Practice Advisory for Preanesthesia Evaluation

An Updated Report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation

PRACTICE Advisories are systematically developed reports that are intended to assist decision-making in areas of patient care. Advisories provide a synthesis and analysis of expert opinion, clinical feasibility data, open forum commentary, and consensus surveys. Practice Advisories developed by the American Society of Anesthesiologists (ASA) are not intended as standards, guidelines, or absolute requirements, and their use cannot guarantee any specific outcome. They may be adopted, modified, or rejected according to clinical needs and constraints and are not intended to replace local institutional policies.

Practice Advisories are not supported by scientific literature to the same degree as standards or guidelines because of the lack of sufficient numbers of adequately controlled studies. Practice Advisories are subject to periodic update or revision as warranted by the evolution of medical knowledge, technology, and practice.

- What other guideline statements are available on this topic?
  - This Practice Advisory updates the "Practice Advisory for Preanesthesia Evaluation," adopted by the ASA in 2001 and published in 2002.*
- Why was this Advisory developed?
  - In October 2010, the Committee on Standards and Practice Parameters elected to collect new evidence to determine whether recommendations in the existing Practice Advisory were supported by current evidence.
- How does this statement differ from existing guidelines?
  - New evidence presented includes an updated evaluation of scientific literature. The new findings did not necessitate a change in recommendations.
- Why does this statement differ from existing guidelines?
  - The ASA Advisory differs from the existing guidelines because it provides new evidence obtained from recent scientific literature.

This document updates the "Practice Advisory for Preanesthesia Evaluation: A Report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation," adopted by the ASA in 2001 and published in 2002.*

Methodology

A. Definition of Preanesthesia Evaluation

The literature does not provide a standard definition for preanesthesia evaluation. For this Practice Advisory, preanesthesia evaluation is defined as the process of clinical assessment that precedes the delivery of anesthesia care for surgery and for nonsurgical procedures. For this Advisory, "perioperative" refers to the care surrounding operations and procedures. The preanesthetic evaluation is the responsibility of the anesthesiologist.

Preanesthesia evaluation consists of the consideration of information from multiple sources that may include the patient's medical records, interview, physical examination, and findings from medical tests and evaluations. As part of the

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Updated by the Committee on Standards and Practice Parameters, Jeffrey L. Apfelbaum, M.D. (Chair), Chicago, Illinois; Richard T. Connis, Ph.D., Woodinville, Washington; David G. Nickinovich, Ph.D., Bellevue, Washington. The original document was developed by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation: L. Reuven Pasternak, M.D. (Chair), Baltimore, Maryland; James F. Arens, M.D., Houston, Texas; Robert A. Caplan, M.D., Seattle, Washington; Richard T. Connis, Ph.D., Woodinville, Washington; Lee A. Fleisher, M.D., Baltimore, Maryland; Richard Flowerdew, M.B., Portland, Maine; Barbara S. Gold, M.D., Minneapolis, Minnesota; James F. Mayhew, M.D., League City, Texas; David G. Nickinovich, Ph.D., Bellevue, Washington; Linda Jo Rice, M.D., St. Petersburg, Florida; Michael F. Roizen, M.D., Chicago, Illinois; Rebecca S. Twersky, M.D., Brooklyn, New York.

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Address correspondence to the American Society of Anesthesiologists: 520 North Northwest Highway, Park Ridge, Illinois 60068-2573. This Practice Advisory, as well as all published ASA Practice Parameters, may be obtained at no cost through the Journal Web site, www.anesthesiology.org.

* American Society of Anesthesiologists Task Force on Preanesthesia Evaluation: Practice advisory for preanesthesia evaluation: A report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation. ANESTHESIOLOGY 2002; 96:485–96. The Practice Advisory was amended by the ASA House of Delegates on October 15, 2003.

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preanesthesia evaluation process, the anesthesiologist may choose to consult with other healthcare professionals to obtain information or services that are relevant to perioperative anesthetic care. Preoperative tests, as a component of the preanesthesia evaluation, may be indicated for various purposes, including but not limited to (1) discovery or identification of a disease or disorder that may affect perioperative anesthetic care; (2) verification or assessment of an already known disease, disorder, medical or alternative therapy that may affect perioperative anesthetic care; and (3) formulation of specific plans and alternatives for perioperative anesthetic care.

The assessments made in the process of preanesthetic evaluation may be used to educate the patient, organize resources for perioperative care, and formulate plans for intraoperative care, postoperative recovery, and perioperative pain management.

B. Purposes of the Advisory for Preanesthesia Evaluation

The purposes of this Advisory are to (1) assess the currently available evidence pertaining to the healthcare benefits of preanesthesia evaluation, (2) offer a reference framework for the conduct of preanesthesia evaluation by anesthesiologists, and (3) stimulate research strategies that can assess the healthcare benefits of a preanesthesia evaluation.

C. Focus

A preanesthesia evaluation is considered a basic element of anesthesia care. Therefore the focus of this Advisory is the assessment of evidence pertaining to the content and timing of a preanesthesia evaluation. The interactions between the preanesthesia evaluation, preoperative testing, and perioperative care are beyond the scope and mandate of the Advisory. Informed consent, often undertaken at the same time as the preanesthesia evaluation, is also beyond the scope of this Advisory.

D. Application

This Advisory is intended for use by anesthesiologists and those who provide care under the direction of an anesthesiologist. The Advisory applies to patients of all ages who are scheduled to receive general anesthesia, regional anesthesia, and moderate or deep sedation for elective surgical and nonsurgical procedures. The Advisory does not address the selection of anesthetic technique; nor does it address the preanesthetic evaluation of patients requiring urgent or emergency surgery or anesthetic management provided on an urgent basis in other locations, (*e.g.*, emergency rooms).

E. Criteria for Anesthesia Intervention, Testing, and Consultation

Any evaluations, tests, and consultations required for a patient are done with the reasonable expectation that such activities will result in benefits that exceed the potential adverse effects. Potential benefits may include a change in the content or timing of anesthetic management or perioperative resource use that may improve the safety and effectiveness of anesthetic processes involved with perioperative care. Potential adverse effects may include interventions that result in injury, discomfort, inconvenience, delays, or costs that are not commensurate with the anticipated benefits.

F. Task Force Members and Consultants

The original Advisory was developed by an ASA-appointed task force of 12 members, consisting of anesthesiologists from various geographic areas of the United States and two methodologists from the ASA Committee on Standards and Practice Parameters.

The Task Force developed the original Advisory by means of a six-step process. First, they reached consensus on the criteria for evidence of effectiveness of preanesthesia evaluation. Second, original published articles from peer-reviewed journals relevant to preanesthesia evaluation were evaluated. Third, consultants who had expertise or interest in preanesthesia evaluation and who practiced or worked in various settings (*e.g.*, academic and private practice) were asked to (1) participate in opinion surveys on the effectiveness of various preanesthesia evaluation strategies, and (2) review and comment on a draft of the Advisory developed by the Task Force. Fourth, additional opinions were solicited from active members of the ASA. Fifth, the Task Force held several open forums at three major national anesthesia meetings† to solicit input on the draft Advisory. Sixth, all available information was used to build consensus within the Task Force to finalize the Advisory. A summary of recommendations may be found in appendix 1.

In 2009, the ASA Committee on Standards and Practice Parameters requested that scientific evidence for this Advisory be updated. The update consists of an evaluation of literature published after completion of the original Advisory. The draft of this updated document was made available for review on the ASA Web site.

G. Availability and Strength of Evidence

Preparation of this update used the same methodological process as was used in the original Advisory to obtain new scientific evidence. Opinion-based evidence obtained from the original Advisory is reported in this update. The protocol for reporting each source of evidence is described.

Scientific Evidence

Study findings from published scientific literature were aggregated and are reported in summary form by evidence category, as described below. All literature (*e.g.*, randomized

† Society for Ambulatory Anesthesia 11th Annual Meeting, Orlando, Florida, 1996; Society for Ambulatory Anesthesia 12th Annual Meeting, Orlando, Florida, 1997; Postgraduate Assembly in Anesthesiology 54th Annual Meeting, New York, New York, 2000.

controlled trials, observational studies, case reports) relevant to each topic was considered when evaluating the findings. However, for reporting purposes in this document, only the highest level of evidence (*i.e.*, level 1, 2, or 3 identified below) within each category (*i.e.*, A, B, or C) is included in the summary.

Category A: Supportive Literature

Randomized controlled trials report statistically significant ($P < 0.01$) differences between clinical interventions for a specified clinical outcome.

Level 1: The literature contains multiple randomized controlled trials, and the aggregated findings are supported by meta-analysis.‡

Level 2: The literature contains multiple randomized controlled trials, but there is an insufficient number of studies to conduct a viable meta-analysis.

Level 3: The literature contains a single randomized controlled trial.

Category B: Suggestive Literature

Information from observational studies permits inference of beneficial or harmful relationships among clinical interventions and clinical outcomes.

Level 1: The literature contains observational comparisons (*e.g.*, cohort, case-control research designs) of clinical interventions or conditions and indicates statistically significant differences between clinical interventions for a specified clinical outcome.

Level 2: The literature contains noncomparative observational studies with associative (*e.g.*, relative risk, correlation) or descriptive statistics.

Level 3: The literature contains case reports.

Category C: Equivocal Literature

The literature cannot determine whether there are beneficial or harmful relationships among clinical interventions and clinical outcomes.

Level 1: Meta-analysis did not find significant differences among groups or conditions.

Level 2: The number of studies is insufficient to conduct meta-analysis, and (1) randomized controlled trials have not found significant differences among groups or conditions or (2) randomized controlled trials report inconsistent findings.

Level 3: Observational studies report inconsistent findings or do *not* permit inference of beneficial or harmful relationships.

‡ Practice Advisories lack the support of a sufficient number of adequately controlled studies required to conduct an appropriate meta-analysis. Therefore, categories A1 and C1 evidence are not reported in this document.

Category D: Insufficient Evidence from Literature

The lack of scientific evidence in the literature is described by the following terms.

Inadequate. The available literature cannot be used to assess relationships among clinical interventions and clinical outcomes. The literature either does not meet the criteria for content as defined in the "Focus" of the Advisory or does not permit a clear interpretation of findings due to methodological concerns (*e.g.*, confounding in study design or implementation).

Silent. No identified studies address the specified relationships among interventions and outcomes.

Limitations of the Literature. Numerous methodological concerns were encountered in the preanesthesia evaluation literature, including (1) lack of "no-test" controls, (2) failure to blind the practitioner to test results before and during the procedure, and (3) confounding of outcomes. These concerns limit the interpretability of published findings and are discussed in more detail in appendix 2.

Opinion-based Evidence

The original Advisory contained formal survey information collected from expert consultants and random samples of active members of the ASA. Additional information was obtained from open forum presentations and other invited and public sources. All opinion-based evidence relevant to each topic (*e.g.*, survey data, open-forum testimony, Internet-based comments, letters, and editorials) was considered in the development of the original Advisory. However, only the findings obtained from formal surveys are reported.

Survey responses from Task Force-appointed expert consultants and specialty society members obtained during development of the original Advisory are summarized in the text and reported in appendix 2, tables 1–5.

Advisories

I. Preanesthesia History and Physical Examination

Impact. A preanesthesia history and physical examination precedes the ordering, requiring, or performance of specific preanesthesia tests and consists of (1) evaluation of pertinent medical records, (2) patient interview(s), and (3) physical examination. No controlled trials of the clinical impact of performing a preanesthesia medical records review or physical examination were found (*Category D evidence*). Observational studies of asymptomatic or nonselected surgical patients reported associations between several preoperative patient characteristics (*e.g.*, age, health status) and postoperative morbidity and mortality (*Category B2 evidence*).[1–14] Several observational studies reported perioperative complications (*e.g.*, cardiac, respiratory, renal, hemorrhagic) associated with specific preexisting conditions (*e.g.*, diabetes, pulmonary disease, chronic hypertension, previous myocardial infarction, history of smoking, high body mass index, extremes of age) (*Category B2 evidence*).[15–55] These associations do not provide evidence

regarding the clinical impact of perioperative interventions that may be derived from preoperative knowledge of a patient's condition. Additional studies were examined that reported changes in resource management based on preexisting conditions (*e.g.*, airway abnormalities, cardiopulmonary disorders) detected during a preanesthetic examination, interview, or questionnaire administration (*Category B2 evidence*).[56–61]

Timing. The activities encompassed by a preanesthetic history and physical examination occur over a variable period of time. The timing of an initial preanesthetic evaluation is guided by such factors as patient demographics, clinical conditions, type and invasiveness of procedure, and the nature of the healthcare system. Three options that practices use for the timing of an initial preanesthetic evaluation are: (1) always before the day of surgery, (2) either on or before the day of surgery, and (3) only on the day of surgery.

Consultant and ASA member opinions regarding the timing of an initial assessment of pertinent medical records for high, medium, and low levels of surgical invasiveness, independent of medical condition, were obtained during development of the original Advisory and are reported in table 1 (appendix 2). The majority of consultants and ASA members agree that for high surgical invasiveness, the initial assessment of pertinent medical records should be done before the day of surgery by anesthesia staff. For medium surgical invasiveness, the majority of consultants indicate that the initial assessment of pertinent medical records should be done before the day of surgery by anesthesia staff, although the majority of ASA members indicate that the initial assessment may be done on or before the day of surgery. For low surgical invasiveness, the majority of consultants and ASA members agree that the initial assessment may be done on or before the day of surgery.

Consultant and ASA membership opinions regarding the timing of an initial preanesthetic interview and physical examination for high and low severities of disease are reported in table 2 (appendix 2). The majority of consultants and ASA members agree that, for patients with high severity of disease, it is preferable that the interview and physical examination be done before the day of surgery by anesthesia staff. For low severity of disease and high surgical invasiveness, consultants and ASA members agree that it is preferable that the interview and physical examination should be done before the day of surgery. For patients with low severity of disease and medium or low surgical invasiveness, consultants and ASA members agree that the interview and physical examination may be done on or before the day of surgery.

A majority of consultants and the ASA membership, respectively, agree that, *at a minimum*, a preanesthetic physical examination should include (1) an airway examination (100%, 100%), (2) a pulmonary examination to include auscultation of the lungs (88%, 85%), and (3) a cardiovascular examination (81%, 82%).

Advisory for Preanesthetic History and Physical Examination

Impact. The assessment of anesthetic risks associated with the patient's medical conditions, therapies, alternative treatments, surgical and other procedures, and of options for anesthetic techniques is an essential component of basic anesthetic practice. Benefits may include, but are not limited to, the safety of perioperative care, optimal resource use, improved outcomes, and patient satisfaction.

Timing. An assessment of readily accessible, pertinent medical records with consultations, when appropriate, should be performed as part of the preanesthetic evaluation before the day of surgery for procedures with high surgical invasiveness. For procedures with low surgical invasiveness, the review and assessment of medical records may be done on or before the day of surgery by anesthesia staff. The information obtained may include, but should not be limited to, (1) a description of current diagnoses; (2) treatments, including medications and alternative therapies used; and (3) determination of the patient's medical condition(s). The Task Force cautions that the timing of such assessments may not be practical with the current limitation of resources provided in specific healthcare systems or practice environments.

An initial record review, patient interview, and physical examination should be performed before the day of surgery for patients with high severity of disease. For patients with low severity of disease and those undergoing procedures with high surgical invasiveness, the interview and physical exam should also be performed before the day of surgery. For patients with low severity of disease undergoing procedures with medium or low surgical invasiveness, the initial interview and physical exam may be performed on or before the day of surgery. *At a minimum*, a focused preanesthetic physical examination should include an assessment of the airway, lungs, and heart, with documentation of vital signs.

The Task Force believes it is the obligation of the healthcare system to, at a minimum, provide pertinent information to the anesthesiologist for the appropriate assessment of the severity of medical condition of the patient and invasiveness of the proposed surgical procedure well in advance of the anticipated day of procedure for all elective patients.

II. Selection and Timing of Preoperative Tests

Literature regarding controlled trials and test findings regarding the incidence or frequency of commonly used preoperative tests are described below. For purposes of this Advisory, a *routine* test is defined as a test ordered in the absence of a specific clinical indication or purpose. Global designations such as "preop status" or "surgical screening" are not considered as specific clinical indications or purposes. An *indicated* test is defined as a test that is ordered for a specific clinical indication or purpose. For example, assessment of warfarin therapy effects would be considered an indication for specific coagulation studies.

Electrocardiogram (ECG). Observational studies report abnormal ECG findings for asymptomatic or nonselected patients ranging from 4.6 to 44.9% of patients (*Category B2 evidence*).[62–72] Abnormal findings led to cancellations of surgery or changes in management in 0.46–2.6% of cases (*Category B2 evidence*).[64,67]

Observational studies report abnormal findings for ECGs that were ordered as indicated tests in 11.0–78.8% of patients,[15,35,57,62,68,73–87] leading to postponement, cancellations, or changes in management in 2.0–20.0% of cases (*Category B2 evidence*).[57,80,81] One observational study with investigator and practitioner blinding found that preoperative ECG ischemic episodes were associated with intraoperative and postoperative myocardial infarction for older patients with severe coronary artery disease scheduled for elective coronary artery bypass surgery (*Category B2 evidence*).[79]

Other Cardiac Evaluation. An observational study reports abnormal transthoracic echocardiography findings in 25% of asymptomatic or nonselected patients (*Category B2 evidence*).[88] Another observational study reports abnormal stress test values in 24% of asymptomatic or nonselected patients, leading to a management change in 2% of the cases (*Category B2 evidence*).[60]

For patients with cardiac indications, observational studies report abnormal echocardiography findings in 7.5–25.2% of patients,[89–92] leading to cancellation of surgery in 0.8% of cases (*Category B2 evidence*).[92] In selected or indicated patients, abnormal stress or exercise test findings were reported for 15.2–61.9% of patients,[74,93–96] leading to additional cardiac testing in 39.5% of patients with abnormal findings (*Category B2 evidence*).[96] A retrospective nonblinded study of vascular surgery patients administered a preoperative stress test reports a reduced 30-day mortality compared with patients not administered a preoperative cardiac test (*Category B2 evidence*).[97] In selected coronary artery bypass patients, ventriculography findings indicated low ejection fraction values (*e.g.*, less than 40–50%) in 22.5–24.3% of patients (*Category B2 evidence*).[98,99]

Chest Radiography. Chest radiography findings were reported as abnormal in 0.3–60.1% of asymptomatic or nonselected patients,[57,62,67,68,70,100–118] and led to postponement, cancellations, or changes in management in 0.6–20.3% of cases found to be abnormal (*Category B2 evidence*).[57,67,70,100,101,103,113,115,117,118]

For selected or indicated patients, abnormal chest radiography findings were reported in 7.7–86.0% of patients,[33,62,68,75,81,101,111,114,119–124] and led to postponement, cancellations, or changes in management in 0.5–17.1% of the cases with abnormal findings (*Category B2 evidence*).[81,101,120]

Pulmonary Evaluation (*i.e.*, Pulmonary Function Tests, Spirometry). Spirometry studies reported abnormal findings in 14.0–51.7% of asymptomatic or nonselected patients (*Category B2 evidence*).[125–127] Changes in clinical management were not reported.

For selected or indicated patients, abnormal pulmonary function test findings were reported in 27.1–65.6% of patients[128–130]; abnormal spirometry findings were reported in 42.0% of patients (*Category B2 evidence*).[131] Changes in clinical management were not reported.

Hemoglobin/Hematocrit Measurement. In asymptomatic or nonselected patients, abnormal hemoglobin findings were reported in 0.5% to 65.4% of patients[8,70,107,114,132–140] and led to cancellations or changes in management in 2.4–28.6% of cases with abnormal findings (*Category B2 evidence*).[70,133,138,139]

For selected or indicated patients, abnormal hemoglobin findings were reported in 54.0% of patients (*Category B2 evidence*).[114] Changes in clinical management were not reported.

In asymptomatic or nonselected patients, abnormal hematocrit findings were reported in 0.2–38.9% of patients[110,134,141–143] and led to delay of surgery in 20.0% of the cases with abnormal findings (*Category B2 evidence*).[110]

In asymptomatic or nonselected patients, abnormal complete blood counts (*i.e.*, individual test results not reported) were reported in 2.9–9.0% of patients[59,62,67,144] and led to changes in clinical management in 2.9% of cases with abnormal findings (*Category B2 evidence*).[67]

For selected or indicated patients, abnormal complete blood counts were reported in 6.3–60.8% of patients[62,75,81] and led to changes in clinical management in 14.9% of the cases with abnormal findings (*Category B2 evidence*).[81]

Coagulation Studies. In asymptomatic or nonselected patients, coagulation abnormalities (*i.e.*, bleeding time, prothrombin time, partial prothrombin time, or platelet count) were reported in 0.06–21.2% of patients[8,110,134,137,144–157] and led to cancellations or changes in management in 0.0–4.0% of cases with abnormal findings (*Category B2 evidence*).[110,148,152]

For selected or indicated patients, abnormal coagulation findings were reported in 3.4–29.1% of patients (*Category B2 evidence*).[156,158–160] Changes in clinical management were not reported.

Serum Chemistries. In asymptomatic or nonselected patients, abnormal sodium concentrations were reported in 1.9% of patients[8]; abnormal potassium concentrations were reported in 0.2–16.0% of patients[8,107,114,134,137,161]; abnormal glucose concentrations were reported in 0.9–40.4% of patients (*Category B2 evidence*).[8,107,134,137,144,162–164] Changes in clinical management were not reported.

For selected or indicated patients, abnormal potassium concentrations were reported in 2.9–71.0% of patients (*Category B2 evidence*).[114,165,166] One nonrandomized study compared preoperative serum potassium concentrations 3 days before surgery with serum potassium concentrations at induction, and found lower potassium concentrations (hypokalemia) at induction (*Category B2 evidence*).[161] Changes in clinical management were not reported.

Urine Testing. In asymptomatic or nonselected patients, abnormal findings for urinalysis, not including pregnancy testing, were reported in 0.7–42.0% of patients[59,62,64,70,110,114,134,138,142,167–169] and led to cancellations or changes in management in 2.3–75.0% of the cases with abnormal findings (*Category B2 evidence*).[110,138,168]

For selected or indicated patients, abnormal urinalysis findings, not including pregnancy testing, were reported in 4.6–90.0% of patients[62,81,114,167,168] and led to changes in clinical management in 23.1–42.8% of cases with abnormal findings (*Category B2 evidence*).[81,168]

Pregnancy Testing. In asymptomatic or nonselected patients (*i.e.*, premenopausal menstruating females, not excluding anyone on the basis of history) positive pregnancy test findings were reported in 0.3–1.3% of patients[170–173] and led to postponement, cancellations, or changes in management in 100.0% of the cases of pregnancy (*Category B2 evidence*).[170–173]

Survey Responses for Selection and Timing of Preoperative Tests. For the original Advisory, consultants and ASA members were asked to consider whether specific preoperative tests (1) should be conducted on a routine basis (*i.e.*, given to patients regardless of known or suspected diseases or disorders), (2) should be conducted for selected patients or for selected types of surgery, or (3) are not necessary. For the tests considered, consultant and ASA membership responses are reported in table 3 (appendix 2). Consultants and ASA members were also asked to identify specific patient characteristics that would favor a decision to order, require, or perform a preoperative test. For these specific patient characteristics, consultant and ASA membership responses are reported in table 4 (appendix 2).

Consultants and ASA members were asked whether or not they agree that selected preoperative test results are acceptable if obtained from the patient's medical chart, assuming the patient's medical history has not changed substantially since the test result was obtained. The percentages of agreement of consultants and ASA members are reported, respectively, as follows: ECG (99%, 98%), other cardiac evaluation (94%, 98%), chest x-ray (97%, 92%), hemoglobin or hematocrit (99%, 96%), coagulation studies (86%, 98%), and serum chemistries (96%, 98%).

Respondents who agreed that test findings might be obtained from a patient's medical chart were asked how recent the findings should be to be acceptable. Opinions on how recent test findings should be are reported in table 5 (appendix 2).

Advisory for Selection and Timing of Preoperative Tests

Routine Preoperative Testing. Preoperative tests should not be ordered routinely. Preoperative tests may be ordered, required, or performed *on a selective basis* for purposes of guiding or optimizing perioperative management. The indications for such testing should be documented and based on information obtained from medical records, patient interview, physical examination, and type and invasiveness of the planned procedure.

Preoperative Testing in the Presence of Specific Clinical Characteristics

The Task Force believes that there is insufficient evidence to identify explicit decision parameters or rules for ordering preoperative tests on the basis of specific clinical characteristics. However, consideration of selected clinical characteristics may assist the anesthesiologist when deciding to order, require, or perform preoperative tests. The following clinical characteristics may be of merit, although the anesthesiologist should not limit consideration to the characteristics suggested below.

ECG. Important clinical characteristics may include cardiocirculatory disease, respiratory disease, and type or invasiveness of surgery. The Task Force recognizes that ECG abnormalities may be more frequent in older patients and in patients with multiple cardiac risk factors. The Task Force did not reach consensus on a specific minimum age in those patients without specific risk factors. The Task Force recognizes that age alone may not be an indication for ECG. An ECG may be indicated for patients with known cardiovascular risk factors or for patients with risk factors identified in the course of a preanesthesia evaluation.

Preanesthesia Cardiac Evaluation (Other than ECG). Preanesthesia cardiac evaluation may include consultation with specialists and ordering, requiring, or performing tests that range from noninvasive passive or provocative screening tests (*e.g.*, stress testing) to noninvasive and invasive assessment of cardiac structure, function, and vascularity (*e.g.*, echocardiogram, radionucleotide imaging, cardiac catheterization). Anesthesiologists should balance the risks and costs of these evaluations against their benefits. Clinical characteristics to consider include cardiovascular risk factors and type of surgery.

Preanesthesia Chest Radiographs. Clinical characteristics to consider include smoking, recent upper respiratory infection, chronic obstructive pulmonary disease (COPD), and cardiac disease. The Task Force recognizes that chest radiographic abnormalities may be higher in such patients but does not believe that extremes of age, smoking, stable COPD, stable cardiac disease, or resolved recent upper respiratory infection should be considered unequivocal indications for chest radiography.

Preanesthesia Pulmonary Evaluation (Other than Chest X-ray). Preanesthesia pulmonary evaluation other than chest x-ray may include consultation with specialists and tests that range from noninvasive passive or provocative screening tests (*e.g.*, pulmonary function tests, spirometry, pulse oximetry) to invasive assessment of pulmonary function (*e.g.*, arterial blood gas). Anesthesiologists should balance the risks and costs of these evaluations against their benefits. Clinical characteristics to consider include type and invasiveness of the surgical procedure, interval from previous evaluation, treated

or symptomatic asthma, symptomatic COPD, and scoliosis with restrictive function.

Preanesthesia Hemoglobin or Hematocrit. Routine hemoglobin or hematocrit is not indicated. Clinical characteristics to consider as indications for such tests include type and invasiveness of procedure, patients with liver disease, extremes of age, and history of anemia, bleeding, and other hematologic disorders.

Preanesthesia Coagulation Studies. Clinical characteristics to consider for ordering selected coagulation studies include bleeding disorders, renal dysfunction, liver dysfunction, and type and invasiveness of procedure. The Task Force recognizes that anticoagulant medications and alternative therapies may present an additional perioperative risk. The Task Force believes that there were not enough data to comment on the advisability of coagulation tests before regional anesthesia.

Preanesthesia Serum Chemistries (*i.e.*, Potassium, Glucose, Sodium, Renal and Liver Function Studies). Clinical characteristics to consider before ordering such tests include likely perioperative therapies, endocrine disorders, risk of renal and liver dysfunction, and use of certain medications or alternative therapies. The Task Force recognizes that laboratory values may differ from normal values at extremes of age.

Preanesthesia Urinalysis. Urinalysis is not indicated except for specific procedures (*e.g.*, prosthesis implantation, urologic procedures) or when urinary tract symptoms are present.

Preanesthesia Pregnancy Testing. Patients may present for anesthesia with early undetected pregnancy. The Task Force believes that the literature is inadequate to inform patients or physicians on whether anesthesia causes harmful effects on early pregnancy. Pregnancy testing may be offered to female patients of childbearing age and for whom the result would alter the patient's management.

Timing of Preoperative Testing. The current literature is not sufficiently rigorous to permit an unambiguous assessment of the clinical benefits or harms of the timing for preoperative tests. The Task Force believes that there is insufficient evidence to identify explicit decision parameters or "rules" for ordering preoperative tests on the basis of specific patient factors.

Test results obtained from the medical record within 6 months of surgery generally are acceptable if the patient's medical history has not changed substantially. More recent test results may be desirable when the medical history has changed or when a test results may play a role in the selection of a specific anesthetic technique (*e.g.*, regional anesthesia in the setting of anticoagulation therapy).

III. Summary and Conclusions

A *preanesthesia evaluation* involves the assessment of information from multiple sources, including medical records, patient interviews, physical examinations, and findings from preoperative tests.

The current scientific literature does not contain sufficiently rigorous information about the components of a preanesthesia evaluation to permit recommendations that are unambiguously based. Therefore, the Task Force has relied primarily upon observational literature, opinion surveys of consultants, and surveys of a random sample of members of the American Society of Anesthesiologists. The focus of opinion surveys has been threefold: (1) the content of the preanesthesia evaluation, (2) the timing of the preanesthesia evaluation, and (3) the indications for specific preoperative tests.

The following remarks represent a synthesis of the opinion surveys, literature, and Task Force consensus.

- *Content* of the preanesthetic evaluation includes but is not limited to (1) readily accessible medical records, (2) patient interview, (3) a directed preanesthesia examination, (4) preoperative tests when indicated, and (5) other consultations when appropriate. *At a minimum*, a directed preanesthetic physical examination should include an assessment of the airway, lungs, and heart.
- *Timing* of the preanesthetic evaluation can be guided by considering combinations of surgical invasiveness and severity of disease, as shown in table 2 (appendix 2).

The Task Force cautions that limitations in resources available to a specific healthcare system or practice environment may affect the timing of the preanesthetic evaluation. The healthcare system is obligated to provide pertinent information to the anesthesiologist for the appropriate assessment of the invasiveness of the proposed surgical procedure and the severity of the patient's medical condition well in advance of the anticipated day of procedure for all elective patients.

- *Routine preoperative tests* (*i.e.*, tests intended to discover a disease or disorder in an asymptomatic patient) do not make an important contribution to the process of perioperative assessment and management of the patient by the anesthesiologist.
- *Selective preoperative tests* (*i.e.*, tests ordered after consideration of specific information obtained from sources such as medical records, patient interview, physical examination, and the type or invasiveness of the planned procedure and anesthesia) may assist the anesthesiologist in making decisions about the process of perioperative assessment and management.
- *Decision-making parameters* for specific preoperative tests or for the timing of preoperative tests cannot be unequivocally determined from the available scientific literature. Further research is needed, preferably in the form of appropriately randomized clinical trials. Specific tests and their timing should be individualized and based upon information obtained from sources such as the patient's medical record, patient interview, physical examination, and the type and invasiveness of the planned procedure.

Appendix 1: Summary of Advisory Statements

I. Preanesthesia History and Physical Examination

- Impact
  - The assessment of anesthetic risks associated with the patient's medical conditions, therapies, alternative treatments, surgical and other procedures, and of options for anesthetic techniques is an essential component of basic anesthetic practice.
    - Benefits may include, but are not limited to, the safety of perioperative care, optimal resource use, improved outcomes, and patient satisfaction.
- Timing
  - An assessment of readily accessible, pertinent medical records with consultations, when appropriate, should be performed as part of the preanesthetic evaluation before the day of surgery for procedures with high surgical invasiveness.
    - For procedures with low surgical invasiveness, the review and assessment of medical records may be done on or before the day of surgery by anesthesia staff.
    - The information obtained may include, but should not be limited to, (1) a description of current diagnoses; (2) treatments, including medications and alternative therapies used; and (3) determination of the patient's medical condition(s).
    - The timing of such assessments may not be practical with the current limitation of resources provided in specific healthcare systems or practice environments.
  - An initial record review, patient interview, and physical examination should be performed before the day of surgery for patients with high severity of disease.
    - For patients with low severity of disease and undergoing procedures with high surgical invasiveness, the interview and physical exam should also be performed before the day of surgery.
    - For patients with low severity of disease undergoing procedures with medium or low surgical invasiveness, the initial interview and physical exam may be performed on or before the day of surgery.
    - At a minimum, a focused preanesthetic physical examination should include an assessment of the airway, lungs, and heart, with documentation of vital signs.
  - It is the obligation of the healthcare system to, at a minimum, provide pertinent information to the anesthesiologist for the appropriate assessment of the severity of medical condition of the patient and invasiveness of the proposed surgical procedure well in advance of the anticipated day of procedure for all elective patients.

II. Selection and Timing of Preoperative Tests

- Routine Preoperative Testing
  - Preoperative tests should not be ordered routinely.
  - Preoperative tests may be ordered, required, or performed on a selective basis for purposes of guiding or optimizing perioperative management.
    - The indications for such testing should be documented and based on information obtained from medical records, patient interview, physical examination, and type and invasiveness of the planned procedure.
- Preoperative Testing in the Presence of Specific Clinical Characteristics
  - There is insufficient evidence to identify explicit decision parameters or rules for ordering preoperative tests on the basis of specific clinical characteristics.
  - Consideration of selected clinical characteristics may assist the anesthesiologist when deciding to order, require, or perform preoperative tests. The following clinical characteristics may be of merit, although the anesthesiologist should not limit consideration to the characteristics suggested below.
  - Electrocardiogram
    - Important clinical characteristics may include cardiocirculatory disease, respiratory disease, and type or invasiveness of surgery.
    - The Task Force recognizes that ECG abnormalities may be higher in older patients and in patients with multiple cardiac risk factors.
    - An ECG may be indicated for patients with known cardiovascular risk factors or for patients with risk factors identified in the course of a preanesthesia evaluation. Age alone may not be an indication for ECG.
  - Preanesthesia Cardiac Evaluation Other than ECG
    - Preanesthesia cardiac evaluation may include consultation with specialists and ordering, requiring, or performing tests that range from noninvasive passive or provocative screening tests (*e.g.*, stress testing) to noninvasive and invasive assessment of cardiac structure, function, and vascularity (*e.g.*, echocardiogram, radionucleotide imaging, cardiac catheterization).
    - Anesthesiologists should balance the risks and costs of these evaluations against their benefits.
    - Clinical characteristics to consider include cardiovascular risk factors and type of surgery.
  - Preanesthesia Chest Radiographs
    - Clinical characteristics to consider include smoking, recent upper respiratory infection, COPD, and cardiac disease.
      - The Task Force recognizes that chest radiographic abnormalities may be higher in such patients but does not believe that extremes of age, smoking, stable COPD, stable cardiac disease, or resolved recent upper respiratory infection should be considered unequivocal indications for chest radiography.
  - Preanesthesia Pulmonary Evaluation Other than Chest X-ray
    - Preanesthesia pulmonary evaluation other than chest x-ray may include consultation with specialists and tests that range from noninvasive passive or provocative screening tests (*e.g.*, pulmonary function tests, spirometry, pulse oximetry) to invasive assessment of pulmonary function (*e.g.*, arterial blood gas).
      - Anesthesiologists should balance the risks and costs of these evaluations against their benefits.
      - Clinical characteristics to consider include type and invasiveness of the surgical procedure, interval from previous evaluation, treated or symptomatic asthma, symptomatic COPD, and scoliosis with restrictive function.
  - Preanesthesia Hemoglobin or Hematocrit
    - Routine hemoglobin or hematocrit is not indicated.
    - Clinical characteristics to consider as indications for hemoglobin or hematocrit include type and invasiveness of procedure, patients with liver disease, extremes of age, and history of anemia, bleeding, and other hematologic disorders.
  - Preanesthesia Coagulation Studies
    - Clinical characteristics to consider for ordering selected coagulation studies include bleeding disorders, renal dys-

function, liver dysfunction, and type and invasiveness of procedure.
    - The Task Force recognizes that anticoagulant medications and alternative therapies may present an additional perioperative risk.
    - The Task Force believes that there were not enough data to comment on the advisability of coagulation tests before regional anesthesia.
  - Preanesthesia Serum Chemistries (*i.e.*, Potassium, Glucose, Sodium, Renal and Liver Function Studies)
    - Clinical characteristics to consider before ordering preanesthesia serum chemistries include likely perioperative therapies, endocrine disorders, risk of renal and liver dysfunction, and use of certain medications or alternative therapies.
      - The Task Force recognizes that laboratory values may differ from normal values at extremes of age.
  - Preanesthesia Urinalysis
    - Urinalysis is not indicated except for specific procedures (*e.g.*, prosthesis implantation, urologic procedures) or when urinary tract symptoms are present.
  - Preanesthesia Pregnancy Testing
    - Patients may present for anesthesia with early undetected pregnancy.
      - The Task Force believes that the literature is inadequate to inform patients or physicians on whether anesthesia causes harmful effects on early pregnancy.
      - Pregnancy testing may be offered to female patients of childbearing age and for whom the result would alter the patient's management.
  - Timing of Preoperative Testing
    - The current literature is not sufficiently rigorous to permit an unambiguous assessment of the clinical benefits or harms of the timing for preoperative tests.
      - There is insufficient evidence to identify explicit decision parameters or "rules" for ordering preoperative tests on the basis of specific patient factors.
    - Test results obtained from the medical record within 6 months of surgery generally are acceptable if the patient's medical history has not changed substantially.
      - More recent test results may be desirable when the medical history has changed, or when a test results may play a role in the selection of a specific anesthetic technique (*e.g.*, regional anesthesia in the setting of anticoagulation therapy).

III. Summary and Conclusions

- Content of the preanesthetic evaluation includes, but is not limited to, (1) readily accessible medical records, (2) patient interview, (3) a directed preanesthesia examination, (4) preoperative tests when indicated, and (5) other consultations when appropriate. At a minimum, a directed preanesthetic physical examination should include an assessment of the airway, lungs, and heart.
- Timing of the preanesthetic evaluation can be guided by considering combinations of surgical invasiveness and severity of disease, as shown in table 2 (appendix 2).
  - Limitations in resources available to a specific healthcare system or practice environment may affect the timing of the preanesthetic evaluation.
  - The healthcare system is obligated to provide pertinent information to the anesthesiologist for the appropriate assessment of the invasiveness of the proposed surgical procedure and the severity of the patient's medical condition well in advance of the anticipated day of procedure for all elective patients.
- Routine preoperative tests (*i.e.*, tests intended to discover a disease or disorder in an asymptomatic patient) do not make an important contribution to the process of perioperative assessment and management of the patient by the anesthesiologist.
- Selective preoperative tests (*i.e.*, tests ordered after consideration of specific information obtained from sources such as medical records, patient interview, physical examination, and the type or invasiveness of the planned procedure and anesthesia) may assist the anesthesiologist in making decisions about the process of perioperative assessment and management.
- Decision-making parameters for specific preoperative tests or for the timing of preoperative tests cannot be unequivocally determined from the available scientific literature.
  - Specific tests and their timing should be individualized and based upon information obtained from sources such as the patient's medical record, patient interview, physical examination, and the type and invasiveness of the planned procedure.

Appendix 2: Methods and Analyses

A. State of the Literature

For this updated Advisory, a review of studies used in the development of the original Advisory was combined with a review of studies published subsequent to approval of the original Advisory. The updated literature review was based on evidence linkages, consisting of directional statements about relationships between specific preanesthesia evaluation activities and clinical outcomes. The evidence linkage interventions are listed below.

Preanesthesia History and Physical Examination

Preprocedure review of pertinent medical records
Patient interviewing for medical or anesthetic history
Preanesthesia patient examination

Cardiac Evaluation

Electrocardiogram
Other cardiac evaluation (*e.g.*, angiography, echocardiography, stress tests)
Cardiac function tests
Echocardiography (transesophageal, transthoracic)
Stress tests
Ventriculography

Pulmonary Evaluation

Chest radiography
Other pulmonary evaluation (*e.g.*, pulmonary function tests, spirometry)

Blood Tests

Hemoglobin
Hematocrit
Complete blood count
Coagulation studies
Serum chemistries (*i.e.*, sodium, potassium, glucose)
Potassium
Glucose
Urinalysis (as distinct from pregnancy testing)
Pregnancy evaluation

For purposes of literature review, potentially relevant clinical studies were identified via electronic and manual searches of the literature. The updated electronic search covered a 10-yr period from 2002 through 2011. The manual search covered a 15-yr period of time from 1997 through 2011. More than 300 new citations that addressed topics related to the evidence linkages were identified. These articles were reviewed, and studies that did not provide direct evidence were eliminated (combined total = 985). Articles that were accepted as containing direct linkage-related evidence were combined with pre-2002 articles accepted by the 2003 amended Advisory, resulting in a combined total of 245 articles.

No evidence linkage contained sufficient literature with well-defined experimental designs and statistical information to conduct an analysis of aggregated studies (*i.e.*, meta-analysis). A complete bibliography used to develop this updated Advisory, organized by section, is available as Supplemental Digital Content 2, http://links.lww.com/ALN/A789.

A study or report that appears in the published literature can be included as evidence in the development of an advisory if it meets four essential criteria. Failure to meet one or more of these criteria means that a study had features that did not make it suitable for analytic purposes. The four essential criteria are as follows: (1) the study must be related to one of the specified linkage statements; (2) the study must report a clinical finding or set of findings that can be tallied or quantified (This criterion eliminates reports that contain only opinion.); (3) the study must report a clinical finding or set of findings that can be identified as the product of an original investigation or report (This criterion eliminates the repetitive reporting and counting of the same results, such as may occur in review articles or follow-up studies that summarize previous findings.); and (4) the study must use sound research methods and analytical approaches that provide a clear test or indication of the relationship between the intervention and outcome of interest. Because none of the studies in this updated Advisory met all four criteria, the published literature could not be used as a source of quantitative support.

Although evidence linkages are designed to assess causality, the reviewed studies did not provide a clear indication of causality. However, many published studies were evaluated that provided the Task Force with important noncausal evidence. For example, descriptive literature (*i.e.*, reports of frequency or incidence) is often useful in providing an indication of the scope of a problem, and case reports may be useful in identifying the usefulness of preoperative tests for selected patients. In conclusion, the current literature has not been helpful in determining the efficacy of specific preanesthesia evaluation activities in improving patient outcome. Until controlled studies are conducted, evidence from noncausal sources will need to be used, such as consensus-driven data and the opinion of practitioners and experts. It is recommended that future research on preanesthesia evaluation focus on the identification of preoperative tests or other evaluative activities in the context of prospective research designs when feasible.

B. Consensus-based Evidence

For the original Advisory, consensus was obtained from multiple sources, including (1) survey opinion from consultants who were selected based on their knowledge or expertise regarding preanesthesia or preoperative evaluation, (2) survey opinions from a representative sample of ASA members (N = 360), (3) testimony from attendees of three publicly held open forums at national anesthesia meetings,† (4) Internet commentary, and (5) Task Force opinion and interpretation. Consultants and ASA members responded to three surveys addressing the following issues: (1) the appropriateness and completeness of topics selected for evidence review, (2) the appropriateness and need to include algorithm examples for timing of the preanesthesia evaluation, and (3) surveys regarding the timing and content of the preanesthesia evaluation and indications for testing. The survey rate of return for consultants was 55.8% (72 of 129). Of the 360 ASA members contacted, 234 (65%) responded. Survey responses for consultants and ASA members are presented in the text of the Advisory, and complete listings of survey responses are reported in tables 1–5.

In the original Advisory, consultants were asked to indicate which, if any, of the evidence linkages would change their clinical practices if the Advisory was instituted. The rate of return was 27.9% (36 of 129). The percentage of responding consultants expecting no change associated with each linkage were as follows: (1) review of medical records, charts, consultations, or other documentation = 88.6%, (2) preanesthesia patient examination = 91.4%, (3) patient interviewing for medical or anesthesia history = 91.4%, (4) timing of the preanesthesia evaluation = 82.9%, (5) ordering or performing preanesthesia ECGs = 77.1%, (6) ordering or performing other cardiac evaluations = 82.9%, (7) performing preanesthesia pulmonary function tests = 85.7%, (8) performing preanesthesia chest x-rays = 82.9%, (9) performing preanesthesia laboratory tests = 85.7%, and (10) performing preanesthesia urine pregnancy tests = 94.3%. Of the respondents, 94.3% indicated that the Advisory would have no effect on the amount of time spent on a typical case, and 5.7% indicated that there would be a decrease in the amount of time spent on a typical case with the implementation of this Advisory.

Table 1. Consultant and ASA Member Survey Responses: Timing of the Initial Assessment of Pertinent Medical Records*

	High		Medium		Low	
Surgical Invasiveness	Consultants (N = 72)	Members (N = 234)	Consultants (N = 72)	Members (N = 231)	Consultants (N = 72)	Members (N = 233)
Before day of surgery	89%	75%	58%	33%	17%	11%
On or before day of surgery	11%	24%	39%	61%	69%	59%
Only on day of surgery	0%	1%	3%	6%	14%	30%

* N = number of consultants or American Society of Anesthesiologists (ASA) members who responded to each item.

Table 2. Consultant and ASA Member Survey Responses: Timing of the Preanesthetic Interview and Physical Examination*

	Surgical Invasiveness					
	High		Medium		Low	
High Severity of Disease	Consultants (N = 72)	Members (N = 232)	Consultants (N = 72)	Members (N = 232)	Consultants (N = 72)	Members (N = 232)
Before day of surgery	96%	89%	94%	69%	71%	53%
On or before day of surgery	4%	9%	4%	28%	24%	32%
Only on day of surgery	0%	2%	1%	3%	5%	15%
	Surgical Invasiveness					
	High		Medium		Low	
Low Severity of Disease	Consultants (N = 72)	Members (N = 229)	Consultants (N = 72)	Members (N = 229)	Consultants (N = 72)	Members (N = 229)
Before day of surgery	72%	53%	29%	21%	13%	25%
On or before day of surgery	11%	20%	49%	46%	39%	34%
Only on day of surgery	15%	11%	21%	34%	47%	56%

* N = number of consultants or American Society of Anesthesiologists (ASA) members who responded to each item.

Table 3. Consultant and ASA Member Survey Responses: Routine or Selective Preoperative Testing*

Preoperative Test	All Patients (Routine) Percent Agreement*	Selected Patients Percent Agreement	Test Not Necessary Percent Agreement
ECG			
Consultants (N = 72)	0%	100%	0%
ASA members (N = 233)	1%	98%	1%
Cardiac tests other than ECG			
Consultants (N = 72)	0%	97%	0%
ASA members (N = 233)	1%	99%	0%
Chest x-rays			
Consultants (N = 72)	3%	90%	7%
ASA members (N = 233)	1%	92%	6%
Pulmonary function tests			
Consultants (N = 42)	0%	98%	2%
ASA members (N = 234)	0%	96%	3%
Office spirometry			
Consultants (N = 42)	0%	88%	10%
ASA members (N = 234)	1%	63%	20%
Hemoglobin/Hematocrit			
Consultants (N = 72)	3%	96%	1%
ASA members (N = 234)	4%	95%	1%
Coagulation studies			
Consultants (N = 72)	3%	94%	1%
ASA members (N = 234)	1%	98%	1%
Serum chemistries			
Consultants (N = 72)	1%	99%	0%
ASA members (N = 234)	1%	99%	0%
Urinalysis			
Consultants (N = 72)	1%	53%	46%
ASA members (N = 233)	2%	47%	49%
Pregnancy test			
Consultants (N = 72)	7%	88%	5%
ASA members (N = 232)	17%	78%	3%

Row percentages do not include "don't know" responses, so row totals may not sum to 100%.

* N = number of consultants or American Society of Anesthesiologists (ASA) members who responded to each item.

ECG = electrocardiogram.

Table 4. Consultant and ASA Member Survey Responses: Patient Characteristics for Selected Preoperative Testing*

Preoperative Test	Patient Characteristics (N = 72)	Consultants (N = 234)	ASA Members
Electrocardiogram	Advanced age	93%	94%
	Cardiocirculatory disease	97%	98%
	Respiratory disease	74%	74%
Other cardiac evaluation (*e.g.*, stress test)	Cardiovascular compromise	88%	95%
Chest radiograph	Recent upper respiratory infection	45%	59%
	Smoking	42%	60%
	COPD	71%	76%
	Cardiac disease	62%	75%
Pulmonary function tests	Reactive airway disease	68%	71%
	COPD	80%	89%
	Scoliosis	53%	60%
Office spirometry (*i.e.*, portable spirometer)	Reactive airway disease	83%	86%
	COPD	77%	90%
	Scoliosis	51%	52%
Hemoglobin/hematocrit	Advanced age	57%	68%
	Very young age	52%	56%
	Anemia	96%	99%
	Bleeding disorders	93%	94%
	Other hematologic disorders	74%	84%
Coagulation studies	Bleeding disorders	99%	98%
	Renal dysfunction	40%	52%
	Liver dysfunction	97%	91%
	Anticoagulants	97%	96%
Serum chemistries (Na, K, CO_2, Cl, glucose)	Endocrine disorders	93%	95%
	Renal dysfunction	96%	98%
	Medications	87%	89%
Pregnancy test	Uncertain pregnancy history	84%	91%
	History suggestive of current pregnancy	94%	96%

* N = number of consultants or American Society of Anesthesiologists (ASA) members who responded to each item.
COPD = chronic obstructive pulmonary disease.

Table 5. Consultant and ASA Member Survey Responses: Timing of Test Findings*

Preoperative Test	24 h	48 h	1 wk	2 wk	1 mo	3 mo	6 mo	1 yr	>1 yr
Electrocardiogram									
Consultants (N = 72)	0%	0%	4%	0%	31%	0%	46%	19%	0%
ASA members (N = 218)	1%	0%	6%	0%	34%	0%	45%	12%	2%
Other cardiac tests									
Consultants (N = 72)	0%	0%	5%	0%	33%	0%	27%	26%	10%
ASA members (N = 217)	0%	0%	7%	0%	33%	0%	40%	18%	4%
Chest x-ray									
Consultants (N = 72)	0%	5%	5%	0%	25%	23%	19%	23%	0%
ASA members (N = 206)	0%	2%	8%	0%	27%	9%	31%	23%	0%
Hemoglobin/Hematocrit									
Consultants (N = 72)	0%	0%	14%	8%	42%	23%	8%	5%	0%
ASA members (N = 213)	0%	0%	13%	11%	46%	17%	11%	1%	0%
Coagulation studies									
Consultants (N = 42)	28%	11%	30%	6%	19%	6%	0%	0%	0%
ASA members (N = 194)	33%	16%	26%	6%	16%	4%	0%	0%	0%
Serum Chemistries									
Consultants (N = 72)	15%	7%	27%	17%	27%	7%	0%	0%	0%
ASA members (N = 203)	11%	12%	26%	9%	34%	7%	0%	0%	0%

* N = number of consultants or American Society of Anesthesiologists (ASA) members who responded to each item.

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