

## SMART TESTING

**NATHAN HOUCHENS, MD, FACP**

Department of Hospital Medicine, Medicine Institute, Cleveland Clinic; Assistant Professor, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, OH

# Q: Do healthy patients need routine laboratory testing before elective noncardiac surgery?

**A:** 63-YEAR-OLD PHYSICIAN is referred for preoperative evaluation before arthroscopic repair of a torn medial meniscus. Her exercise tolerance was excellent before the knee injury, including running without cardiopulmonary symptoms. She is otherwise healthy except for hypertension that is well controlled on amlodipine. She has no known history of liver or kidney disease, bleeding disorder, recent illness, or complications with anesthesia. She inquires as to whether “routine blood testing” is needed before the procedure.

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What laboratory studies, if any, should be ordered?

### ■ UNLIKELY TO BE OF BENEFIT

Preoperative laboratory testing is not necessary in this otherwise healthy, asymptomatic patient. In the absence of clinical indications, routine testing before elective, low-risk procedures often increases both the cost of care and the potential anxiety caused by abnormal results that provide no substantial benefit to the patient or the clinician.

Preoperative diagnostic tests should be ordered only to identify and optimize disorders that alter the likelihood of perioperative and postoperative adverse outcomes and to establish a baseline assessment. Yet clinicians often perceive that laboratory testing is required by their organization or by other providers.

A comprehensive history and physical examination are the cornerstones of the effective preoperative evaluation. Preferably, the history and examination should guide further

testing rather than ordering a battery of standard tests for all patients. However, selective preoperative laboratory testing may be useful in certain situations, such as in patients undergoing high-risk procedures and those with known underlying conditions or factors that may affect operative management (Table 1).

Unfortunately, high-quality evidence for this selective approach is lacking. According to one observational study,<sup>1</sup> when laboratory testing is appropriate, it is reasonable to use test results already obtained and normal within the preceding 4 months unless the patient has had an interim change in health status.

Definitions of risk stratification (eg, urgency of surgical procedure, graded risk according to type of operation) and tools such as the Revised Cardiac Risk Index can be found in the 2014 American College of Cardiology/American Heart Association guidelines<sup>2</sup> and may be useful to distinguish healthy patients from those with significant comorbidities, as well as to distinguish low-risk, elective procedures from those that impart higher risk.

Professional societies and guidelines in many countries have criticized the habitual practice of extensive, nonselective laboratory testing.<sup>3-6</sup> Yet despite lack of evidence of benefit, routine preoperative testing is still often done. At an estimated cost of more than \$18 billion in the United States annually,<sup>7</sup> preoperative testing deserves attention, especially in this time of ballooning healthcare costs and increased focus on effective and efficient care.

### ■ EVIDENCE AND GUIDELINES

Numerous studies have established that routine laboratory testing rarely changes the preoperative management of the patient or improves

Testing often leads to increased costs and anxiety without substantial benefit

doi:10.3949/ccjm.82a.14152

TABLE 1

**Suggested selective approach to common preoperative laboratory testing**

Test	Appropriate population for testing
<b>Complete blood cell count</b>	Patients at risk of anemia based on history and physical examination findings and those in whom significant perioperative blood loss is anticipated
<b>Electrolytes and creatinine</b>	Patients at risk of electrolyte abnormalities (eg, those taking diuretics) or renal impairment
<b>Glucose or hemoglobin A<sub>1c</sub></b>	Patients in whom an abnormal result would change the perioperative management
<b>Coagulation testing</b>	Patients who take anticoagulants, who have a history of bleeding, or who have conditions that predispose to coagulopathy (eg, liver disease)
<b>Urinalysis</b>	Patients undergoing urologic procedures or implantation of foreign material

Note: These nonexhaustive recommendations are based on consensus, expert opinion, and case series.<sup>5,9-11</sup> Clear, consistent guidelines outlining indications for specific tests are not currently available.

surgical outcomes. Narr et al<sup>8</sup> found that 160 (4%) of 3,782 patients who underwent ambulatory surgery had abnormal test results, and only 10 required treatment. In this study, there was no association between abnormal test results and perioperative management or postoperative adverse events.

In a systematic review, Smetana and Macpherson<sup>9</sup> noted that the incidence of laboratory test abnormalities that led to a change in management ranged from 0.1% to 2.6%. Notably, clinicians ignore 30% to 60% of abnormal preoperative laboratory results, a practice that may create additional medicolegal risk.<sup>7</sup>

Little evidence exists that helps in the development of guidelines for preoperative laboratory testing. Most guidelines are based on expert opinion, case series, and consensus. As an example of the heterogeneity this creates, the American Society of Anesthesiologists, the Ontario Preoperative Testing Group, and the Canadian Anesthesiologists' Society provide different recommended indications for preoperative laboratory testing in patients with "advanced age" but do not define a clear minimum age for this cohort.<sup>10</sup>

However, one area that does have substantial data is cataract surgery. Patients in their usual state of health who are to undergo this procedure do not require preoperative testing, a claim supported by high-quality evidence in-

cluding a 2012 Cochrane systematic review.<sup>11</sup>

Munro et al<sup>5</sup> performed a systematic review of the evidence behind preoperative laboratory testing, concluding that the power of preoperative tests to predict adverse postoperative outcomes in asymptomatic patients is either weak or nonexistent. The National Institute for Health and Clinical Excellence guidelines of 2003,<sup>6</sup> the Practice Advisory for Preanesthesia Evaluation of the American Society of Anesthesiologists of 2012,<sup>12</sup> the Institute for Clinical Systems Improvement guideline of 2012,<sup>13</sup> and a systematic review conducted by Johansson et al<sup>14</sup> found no evidence from high-quality studies to support the claim that routine preoperative testing is beneficial in healthy adults undergoing noncardiac surgery, but that certain patient populations may benefit from selective testing.

A randomized controlled trial evaluated the elimination of preoperative testing in patients undergoing low-risk ambulatory surgery and found no difference in perioperative adverse events in the control and intervention arms.<sup>15</sup> Similar studies achieved the same results.

**The Choosing Wisely campaign**

The American Board of Internal Medicine Foundation has partnered with medical specialty societies to create lists of common practice patterns that should be questioned and

**Most guidelines on preoperative testing are based on expert opinion, case series, or consensus**

possibly discontinued. These lists are collectively called the Choosing Wisely campaign ([www.choosingwisely.org](http://www.choosingwisely.org)). Avoiding routine preoperative laboratory testing in patients undergoing low-risk surgery without clinical indications can be found in the lists for the American Society of Anesthesiologists, the American Society for Clinical Pathology, and the Society of General Internal Medicine.

### THE POSSIBLE HARMS OF TESTING

The prevalence of unrecognized disease that influences the risk of surgery in healthy patients is low, and thus the predictive value of abnormal test values in these patients is low. This leads to substantial false-positivity, which is of uncertain clinical significance and which may in turn cause a cascade of further testing. Not surprisingly, the probability of an abnormal test result increases dramatically with the number of tests ordered, a fact that magnifies the problem of false-positive results.

The costs and harms associated with testing are both direct and indirect. Direct effects include increased healthcare costs of further testing or potentially unnecessary treatment as well as risk associated with additional testing, though these are not common, as there is a low (< 3%) incidence of a change in preoperative management based on an abnormal test result. Likewise, normal results do not ap-

pear to substantially reduce the likelihood of postoperative complications.<sup>9</sup>

Indirect effects, which are particularly challenging to measure, may include time lost from employment to pursue further evaluation and anxiety surrounding abnormal results.

### THE CLINICAL BOTTOM LINE

Based on over 2 decades of data, our 63-year-old patient should not undergo “routine” preoperative laboratory testing before her upcoming elective, low-risk, noncardiac procedure. Her hypertension is well controlled, and she is taking no medications that may lead to clinically significant metabolic derangements or significant changes in surgical outcome. There are no convincing clinical indications for further laboratory investigation. Further, the results are unlikely to affect the preoperative management and rate of adverse events; the direct and indirect costs may be substantial; and there is a small but tangible risk of harm.

Given the myriad factors that influence unnecessary preoperative testing, a focus on systems-level solutions is paramount. Key steps may include creation and adoption of clear and consistent guidelines, development of clinical care pathways, physician education and modification of practice, interdisciplinary communication and information sharing, economic analysis, and outcomes assessment.

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ADDRESS: Nathan Houchens, MD, FACP, Department of Hospital Medicine, M2 Annex, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195; e-mail: [houchen@ccl.org](mailto:houchen@ccl.org)