Preoperative Laboratory Testing: What is Needed?

Michael F. Roizen, M.D. **Cleveland, Ohio**

Three major issues are at the forefront of the current surgical case burden in the United States: patients are given too little responsibility for their health, the aging population has a desire for functional recovery, and too few specialists and registered nurses are trained in anesthesia and perioperative medicine. This combination of factors has led to an imbalance of supply and demand for perioperative care.

This review lecture will focus on the preoperative evaluation as a means to improve efficiencies in perioperative care that result in desirable outcomes while decreasing the institutional costs associated with surgery.

The ultimate goals of preoperative and preprocedure medical assessment of patients who are to undergo anesthesia care are to reduce the morbidity of surgery, to increase the quality but decrease the cost of perioperative care, and to return the patient to desirable functioning as quickly as possible. We include preprocedure in this assessment period as increasingly anesthesia care involves rendering the patient more comfortable during procedures that do not involve classic surgery. Traditionally, these goals have been facilitated by a preoperative meeting between the patient and the anesthesiologist. The meeting now has six specific purposes:

(1) To obtain pertinent information about the patient's medical history and physical and mental conditions, in order to determine which tests and consultations are needed.
(2) Guided by patient choices and the risk factors uncovered by medical history, to choose the care plans.
(3) To obtain informed consent.
(4) To educate the patient about anesthesia, perioperative care, and pain treatments in the hope of reducing anxiety and facilitating recovery.
(5) To make perioperative care more efficient and less expensive.
(6) To utilize the operative experience to motivate the patient to more optimal health and thereby improve perioperative and/or long-term outcome.

Reduction of anxiety and informed consent should not be overlooked at the time of preoperative evaluation. Recovery occurs more quickly when the anesthesiologist allays the patient's concerns, informs the patient about what is to come, and plans postoperative pain therapy with the patient.(1-4)

Because we now no longer enjoy the luxury of seeing patients leisurely in the hospital the night before surgery, the methods of preoperative evaluation are changing. In response to these changes, the ASA has developed a practice advisory for preanesthetic evaluation.(5) Most concepts of that document will be discussed here. These changes in patterns also mean that we must ensure that perioperative care is predictable for both patient and surgeon; comprehensive, so that no facet of care is overlooked to create problems later; and efficient and cost-effective, to save resources and time. Further, the sixth function is relatively new: can you change therapy now and into the immediate postoperative period and alter perioperative outcome and/or long term outcome. Rolled into this new sixth function are three questions: Do you have enough time to initiate such that that change will make a positive outcome difference to the patient, do you have the time to motivate and can you motivate the patient to accept and initiate such changes.

To attempt effective preoperative and preprocedure evaluation without the consensus of your group, the surgeons, gynecologists, and radiologists you serve, and your administration will be futile and frustrating. But efficient choice of laboratory tests, effective patient education, and consensus building yields a satisfying practice and expands the role of the anesthesiologist.

Two initial steps of preoperative evaluation are closely related. A pertinent medical history and information about physical and medical conditions affect all the decisions about testing, consultation, and discussion of care plans with the patient. Optimizing patient health before surgery and planning the most appropriate perioperative management improve outcome and reduce costs. Data supporting these claims are substantial but indirect: Studies over four decades repeatedly show that preoperative patient conditions predict postoperative morbidity.(5-11) The data imply (but do not prove) that preoperative treatment of conditions such as congestive heart failure and diabetes can reduce the severity of disease and thus perioperative morbidity and mortality. To reduce morbidity, preoperative assessment must be made far enough in advance to provide the primary care physician with a "second opinion" to guide optimization of preoperative health of the patient. This step obliges the preoperative evaluator to take a thorough history to find alterable factors that influence perioperative risk and to order laboratory tests that will be beneficial in planning perioperative care. The list of indications in Table 1 (to be shown)can be considered, as well as whether or not the patient has had laboratory tests recently (you can email me at roizenm@ccf.org for two weeks after this conference to obtain an electronic version of that table—specify "Send ASA Chart 1" in the subject line). Tests within one year need not be repeated. Patients of ASA physical status 1 or patients who will undergo a minimally invasive procedure may not need laboratory tests to alter their risk.(5,12-18) Also, preoperative consultations may initiate additional risk-modification tactics such as reducing tachycardia[5] or the

stress on plaque with a beta adrenergic blocking agent, (19-24) controlling hypertension, reduce inflammation in blood vessels with aspirin or a statin (24-31), perioperative cessation of smoking (32-35), stamina/strength training (36-39), nutritional fortification (41), and immunization (42) and in these ways improve perioperative outcome. Preoperative evaluation produces other benefits as well. Patient education about perioperative care expectations can radically reduce the length of stay and costs and as mentioned substantially improve quality of life. Data from Stanford (40-42), the University of Chicago (4,43-44), the University of South Florida (45), the University of Rochester (40), the University of Massachusetts (41), and community hospitals in London, Ontario (42), and in Australia (38,39), and elsewhere (see review in ref #43) all confirm these cost and outcome advantages (46-49).

Can this process be accomplished in isolation by a primary care physician? Although much of the process probably could be, a condition considered optimal for daily life (such as some degree of prerenal azotemia in the patient with congestive heart failure) may not be optimal preoperative and preprocedure status (at which time vasodilation may cause hypotension and/or permanent renal impairment). Thus, attention to the effects of planned perioperative maneuvers on patient physiology would be desirable, maybe even necessary, if the benefit of such preplanning is deemed worth the cost. While a nurse practitioner can substitute for a physician in primary care screening in a cost and quality efficient fashion, such has not been shown quantitatively in the preoperative and preprocedure setting (50,51). Preoperative and preprocedure evaluation by a specialty trained physician (or even a specialty trained nurse) is not inexpensive. However, preoperative and preprocedure planning can be much less expensive if tests are ordered selectively and information tools are used to increase efficiency. Thorough preoperative and preprocedure assessment can uncover hidden conditions that may affect outcome. In this way, an anesthesiologist can anticipate problems and plan therapies to minimize their effects.

At the University of Florida, preanesthetic evaluations altered care plans for more than 15 percent of all healthy patients (i.e., ASA class 1 or 2 patients) and for 20 percent of all patients (52). The most common conditions causing changes were gastric reflux, insulin-dependent diabetes mellitus, asthma, and suspected difficult intubation. However, no data indicated that the changes initiated improved patient outcome. Nevertheless, practitioners think that the discovery of these conditions calls for a change in plans, which usually delays operating room schedules and increases costs. Examples of last-minute changes would be administration of an H_2 blocker 1-2 hr before surgery and an oral antacid before OR entry; obtaining equipment to measure blood glucose levels; obtaining a history of a patient's diabetic course from his primary care physician; and requesting a fiberoptic laryngoscope or additional skilled help. Thus, even if preoperative and preprocedure evaluation were not to alter outcome substantially, its ability to reduce costs by reducing laboratory tests and delays in obtaining equipment or treatments perceived to be beneficial (and medicolegally required) would be substantial. In addition, preoperative and preprocedure evaluation gives practitioners confidence that unexpected patient conditions will not surprise them and gives patients confidence that your health care system is responding to their needs. Preoperative and preprocedure evaluation can take place in various settings: for relatively well patients, in the surgeon's office or via telephone; for sicker patients or for those in whom more invasive surgical procedures are planned, in a preoperative/ preprocedure evaluation clinic.

History, Physical Examination, and Chart Review vs. Laboratory Tests

Discussing testing theory might lead to boredom were it not so economically relevant. More than 70 percent of patients now receiving anesthesia are either outpatients or "come-and-stay" patients. I believe that use of a written, telephonic, or automated questionnaire to ask the screening questions, coupled with a personal interview to pursue positive answers, does not decrease the accuracy or perceived personalization of the care given (54-57). My own practice gradually adopted this combination for inpatients as well, so that my task is to explore areas of positive history in depth and to discuss issues important to the patient. There are ways of putting the classic pattern together (chart review; history-taking; physical exam; discussion of risks, alternative anesthetic plans, and postoperative pain therapies) so that all elements are part of a compassionate flow of thought that facilitates patient recall and care.

Laboratory Tests As Screening Devices

It has been suggested that we forget the history and use laboratory screening for disease. Review of the literature forces me to disagree strongly: the history and the investigation of positive answers by an in-person interview is many times more effective in screening for disease than use of laboratory tests alone. The primary problem with ordering batteries of laboratory tests for all patients is that laboratory tests are not very good screening devices for disease; their results are costly to pursue; and they add new risk for the patient, increase medicolegal risk to the physician, and render ORs inefficient. Many studies have compared the yield from indicated (warranted from history or risk group) vs. unindicated (unwarranted) preoperative and preprocedure testing (12,45,58-62). Few unindicated tests yield beneficial changes in perioperative care: at most, only 16 patients of more than 16,000 who had unindicated preoperative and preprocedure tests benefited from such testing. Furthermore, this figure represents the most optimistic interpretation, as four patients in a study by Kaplan et al(58) received no benefit, and for at least

another seven patients in a study by O'Connor and Drasner (60), the benefit of treating asymptomatic anemia before surgery with expected minor blood loss was not clear. Assuming that results of tests are independent of one another, the more tests ordered, the higher the likelihood of an abnormal result. For example, assuming a specificity of 95 percent, if two tests are ordered for a patient without disease, the chance of both being normal is 0.95 x 0.95 or 0.90. For 20 tests, the chance that all would be normal would be only 36 percent. The chance that at least one result would be abnormal is 64 percent. Thus, if one chooses to use more than 13 tests to screen patients before surgery, one should expect at least one abnormal test result.

HIV testing provides another example. More than 92 percent of the population at low risk for HIV infection who have positive (abnormal) results on two enzyme-linked immunosorbent assays (ELISAs) and one Western blot test in reality are not infected with HIV (63). Similar false-positive results have been found for mammography (64). Therefore, it is not surprising that the benefit from nonselective testing is so low, or that so few abnormal results arising from unwarranted tests are acted upon.

Patient Risk

Unnecessary testing may lead physicians to pursue and treat borderline and false-positive laboratory abnormalities. In one study addressing this issue, Roizen et al (65) retrospectively examined the adverse effects of chest radiographs on patients. For 606 patients, 386 extra chest radiographs were ordered without indication of need. Among those 386 patients, the discovery of only one abnormality (an elevated hemidiaphragm probably caused by phrenic nerve palsy) may have resulted in improved care for that patient. On the other hand, the existence of three lung shadows on chest radiographs led to three sets of invasive tests, including one thoracotomy, but no discovery of disease. Tape and Mushlin (66) found a similar result when examining the benefits and risks of chest radiographs obtained preoperatively.

Development of Testing Guidelines: Benefit-Risk Strategies

From a review of the literature and benefit-risk analysis, one can derive a practice policy to help clinicians select tests that are likely to be more beneficial than risky for their patients. Let us assume the chest x-ray in the under-40 population has a sensitivity of 75 percent and a specificity of 95 percent. (These values are better than the best in the literature for readings reviewed by a single radiologist.) Let us also assume that the prevalence of disease detectable by the test is 0.5 percent, that the benefit from true positives is 20/100 (higher than the greatest benefit reported in the literature)(12,57-63,67), and that harm from false positives is 6/100 (34) and Apfelbaum, JL et al, unpublished data. For the asymptomatic under-40 population, the result would be harm to three individuals and benefit to only 0.8 individuals per 1,000 chest x-rays. Similar analyses are possible for other tests and situations (68).

Patients undergoing minimally invasive surgery after a careful medical history was obtained have little potential to benefit from more testing (5,11,12,69). The 30-day morbidity of these patients was little different from that which could be expected simply from living 30 days. Guidelines for preoperative and preprocedure tests could be modified when more invasive procedures are anticipated.

Lead- and Length-Time Biases

Two important concepts related to the reported benefits and risks of screening tests deserve consideration: lead-time and length-time biases. These two factors can indicate an apparent benefit of testing when there is none. This subject has been reviewed in detail (56).

Implementing Accuracy and Efficiency in Preoperative and Preprocedure Evaluation

The ability of preoperative and preprocedure evaluation even of healthy patients (ASA class 1 or 2) to detect important symptoms from medical history makes its benefit greater than its risk. An informed patient will know what to expect, and planned pain therapy can decrease resource utilization (43-48). Specific issues regarding pregnancy and genetic testing can be included in the evaluation protocol. The protocol places the burden of accuracy on the history-taker. Use of the protocol requires that a system be in place to communicate the readiness of the patient for surgery to the primary care physician, surgeon, and scheduling system. *This step places an additional burden on the preoperative and preprocedure assessor: he or she must determine what degree of consultation with the primary care physician and surgeon is necessary to judge optimal health for perioperative care*(43*).* Ultimately, preoperative and preprocedure evaluation is cost effective for the institution, the health care payors, and the patients. It would be justifiable to compensate the anesthesiologist for preoperative and preprocedure assessment at the rate for OR time(39). The preoperative and preprocedure meeting of anesthesiologist and patient should also serve other important functions: to educate about anxiety treatment options and pain therapy. Neither function can be performed adequately by most primary care physicians, and no one is better trained to do so than anesthesiologists.

Our primary goal must be efficient delivery of quality care. Patients undergoing surgery move through a continuum of medical care to which a primary care physician, an internist, an anesthesiologist, and a surgeon contribute to ensure the best outcome possible. No aspect of medicine requires greater cooperation than

performance of surgery and perioperative care for a patient. The importance of integrating practice is even greater because of the increasing life span of our population and the popularity of alternative therapies that may interfere with the drugs we administer perioperatively (70-71). At a time when medical information is encyclopedic, it is difficult for even the most conscientious anesthesiologist to keep abreast of medical issues relevant to perioperative patient management. Thus, the proposed preoperative and preprocedure assessment clinic facilitates those most sought-after goals, increased quality and reduced costs (72).

Averting a Crisis in Perioperative Care: Proposed Solutions

One proposed solution to address the surgical burden is to implement bypass processes in which the healthiest patients are excluded from routine preoperative evaluation. Although this approach may be acceptable at the level of an individual institution, in my opinion it is unacceptable from a societal perspective because the perioperative period is an ideal time to motivate patients to adopt healthier behaviors.

Another potential solution is to work with other providers such as nurse practitioners and medical assistants to gather patient information. The use of information systems is enhancing medical care, but ultimately the most significant factor to minimize the surgical burden will be to make patients healthier.

Note: Dr. Roizen developed and patented a video *preoperative and preprocedure* health questionnaire to help ameliorate the problem of inefficient *preoperative and preprocedure* assessments and test selection methods. If this product is successful, Dr. Roizen and the Cleveland Clinic may benefit financially.

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