients before surgery because they have not been shown to have any value in predicting surgical complications. Although all of these tests are not expensive on an individual basis, the aggregate cost is substantial. As good stewards of the medical system, physicians need to use these tests more judiciously.

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