

in the clinic

# Preoperative Evaluation

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Section Editors  
**Christine Laine, MD, MPH**  
**Sankey V. Williams, MD**

Science Writer  
**Jennifer F. Wilson**

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CME objective: To review strategies to evaluate and reduce perioperative risk.

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**A**lthough every surgical procedure carries some degree of risk, most surgeries carry minimal risk. The goal of preoperative risk assessment is to identify procedure and patient factors that significantly elevate the risk for complications. Careful, directed preoperative evaluation enables implementation of strategies to mitigate risk.

## Risk Factors

### What is the risk for medical complications from surgery in healthy patients?

Healthy patients have significant physiologic reserves and tolerate major and minor surgical procedures well. The risk for serious medical complications from surgery is less than 0.1% overall in healthy patients. When evaluating healthy patients before surgery, physicians should use a focused history and physical examination to predict the risk for serious medical complications.

*Researchers collected information at 16 and 72 hours and 30 days for 38 598 patients undergoing 45 090 consecutive procedures and found that only 33 (0.08%) had major morbidity or mortality. Of 4 deaths that occurred within 30 days of the procedure, 2 were due to myocardial infarction and 2 were due to automobile accidents unlikely to be related to surgery. More than one third of major morbidity occurred 48 hours or more after surgery (1).*

### How does the procedure influence risk for complications in healthy patients undergoing surgery?

The nature of the surgery influences the risk for complications independent of other patient factors (see Box).

*The incidence of surgical adverse events in a random sample of more than 14 000 patients discharged from Colorado and Utah hospitals in 1992 ranged from 2.3% for an amalgam of relatively minor procedures to 18.9% for repair of abdominal aortic aneurysm (2).*

*The incidence of postoperative morbidity and mortality in more than 400 000 major surgeries done in the Veterans Health Administration in the 1990s showed that the complexity of the operation was the third strongest predictor of either morbidity or mortality in multivariate analysis (3).*

The nature of the surgery also influences the risk for specific types of complications. Postoperative pulmonary complications occur in 10% to 40% of patients undergoing upper abdominal and thoracic surgery, whereas they are rarely reported in other types of surgery (4). Moreover, an analysis of 68 831 operations performed in Veterans Affairs hospitals found that not only did perioperative morbidity and mortality vary widely between different procedures, but comorbid conditions had a greater influence in some procedures than in others (5).

### How do underlying chronic conditions influence the risk for medical complications of surgery?

The more comorbid conditions a patient has, the higher the risk for perioperative complications. Comorbid conditions that are associated with higher perioperative risk include ischemic heart disease, heart failure, cerebrovascular disease, diabetes mellitus, and renal insufficiency. Low serum albumin level, a measure of

#### Perioperative Risk Classifications for Surgical Procedures

- High-risk (>5% perioperative risk for death or MI): aortic and peripheral vascular surgery.
- Intermediate-risk (1% to 5% perioperative risk for death or MI): intraperitoneal and intrathoracic surgeries, carotid endarterectomy, head and neck surgery, orthopedic surgery, and prostate surgery.
- Low-risk (<1% perioperative risk for death or MI): endoscopic and superficial procedures, cataract surgery, breast surgery, dental procedures, and ambulatory surgery.

MI = myocardial infarction.

1. Warner MA, Shields SE, Chute CG. Major morbidity and mortality within 1 month of ambulatory surgery and anesthesia. *JAMA*. 1993;270:1437-41. [PMID: 8371443]
2. Gawande AA, Thomas EJ, Zinner MJ, et al. The incidence and nature of surgical adverse events in Colorado and Utah in 1992. *Surgery*. 1999;126:66-75. [PMID: 10418594]
3. Khuri SF, Daley J, Henderson W, et al. The Department of Veterans Affairs' NSQIP: the first national, validated, outcome-based, risk-adjusted, and peer-controlled program for the measurement and enhancement of the quality of surgical care. National VA Surgical Quality Improvement Program. *Ann Surg*. 1998;228:491-507. [PMID: 9790339]
4. Smetana GW. Preoperative pulmonary evaluation. *N Engl J Med*. 1999;340:937-44. [PMID: 10089188]
5. Khuri SF, Daley J, Henderson W, et al. Relation of surgical volume to outcome in eight common operations: results from the VA National Surgical Quality Improvement Program. *Ann Surg*. 1999;230:414-29; discussion 429-32. [PMID: 10493488]
6. Gibbs J, Cull W, Henderson W, et al. Preoperative serum albumin level as a predictor of operative mortality and morbidity: results from the National VA Surgical Risk Study. *Arch Surg*. 1999;134:36-42. [PMID: 9927128]
7. Rizvon MK, Chou CL. Surgery in the patient with liver disease. *Med Clin North Am*. 2003;87:211-27. [PMID: 12575891]

protein–energy malnutrition, is associated with perioperative morbidity (6). Undiagnosed hyperthyroidism can rarely progress to thyroid storm in the perioperative period. Conditions that affect hemostasis may lead to bleeding complications. Surgery during acute hepatitis is associated with a mortality rate exceeding 10%, and cirrhosis is associated with poor outcome in abdominal and other types of surgery (7).

### How do lifestyle factors influence the risk for perioperative complications?

Lifestyle factors can play an important role in the risk for perioperative complications.

#### Exercise

A patient's self-reported ability to exercise is a strong predictor of perioperative medical complications. Perioperative cardiac and neurologic complications doubled in patients who reported an inability to walk 4 blocks or climb 2 flights of stairs, even after adjustment for age (8). In patients undergoing procedures inherently associated with pulmonary complications (thoracotomy, upper abdominal surgery), inability to climb 2 flights of stairs was associated with a positive predictive value of 82% for postoperative complications (9).

#### Smoking

Smoking increases the risk for perioperative pulmonary complications (10). Although earlier studies found that the risk for pulmonary complications is reduced after only 8 weeks of abstinence from tobacco (11), more recent evidence suggests that cessation even 4 weeks before surgery significantly decreases perioperative complications (12, 13).

*A systematic review identified 11 randomized trials involving 1194 patients and concluded that intensive preoperative smoking cessation interventions significantly reduced perioperative com-*

*plications (pooled risk ratio, 0.56 [95% CI, 0.45 to 0.78]) (14).*

For patients who smoke, physicians should strongly recommend cessation and consider delaying elective procedures for 4 to 8 weeks, particularly if the procedure itself incurs a high risk for pulmonary complications.

#### Alcohol and other substances

Hazardous levels of alcohol consumption increase the risk for perioperative complications (15). Alcohol has cardiovascular, gastrointestinal, metabolic, neurologic, and immunologic effects. Withdrawal symptoms from abrupt discontinuation may contribute to perioperative morbidity. During preoperative evaluation, ask patients about quantity of alcohol use, pattern, and time since last drink. Use of recreational drugs is associated with pulmonary and cardiac disorders that may affect management through the perioperative period. Physicians should assess use of such substances as cocaine, heroin, and stimulants.

#### Are obese patients at elevated risk for perioperative complications?

Obese patients are at increased risk for wound problems, pulmonary complications, and difficulties with anesthesia. Obesity is associated with diabetes mellitus, hypertension, and cardiovascular disease, which in turn increase overall surgical risk. Compared with normal-weight patients, overweight and obese patients may also be at higher risk for postoperative deep venous thrombosis; reflux and aspiration of gastric contents perioperatively; and, if morbidly obese, postoperative rhabdomyolysis.

Differences in drug pharmacokinetics in obese patients and normal-weight patients should be taken into account when choosing and dosing anesthetic agents. Regional anesthesia, when feasible, may avoid some of the difficulties posed by general anesthesia in the obese patient.

8. Reilly DF, McNeely MJ, Doerner D, et al. Self-reported exercise tolerance and the risk of serious perioperative complications. *Arch Intern Med.* 1999;159:2185-92. [PMID: 10527296]
9. Girish M, Trayner E Jr, Dammann O, et al. Symptom-limited stair climbing as a predictor of postoperative cardiopulmonary complications after high-risk surgery. *Chest.* 2001;120:1147-51. [PMID: 11591552]
10. Bluman LG, Mosca L, Newman N, et al. Preoperative smoking habits and postoperative pulmonary complications. *Chest.* 1998;113:883-9. [PMID: 9554620]
11. Warner MA, Offord KP, Warner ME, et al. Role of preoperative cessation of smoking and other factors in postoperative pulmonary complications: a blinded prospective study of coronary artery bypass patients. *Mayo Clin Proc.* 1989;64:609-16. [PMID: 2787456]
12. Lindström D, Sadr Azodi O, Wladis A, et al. Effects of a perioperative smoking cessation intervention on postoperative complications: a randomized trial. *Ann Surg.* 2008;248:739-45. [PMID: 18948800]
13. Møller AM, Villebro N, Pedersen T, et al. Effect of preoperative smoking intervention on postoperative complications: a randomized clinical trial. *Lancet.* 2002;359:114-7. [PMID: 11809253]
14. Thomsen T, Tønnesen H, Møller AM. Effect of preoperative smoking cessation interventions on postoperative complications and smoking cessation. *Br J Surg.* 2009;96:451-61. [PMID: 19358172]
15. Tonnesen H, Kehlet H. Preoperative alcoholism and postoperative morbidity. *Br J Surg.* 1999;86:869-74. [PMID: 10417555]

**Risk Factors...** The overall risk for serious medical complications from surgery is less than 0.1% in healthy patients. Comorbid conditions that increase the risk for complications include ischemic heart disease, cerebrovascular disease, heart failure, diabetes mellitus, renal insufficiency, bleeding disorders, and liver disease. Underlying poor nutritional status, obesity, smoking, hazardous alcohol use, and illicit substance use also affect perioperative risk. Poor exercise tolerance is associated with perioperative cardiac and neurologic complications. The nature of the surgery influences the risk for complications independent of other patient factors.

## CLINICAL BOTTOM LINE

## Elements of Evaluation

### Screening Questionnaire for Bleeding Disorders\*

- Do you have family members with bleeding disorders?
- Have you had profuse bleeding from small wounds?
- Do you bruise easily?
- Have you had profuse bleeding after surgery?
- Have you ever had bleeding into a muscle?
- Do you have frequent nosebleeds?
- Have you had profuse bleeding after a tooth extraction?
- Have you ever had blood in your stool?
- Do you have family members who bleed easily?
- Have you ever had bleeding into a joint?
- Do you bleed profusely when menstruating?

\* Positive responses to any question should prompt further evaluation.

### Who should undergo preoperative evaluation?

All patients scheduled for surgery should be considered for preoperative evaluation. For very low-risk procedures, such as dental extractions or cataract surgery, the evaluation may only involve the oral surgeon or ophthalmologist confirming the lack of significant risk factors. For more complex procedures, evaluation by a physician experienced in preoperative assessment may be judicious.

### What are the essential elements of a preoperative history and physical examination?

It is essential to ascertain the patient's age; medication use; exercise tolerance; tobacco, alcohol, and illicit substance use; and overall health, including comorbid conditions, reaction to past surgeries, and experience with anesthesia. The history should include information about the condition for which the surgery is planned and focus on risk factors for cardiac, pulmonary, and infectious complications and include a determination of a patient's functional capacity. It is important to know whether a patient is pregnant.

### Cardiopulmonary

Clinicians should inquire about history of chest discomfort, wheezing, cough, shortness of breath, edema, light-headedness, chest pain, exertional symptoms, and palpitations, as well as coronary revascularization, heart failure, cerebrovascular disease, hypertension, valvular heart disease, and lung disease.

### Hemostasis

Perioperative bleeding risk is related to both patient-specific factors, including congenital and acquired deficiencies, and the type of surgical procedure. The likelihood of previously undetected congenital factor deficiencies is very small in the absence of a history of easy bruising or bleeding. Although routine coagulation testing is common practice before surgery, history is a better predictor of bleeding problems than laboratory testing. Physicians should ask all patients undergoing surgery about personal or family member difficulty with hemostasis and about symptoms that might suggest an undiagnosed bleeding disorder (see Box).

### Medications

Physicians should question patients in detail about use of prescription and nonprescription medications, including dietary and herbal supplements. It is often helpful to have patients bring their medications to the preoperative visit. Note that aspirin and nonsteroidal antiinflammatory drugs may interfere with hemostasis if patients do not stop taking them at an interval before surgery that allows recovery of platelet function.

### Malignant hyperthermia

Anesthetic-induced malignant hyperthermia is rare, but it is important to assess a patient's predisposition to the disorder. Malignant hyperthermia causes a rapid rise in body temperature and severe muscle contractions

16. Denborough M. Malignant hyperthermia. *Lancet*. 1998;352:1131-6. [PMID: 9798607]

17. Schein OD, Katz J, Bass EB, et al. The value of routine preoperative medical testing before cataract surgery. Study of Medical Testing for Cataract Surgery. *N Engl J Med*. 2000;342:168-75. [PMID: 10639542]

18. Smetana GW, Macpherson DS. The case against routine preoperative laboratory testing. *Med Clin North Am*. 2003;87:7-40. [PMID: 12575882]

during general anesthesia, particularly with halothane and succinylcholine (16). Clinicians should ask patients about a history of severe postoperative fever or, for patients never exposed to anesthesia, about severe fever or perioperative death in family members. About one half of the cases of malignant hyperthermia are inherited in an autosomal dominant pattern, and one half are sporadic.

The preoperative physical examination should aim to identify signs of undiagnosed or decompensated underlying conditions (Table 1).

### Which laboratory tests should be performed preoperatively?

Preoperative laboratory testing should be limited in healthy patients, especially those undergoing minor procedures. For minor surgical procedures, especially cataract surgery, routine testing is not indicated in the presence of a normal history and physical examination.

*In a multicenter, randomized, controlled trial comparing routine with selective testing before cataract surgery, the combined event rate of death, hospitalization, or other complications was identical (3.13%) in both groups (17).*

The history and physical examination should guide laboratory testing.

The frequency of abnormal test results that alter perioperative care ranged from 0% to 2.6% across multiple observational studies when the tests were ordered for all patients without consideration of history or physical examination findings (18). When history and physical examination findings guide testing, the yield of abnormal test results increases from 4% to 81% (19). Patients with normal test results in the previous 4 months and stable clinical status do not need repeated testing before surgery (20). Table 2 summarizes the indications for laboratory tests that may be helpful in the preoperative evaluation for some patients.

If patients are older than age 50 and are having major surgery, physicians should consider obtaining a preoperative chest radiograph even if no evidence suggests pulmonary disease. In the largest study of routine preoperative chest radiographs, 18% of 6111 were abnormal and resulted in change in management in 5% (21), but the overall evidence is not robust. However, routine chest radiography is not necessary in younger patients with normal history and physical examination or if the procedure does not normally carry high cardiopulmonary risk.

**Table 1. Preoperative Physical Examination**

Examination Component	Notes
Heart rate	Abnormal heart rate can indicate underlying cardiac disease.
Blood pressure	Controlling marked blood pressure elevation (>180 mm Hg systolic or 110 mm Hg diastolic) before surgery may decrease morbidity.
Respiratory rate	Abnormal respiratory rate can indicate underlying pulmonary disease.
Temperature	Fever suggests possible infection.
Body mass index	Obesity increases the risk for wound infection and other complications. Low body mass index may indicate a serious medical disorder or malnutrition.
Cardiac examination	Clinical signs that increase the likelihood of cardiac complications include murmurs, jugular venous distention, S3 gallop, and arrhythmia.
Lung examination	The presence of expiratory wheezing or decreased breath sounds suggests underlying obstructive disease.
Abdominal examination	Hepatomegaly suggests liver disease.
Extremity examination	Edema on examination may suggest congestive heart failure, renal disease, hepatic disease, or venous thrombosis.
Skin examination	Skin disorders overlying planned surgical sites should be treated to prevent impaired wound healing.
Neurologic examination	Aspiration leading to pneumonia may result from undetected swallowing difficulties.
Mental status examination, especially in elderly persons	May detect dementia that predisposes to perioperative delirium.

19. Charpak Y, Blery C, Chastang C, et al. Usefulness of selectively ordered preoperative tests. *Med Care.* 1988;26:95-104. [PMID: 3339918]
20. Macpherson DS, Snow R, Lofgren RP. Preoperative screening: value of previous tests. *Ann Intern Med.* 1990;113:969-73. [PMID: 2240920]
21. Silvestri L, Maffessanti M, Gregori D, et al. Usefulness of routine pre-operative chest radiography for anaesthetic management: a prospective multicentre pilot study. *Eur J Anaesthesiol.* 1999;16:749-60. [PMID: 10713868]



**Table 2. Laboratory Testing and Indications Before Elective Surgery**

Test	Indication
Hemoglobin	Anticipated major blood loss or symptoms of anemia
Leukocyte count	Symptoms suggest infection, myeloproliferative disorder, or myelotoxic medications
Platelet count	History of bleeding diathesis, myeloproliferative disorder, or myelotoxic medications
Prothrombin time	History of bleeding diathesis, chronic liver disease, malnutrition, recent or long-term antibiotic use
Partial thromboplastin time	History of bleeding diathesis
Electrolytes	Known renal insufficiency, congestive heart failure, medications that affect electrolytes
Renal function	Age >50 years, hypertension, cardiac disease, major surgery, medications that may affect renal function
Glucose	Obesity or known diabetes
Liver function tests	No indication. Consider albumin measurement for major surgery or chronic illness
Urinalysis	No indication
Electrocardiography	Men >40 years, women >50 years, or known coronary artery disease, diabetes, or hypertension
Chest radiography	Age >50 years, known cardiac or pulmonary disease, or symptoms or examination suggest cardiac or pulmonary disease

Even in the absence of history or physical examination findings, electrocardiography (ECG) is recommended to test for the presence of asymptomatic cardiac disease in men older than age 40 and women older than age 50 having major surgery. For patients undergoing minor surgery in whom the history and physical examination is normal, a routine ECG is unlikely to improve outcomes and can be omitted.

*Unrecognized myocardial infarctions, as shown by pathologic Q waves, are rare in patients younger than age 45 (0.65% in men, 0.26% in women) but increase to 6% in men and 3.4% in women age 75 to 84 (22).*

*Some abnormalities on ECGs (ST-T wave changes, left ventricular hypertrophy [LVH]) are of unknown prognostic value, whereas others (bundle-branch block) are not predictive of perioperative cardiac events (23).*

### When should clinicians consider preoperative cardiac stress testing?

In general, the indications for non-invasive cardiac testing are the same for patients undergoing surgery as for those who are not. All symptomatic patients should be evaluated for cardiac ischemia, usually with cardiac stress testing, even if their

symptoms are atypical. Patients undergoing a low- or intermediate-risk surgery who have at most minor clinical risk predictors (advanced age, abnormal ECG, rhythm other than sinus, low functional capacity, history of stroke, or uncontrolled hypertension) may proceed to surgery without preoperative cardiac testing. Likewise, patients with intermediate clinical risk predictors (mild angina, diabetes mellitus, compensated heart failure, previous myocardial infarction, or renal insufficiency) who have good exercise capacity also do not need further preoperative cardiac testing before a low- or intermediate-risk procedure. However, in the absence of high-quality data, some experts recommend that those with intermediate clinical predictors who have poor functional status and are undergoing an intermediate-risk procedure, as well as those with intermediate clinical predictors and good functional status who are undergoing a high-risk procedure, should have noninvasive testing performed before surgery. Patients in the highest-risk group include those with an active cardiac condition, such as unstable angina, decompensated heart failure,

22. Kannel WB, Abbott RD. Incidence and prognosis of unrecognized myocardial infarction. An update on the Framingham study. *N Engl J Med.* 1984;311:1144-7. [PMID: 6482932]
23. Dorman T, Breslow MJ, Pronovost PJ, et al. Bundle-branch block as a risk factor in noncardiac surgery. *Arch Intern Med.* 2000;160:1149-52. [PMID: 10789608]
24. Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation.* 1999;100:1043-9. [PMID: 10477528]

uncontrolled arrhythmias, severe valvular disease, or recent percutaneous coronary intervention, should get further evaluation before all but the most urgent surgical procedures. Identifying patients with recently placed coronary

stents is particularly critical because they are at risk for perioperative stent thrombosis. The Revised Cardiac Risk Index (Table 3) is a tool to estimate a patient's risk for cardiac complications from non-cardiac surgery (24).

**Table 3. Revised Cardiac Risk Index**

How many variables does the patient have?	Risk for major postoperative cardiac complication, %*
0	0.4
1	0.9
2	7.0
≥3	11.0

Variables are high-risk type of surgery, ischemic heart disease (includes any of the following: history of myocardial infarction, history of a positive exercise test, current report of chest pain that is considered to be secondary to myocardial ischemia, use of nitrate therapy, or electrocardiography with pathologic Q waves), congestive heart failure, and history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >176.8 μmol/L (2.0 mg/dL). Patients with more than 2 variables have a postoperative cardiac complication rate of about 10% and are considered to be high-risk.

*Adapted from Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. Circulation 1999;100:1043–9.*

\* The major cardiac complications included myocardial infarction, pulmonary edema, ventricular fibrillation or primary cardiac arrest, and complete heart block.

**Elements of Evaluation...** Essential elements of a preoperative history and physical examination include ascertainment of patient use of medications, tobacco, alcohol, and illicit drugs; overall health and underlying conditions; pregnancy; exercise tolerance; and reaction to previous anesthesia and surgery. History and physical examination should guide laboratory testing, and healthy patients having minor procedures may need no testing. However, routine ECG is indicated in men older than age 40 and women older than age 50 to look for asymptomatic cardiac disease, and routine chest radiography may be useful for patients older than age 50 who are having major surgery.

## CLINICAL BOTTOM LINE

### What are the indications for perioperative β-blockade?

β-Blockade theoretically protects the heart from excessive workload in the perioperative period. It may also prevent plaque rupture and subsequent thrombosis, cardiac ischemia, and infarction. Physicians should consider β-blockade for patients with an existing indication for β-blockade therapy (for example, angina, LVH), especially when they are undergoing procedures associated with high cardiac demand, such as open abdominal aortic

aneurysm resection or other prolonged procedures. A heart rate of 60 to 65 beats per minute should be the target when β-blocker therapy is initiated, and those patients who already have a heart rate lower than 65 beats per minute are unlikely to benefit from β-blocker initiation. In 2006, the American College of Cardiology/American Heart Association (ACC/AHA) issued a focused guideline update on perioperative β-blocker therapy (25). The Figure summarizes these recommendations.

## Risk Reduction

25. American College of Cardiology/American Heart Association. ACC/AHA 2006 Guideline Update on Perioperative Cardiovascular Evaluation for Noncardiac Surgery: Focused Update on Perioperative β-Blocker Therapy. Accessed at [www.acc.org/qualityandscience/clinical/guidelines/perioperiobetablocker.pdf](http://www.acc.org/qualityandscience/clinical/guidelines/perioperiobetablocker.pdf) on 3 June 2009.
26. POISE Study Group. Effects of extended-release metoprolol succinate in patients undergoing noncardiac surgery (POISE trial): a randomised controlled trial. *Lancet*. 2008;371:1839–47. [PMID: 18479744]

**Figure. Summary of 2006 American College of Cardiology/American Heart Association Guidelines on perioperative  $\beta$ -blocker therapy.\***

**Class I** (conditions for which there is evidence for or general agreement that the treatment is beneficial, useful, and effective):

$\beta$ -blockers should be given to:

- Patients undergoing surgery who are receiving  $\beta$ -blockers for an independent indication, such as angina, symptomatic arrhythmias, or hypertension (level of evidence: C)
- Patients undergoing vascular surgery at high cardiac risk owing to the finding of ischemia on preoperative testing (level of evidence: B)

**Class IIa** (conditions for which there is conflicting evidence or a divergence of opinion about the usefulness/efficacy and evidence/weight of opinion is in favor of usefulness/efficacy)

$\beta$ -blockers probably recommended for:

- Patients undergoing vascular surgery in whom preoperative assessment identifies coronary heart disease (level of evidence: B)
- Patients undergoing vascular surgery in whom preoperative assessment identifies multiple clinical predictors of cardiac risk<sup>†</sup> (level of evidence: B)
- Patients undergoing intermediate- or high-risk procedures in whom preoperative assessment identifies coronary heart disease or multiple clinical predictors of cardiac risk<sup>†</sup> (level of evidence: B)

**Class IIb** (conditions for which there is conflicting evidence or a divergence of opinion about the usefulness/efficacy and evidence/weight of opinion is less established)

$\beta$ -blockers may be considered for:

- Patients undergoing intermediate- or high-risk procedures, including vascular surgery in patients whose preoperative assessment identified the presence of a single clinical predictor of cardiac risk<sup>†</sup> (level of evidence: C)
- Patients undergoing vascular surgery with low cardiac risk who are not currently receiving  $\beta$ -blockers (level of evidence: C)

**Class III** (conditions for which there is evidence or general agreement that the treatment is not useful/effective and in some cases may be harmful)

- $\beta$ -blockers should not be given to patients undergoing surgery who have absolute contraindications to  $\beta$ -blockade (level of evidence: C)

\* Levels of evidence: A (multiple randomized, clinical trials), B (single randomized trial or nonrandomized studies), C (consensus of experts, case studies, or standard-of-care).

<sup>†</sup> Clinical predictors of risk include ischemic heart disease, compensated or past heart failure, diabetes mellitus, renal insufficiency, and cerebrovascular disease.

27. Yang H, Raymer K, Butler R, et al. The effects of perioperative beta-blockade: results of the Metoprolol after Vascular Surgery (MaVS) study, a randomized controlled trial. *Am Heart J*. 2006;152:983-90. [PMID: 17070177]
28. POBBLE trial investigators. Perioperative beta-blockade (POBBLE) for patients undergoing infrarenal vascular surgery: results of a randomized double-blind controlled trial. *J Vasc Surg*. 2005;41:602-9. [PMID: 15874923]
29. DIPOM Trial Group. Effect of perioperative beta blockade in patients with diabetes undergoing major non-cardiac surgery: randomised placebo controlled, blinded multicentre trial. *BMJ*. 2006;332:1482. [PMID: 16793810]

However,  $\beta$ -blocker therapy based solely on the presence of clinical predictors for the risk for perioperative cardiac complications is controversial. The release of updated ACC/AHA guidelines is anticipated based on the accumulation of randomized, controlled trials showing either no benefit or harm when  $\beta$ -blockers are used as a risk reduction strategy in patients undergoing noncardiac surgery, even in those patients at risk for cardiovascular events (26-29). The largest of these, the POISE (Perioperative Ischemic Evaluation) trial, found a reduction in myocardial infarction but an increase in stroke and mortality (26).

*A meta-analysis of 22 randomized, controlled trials of perioperative use of  $\beta$ -blockers in 2437 patients showed no statistically significant beneficial relative risk for*

*individual outcomes and only "nominal" statistically significant benefit for a composite outcome of cardiovascular mortality, nonfatal myocardial infarction, and nonfatal cardiac arrest. Because of methodological problems in some of the studies, the review concluded that definitive conclusions could not be made (30).*

**What should clinicians recommend to reduce the risk for postoperative pulmonary complications?**

Before surgery, clinicians should identify patients who are at risk for clinically significant postoperative pulmonary complications, including pneumonia, atelectasis, bronchospasm, prolonged mechanical ventilation, and exacerbation of underlying chronic lung disease. Preoperative chest radiography should be routine in all patients older than age 50 who are undergoing major surgery (21, 31, 32).



## What should clinicians recommend to reduce the risk for postoperative thromboembolic complications?

Most patients undergoing major surgery can benefit from wearing properly fitted elastic stockings preoperatively and postoperatively to prevent any venous wall damage and impaired venous flow that occurs during the passive venous dilation from anesthesia and surgery (33). Early ambulation postoperatively can also prevent thromboembolic complications, especially in patients undergoing elective hip surgery (34). Pharmacologic measures may be helpful for patients at high risk for thromboembolism or undergoing high-risk procedures.

## How should clinicians manage medications in the perioperative period?

Physicians should weigh the risks and benefits of continuing, stopping, or starting a drug treatment preoperatively. Continue medications deemed essential, such as cardiac drugs, antihypertensive agents, and steroids. Untreated or poorly controlled medical illness may have a more harmful effect on surgical outcome than the medications used to treat it. Patients should stop taking aspirin 5 to 10 days before surgery and restart 1 to 2 days after surgery if the bleeding risk outweighs the risk for thrombosis with abrupt cessation. Nonsteroidal anti-inflammatory drugs are often discontinued for similar reasons, although no compelling evidence supports this practice. If they are discontinued, the half-life of the individual agent should guide when to stop them. Withhold or discontinue medications, such as anticoagulants or oral hypoglycemic agents, with significant potential for adverse events. Sulfonylureas and the biguanide metformin should be discontinued for 1 to 2 days before surgery because of the respective risks for hypoglycemia and lactic acidosis; glucose control should be

maintained in this period with insulin. Diuretics and angiotensin-converting enzyme inhibitors are frequently withheld on the day of surgery because of concerns for hypokalemia and hypotension, respectively, although evidence to support this practice is weak.

*A recently published nested case-control analysis of 96 128 men who had cataract surgery found that men who received the  $\alpha$ -blocker tamsulosin within 14 days of cataract surgery were significantly more likely than men who did not to have serious postoperative ophthalmic adverse events (7.5% vs. 2.7%; adjusted odds ratio, 2.33 [CI, 1.22 to 4.43]). Previous exposure to other  $\alpha$ -blockers used to treat benign prostatic hypertrophy was not associated with these events (35).*

If medications are stopped, be aware of any potential for withdrawal syndromes. Withdrawal syndromes have been documented after cessation of various antihypertensive agents and glucocorticoids. The known benefit of continuing these medications will usually outweigh any theoretical concerns about drug interactions or adverse outcomes. Hospitalization may be required for serious comorbid illness or preoperative adjustment of specific medical regimens that would be difficult or impossible to perform on an outpatient basis (see Box).

## What are the special preoperative considerations for patients with diabetes?

Patients with diabetes face a higher risk for perioperative morbidity and mortality, with complications including hyperglycemia, hypoglycemia, diabetic ketoacidosis (DKA), postoperative infections, cardiac complications, and postoperative stroke. Early-morning surgery is generally advised to minimize disruption in glycemic control. Before surgery, clinicians should advise patients about how to adjust insulin and oral medications while preparing for surgery. Generally, patients on an insulin pump or insulin glargine do not need to change their basal rate or usual dose, but should hold all bolus

## Hospitalize Patients Preoperatively for:

- Anticoagulant "bridge therapy"
- Diabetic ketoacidosis or hyperosmolar state
- Bowel prep in an elderly, debilitated patient to minimize risk for dehydration
- Detoxification of an alcohol or drug abuser
- Instituting certain antiarrhythmic therapy
- Abrupt discontinuation of a drug that may trigger an exacerbation of a chronic illness, such as asthma, arrhythmia, or seizure
- New illness or exacerbation of a chronic illness (pneumonia, asthma, angina) requiring inpatient observation, monitoring, or treatment not available in the outpatient setting

30. Devereaux PJ, Beaty WS, Choi PT, et al. How strong is the evidence for the use of perioperative beta blockers in non-cardiac surgery? Systematic review and meta-analysis of randomised controlled trials. *BMJ*. 2005;331:313-21. [PMID: 15996966]
31. Gagner M, Chiasson A. Preoperative chest x-ray films in elective surgery: a valid screening tool. *Can J Surg*. 1990;33:271-4. [PMID: 2383834]
32. Perez A, Planell J, Bacardaz C, et al. Value of routine preoperative tests: a multicentre study in four general hospitals. *Br J Anaesth*. 1995;74:250-6. [PMID: 7718366]
33. Wells PS, Lensing AW, Hirsh J. Graduated compression stockings in the prevention of postoperative venous thromboembolism. A meta-analysis. *Arch Intern Med*. 1994;154:67-72. [PMID: 8267491]
34. White RH, Gettner S, Newman JM, et al. Predictors of rehospitalization for symptomatic venous thromboembolism after total hip arthroplasty. *N Engl J Med*. 2000;343:1758-64. [PMID: 11114314]

doses. Patients on twice-daily 70/30 insulin should take one quarter to one half of their usual dose the morning of surgery. The night before and the morning of surgery, patients should monitor glucose levels and contact a physician if they have low readings ( $<4.0$  mmol/L [ $70$  mg/dL]).

If glucose levels are very high ( $>12$  mmol/L [ $220$  mg/dL]) or if patients have signs or symptoms of dehydration due to hyperglycemia, consider postponing elective surgery. If glucose is more modestly above the goal for glycemic control and the risks of not undergoing surgery outweigh the risks of undergoing surgery, then surgery should proceed with attention to improving glycemic control. Physiologic studies show that epidural anesthesia has less impact on gluoregulatory hormones than general anesthesia (36).

Patients with type 1 diabetes or insulin-deficient type 2 diabetes are at risk for DKA, especially if their insulin is withheld for as little as 8 hours. These patients require insulin even when their glucose levels are in the normal range. Patients prone to DKA should have serum ketones, bicarbonate level, and anion gap tested before surgery.

Patients with diabetes are at high risk for postoperative cardiac and renal complications. Consider noninvasive cardiac testing as part of the preoperative evaluation, particularly before high-risk procedures. Consider starting a  $\beta$ -blocker if no contraindication is present, the patient has a specific indication for  $\beta$ -blockade, and the heart rate is greater than 65 beats per minute. Check renal function using blood urea nitrogen, serum creatinine level, and an estimate of glomerular filtration rate.

### What are the special preoperative considerations for patients with cardiovascular disease?

#### Hypertension

Severe hypertension and LVH are risk factors for adverse perioperative

outcome. Persistent diastolic pressure greater than 110 mm Hg is associated with perioperative risk independent of the presence of LVH. In the absence of other cardiovascular disease or hypertensive end-organ damage, hypertension with systolic pressure less than 160 mm Hg and diastolic pressure less than 100 mm Hg does not increase perioperative risk among patients undergoing noncardiac surgery (37). In cardiac surgery, systolic hypertension increases the risk for perioperative death, stroke, left ventricular dysfunction, and renal failure even in the absence of LVH (38).

In patients with hypertension, obtain a preoperative ECG to check for LVH or other abnormalities and also check for renal insufficiency and electrolyte disturbances. Detection of LVH, myocardial ischemia, or previously undetected infarction in patients with hypertension should prompt preoperative investigation, preoperative therapy, and consideration of delay in surgery. In patients with no other cardiovascular disease, do not delay surgery when the diastolic blood pressure is 110 to 130 mm Hg on the day of surgery. Delay in elective surgery should be more carefully considered for patients with baseline blood pressure 180/110 mm Hg or greater.

Continue  $\beta$ -blockade, clonidine, or calcium-channel blockade, including on the day of surgery. Discontinue angiotensin-converting enzyme inhibitors, angiotensin-receptor blockers, and diuretics on the morning of surgery, if possible, because of the potential risk for perioperative hypotension or hypokalemia.

#### Coronary artery disease

Preoperative drug interventions and revascularization may prevent cardiac events in patients with known or suspected CAD. Perioperative  $\beta$ -blocker therapy should be considered for patients with a specific indication (Figure) or who are undergoing high-risk vascular surgery.

35. Bell CM, Hatch WV, Fischer HD, et al. Association between tamsulosin and serious ophthalmic adverse events in older men following cataract surgery. *JAMA*. 2009;301:1991-6. [PMID: 19454637]
36. Brandt M, Kehlet H, Binder C, et al. Effect of epidural analgesia on the glycoregulatory endocrine response to surgery. *Clin Endocrinol (Oxf)*. 1976;5:107-14. [PMID: 12691588]
37. Howell SJ, Sear JW, Foëx P. Hypertension, hypertensive heart disease and perioperative cardiac risk. *Br J Anaesth*. 2004;92:570-83. [PMID: 15013960]
38. Aronson S, Boisvert D, Lapp W. Isolated systolic hypertension is associated with adverse outcomes from coronary artery bypass grafting surgery. *Anesth Analg*. 2002;94:1079-84, table of contents. [PMID: 11973166]
39. Le Manach Y, Godet G, Coriat P, et al. The impact of postoperative discontinuation or continuation of chronic statin therapy on cardiac outcome after major vascular surgery. *Anesth Analg*. 2007;104:1326-33, table of contents. [PMID: 17513620]

Statins should be continued in all patients already receiving them, because they may reduce the incidence of perioperative cardiovascular events (39).

Coronary revascularization is rarely needed just to get a patient through surgery, but it may be warranted in selected patients with CAD undergoing noncardiac surgery if they would have required the procedure anyway. However, the only large randomized trial on the subject showed no benefit for revascularization (40). Avoid preoperative coronary stenting to avoid the risk for perioperative stent thrombosis.

Patients with recently placed coronary stents are at risk for perioperative stent thrombosis. For bare-metal stents, the risk diminishes 4 to 6 weeks after implantation; for drug-eluting stents, an elevated risk for rethrombosis persists for at least 12 months after placement because of delayed endothelialization. Because these patients require antiplatelet treatment to mitigate this risk, purely elective procedures should be delayed accordingly, and the interval without antiplatelet therapy should be minimized when surgery is required within the window of vulnerability.

#### *Congestive heart failure*

Decompensated heart failure is a major predictor of increased perioperative risk, and compensated heart failure is an intermediate predictor of risk (41). Before a planned elective surgery, clinicians should establish an effective medical regimen for the treatment of heart failure. Patients who are stable and have minimal or no residual fluid retention can start taking  $\beta$ -blockers at the lowest dose, which can be slowly titrated as tolerated. Although  $\beta$ -blockers are beneficial for patients with compensated congestive heart failure, initiation is not appropriate with decompensated heart failure.

On the day of elective surgery,  $\beta$ -blockers should be continued. Consider withholding or reducing the normal doses of angiotensin-converting enzyme inhibitor, diuretic, or both (especially spironolactone) the day of and even 24 hours before the elective surgical procedure, because these medications can affect renal function, electrolyte status, and hemodynamic status. If the patient has a low baseline hematocrit level and major blood loss is anticipated, preoperative transfusion may be warranted.

#### *Rhythm and conduction disorders*

Postoperative arrhythmias are substantially more common after open cardiac procedures than noncardiac surgeries, with a postoperative atrial arrhythmia risk of 30% to 50% in most patients undergoing open cardiac surgery, compared with a risk of 8% to 13% in other high-risk noncardiac surgical procedures (42). Clinicians should evaluate patients undergoing cardiac surgery with transthoracic echocardiography to assess left atrial volume and risk for postoperative atrial fibrillation. A baseline ECG and electrolyte panel are recommended before all open cardiac procedures as well as intermediate- and high-risk noncardiac surgical procedures. Do not obtain a routine ECG or electrolyte panel before procedures with a low risk for arrhythmia, with the possible exception of patients with a history of coronary disease or diabetes. Preoperative Holter monitoring for the sole purpose of predicting postoperative arrhythmia risk is unnecessary.

Patients at high risk for postoperative atrial fibrillation, particularly elderly patients undergoing valvular surgery, should, in the absence of contraindications, receive either a  $\beta$ -blocker or oral amiodarone during the week before surgery. For patients with chronic atrial fibrillation, base the management of oral anticoagulation on thromboembolic risk. Patients at low thromboembolic risk can stop warfarin

40. McFalls EO, Ward HB, Moritz TE, et al. Coronary-artery revascularization before elective major vascular surgery. *N Engl J Med*. 2004;351:2795-804. [PMID: 15625331]
41. American College of Cardiology/American Heart Association Task Force on Practice Guidelines. ACC/AHA 2007 guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery) developed in collaboration with the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery. *J Am Coll Cardiol*. 2007;50:e159-241. [PMID: 17950140]
42. Creswell LL. Postoperative atrial arrhythmias: risk factors and associated adverse outcomes. *Semin Thorac Cardiovasc Surg*. 1999;11:303-7. [PMID: 10535369]

**Calculate the Revised Cardiac Risk Index in Patients With Valvular Heart Disease by Assigning 1 Point to Each of the Following Characteristics:**

- High-risk surgery
- Ischemic heart disease
- History of heart failure or cerebrovascular disease
- Insulin therapy for diabetes
- Preoperative serum creatinine level >176.8 μmol/L (2.0 mg/dL)

therapy 4 to 5 days before surgery. Patients at high risk should have short-term therapy with heparin while they are not receiving oral anticoagulants.

No specific therapy is needed for most preexisting conduction delays. However, patients with an implantable cardioverter defibrillator or pacemaker should have preoperative interrogation of the device.

**Valve disease**

If initial clinical evaluation yields suspicion of valve disease, obtain transthoracic ECG for further investigation, and possibly specialist referral. According to expert consensus, patients with severe aortic stenosis undergoing non-cardiac surgery are usually best treated by preoperative aortic valve replacement.

Clinicians should assess global cardiac risk in all patients, not only risk due to the valvular abnormality (Box). Patients with a revised cardiac risk index of zero and known, asymptomatic moderate aortic stenosis may have a favorable outcome after noncardiac surgery. Careful inquiry yielding symptoms of decreased exercise tolerance or subtle symptoms of orthopnea or paroxysmal nocturnal dyspnea in a patient previously thought to be asymptomatic from valvular heart disease may lower the threshold for possible valvular repair before elective noncardiac surgery.

**What are the special preoperative considerations for patients with pulmonary disease?**

Factors that increase the risk for pulmonary complications include chronic obstructive pulmonary disease (COPD), smoking, uncontrolled asthma, poor exercise capacity, low albumin, renal insufficiency, and obstructive sleep apnea. Type of surgery influences pulmonary complications, with aortic, upper abdominal, and thoracic procedures carrying the highest risk. General anesthesia also

increases risk. Clinical evaluation is the main basis for risk stratification in patients with COPD or asthma. Reserve spirometry for patients undergoing thoracic or upper abdominal surgery who have cough, dyspnea, or impaired exercise tolerance that remains unexplained after a careful history and physical examination.

To minimize the risk for postoperative pulmonary complications, patients should cease smoking at least 4 to 8 weeks before surgery. Lung expansion maneuvers reduce the risk for postoperative pulmonary complications by one half (43) and are more effective in the postoperative period if taught to patients before surgery. Continuous positive airway pressure is as effective as deep breathing exercises or incentive spirometry, but it is more costly and more complicated to administer. Preoperative efforts to reduce airflow obstruction and treat respiratory infection in patients with asthma or COPD will also reduce pulmonary complications. Patients with an ineffective cough and upper airway secretions, with persistent sputum production despite other therapies, or with poor functional capacity due to exertional dyspnea are candidates for preoperative chest physical therapy.

**What are the special preoperative considerations for patients with chronic kidney disease?**

Procedures generally considered to be low risk (laparoscopic procedures, cataract surgery) in other patients have higher morbidity in patients with end-stage renal disease. Expert consensus advises that preoperative evaluation of patients with chronic kidney disease should include complete blood count, serum chemistries, serum creatinine concentration, and estimated glomerular filtration rate. It should also include an ECG in patients with existing cardiac disease or risk factors for cardiac disease. If the clinical history

43. Thomas JA, McIntosh JM. Are incentive spirometry, intermittent positive pressure breathing, and deep breathing exercises effective in the prevention of postoperative pulmonary complications after upper abdominal surgery? A systematic overview and meta-analysis. *Phys Ther.* 1994;74:3-10; discussion 10-6. [PMID: 8265725]  
44. IV. NKF-K/DOQI Clinical Practice Guidelines for Anemia of Chronic Kidney Disease: update 2000. *Am J Kidney Dis.* 2001;37:5182-238. [PMID: 11229970]



and examination do not provide sufficient confidence regarding fluid status, ECG may be helpful. For patients without evidence of bleeding diathesis, routine assessment of bleeding time has little utility. Before a planned procedure, patients should maintain hemoglobin level greater than 12 g/dL (44). Clinicians should review all medications preoperatively to assess for possible nephrotoxicity.

### What are the special preoperative considerations for patients with rheumatologic disease?

Patients with rheumatoid arthritis and cervical joint disease are at risk for severe perioperative neurologic problems from neck manipulation during intubation (45, 46). It is prudent to assess C1–2 stability with preoperative lateral flexion and extension cervical spine films, particularly in patients who have significant peripheral joint erosions or have used long-term corticosteroid therapy. Patients with advanced ankylosing spondylitis may have fusion of cervical vertebrae and may thus require careful neck positioning.

Rheumatologic diseases and their treatments increase risk for perioperative infection. Consider holding disease-modifying antirheumatic drugs in the perioperative period, including discontinuing methotrexate 1 to 2 weeks before surgery and holding

leflunomide, etanercept, or infliximab in the perioperative period.

Hypotensive shock during the stress of surgery is a risk among patients with suppression of the hypothalamic–pituitary–adrenal axis from previous corticosteroid therapy. Patients who have received the equivalent of 5 or more mg/d of prednisone for 3 or more weeks within the year before surgery may be at risk for this complication. Preoperative cosyntropin-stimulation testing or empirical stress doses of hydrocortisone are recommended for these patients who are also undergoing procedures of at least moderate stress (see Box).

### What are the special considerations for pregnant women undergoing surgery?

Physicians should test for pregnancy before surgery in all women of child-bearing potential and postpone nonemergency surgery in women who are pregnant. Nonobstetric surgery poses finite risks in healthy pregnant women. The risk for perioperative complications in the mother is similar to that of other surgical patients with similar patient demographic characteristics. However, perioperative risk for miscarriage, preterm labor and delivery, intrauterine growth restriction, and stillbirth is increased, as is risk for anesthesia to the fetus, particularly in the first trimester (47).

**Risk Reduction...** Patients found to have unstable heart or lung disease should undergo evaluation and treatment before surgery. Before surgery, ask patients to bring in their actual medications or a list to ensure all are accounted for. Perform a careful risk–benefit analysis of continuing or stopping each drug perioperatively. To prevent thromboembolic complications, advise patients to wear elastic stockings and ambulate early postoperatively; anticoagulants may be warranted in patients at high risk for thromboembolism. To prevent postoperative infections, minimize length of preoperative hospital stay, limit use of immunosuppressive drugs, follow recommended guidelines for catheters, and maintain glucose control in patients with diabetes. Special preoperative consideration of chronic conditions can reduce the risk for surgical complications.

## CLINICAL BOTTOM LINE

### Perioperative Stress Dose Corticosteroid Therapy

Major surgeries (cardiothoracic, oncologic, or major abdominal surgeries)

- Start hydrocortisone, 100 mg intravenously every 8 h for 3 doses
- Then 50 mg for 3 doses
- Then 25 mg for 3 doses
- Then resume usual outpatient dose in uncomplicated patients

Moderate surgeries (orthopedic, urologic, otolaryngologic)

- Start hydrocortisone, 50 mg intravenously every 8 h for 3 doses
- Then 25 mg for 3 doses
- Then resume usual outpatient dose in uncomplicated patients

Minor procedures (cataract surgery, other outpatient procedures)

- Usual dose on the day of surgery
- Double the first postoperative dose

- Macarthur A, Kleiman S. Rheumatoid cervical joint disease—a challenge to the anaesthetist. *Can J Anaesth.* 1993;40:154–9. [PMID: 8443854]
- Crosby ET, Lui A. The adult cervical spine: implications for airway management. *Can J Anaesth.* 1990;37:77–93. [PMID: 2136808]
- Mazze RI, Källén B. Reproductive outcome after anesthesia and operation during pregnancy: a registry study of 5405 cases. *Am J Obstet Gynecol.* 1989;161:1178–85. [PMID: 2589435]



# Practice Improvement

## What do professional organizations recommend regarding preoperative evaluation?

Recommendations for preoperative cardiac risk assessment are largely drawn from the 2007 update of the American College of Cardiology/American Heart Association (ACC/AHA) guidelines (41). In 2006, the American College of Physicians issued guidelines that

address preoperative assessment and strategies to reduce perioperative pulmonary complications (48).

The ACC/AHA issued a focused guideline update on perioperative  $\beta$ -blocker therapy in 2006 (25). However, at the time of this article preparation, a new update is anticipated because evidence on  $\beta$ -blockade has become available since the 2006 update.

48. Qaseem A, Snow V, Fitterman N, et al; Clinical Efficacy Assessment Subcommittee of the American College of Physicians. Risk assessment for and strategies to reduce perioperative pulmonary complications for patients undergoing noncardiothoracic surgery: a guideline from the American College of Physicians. *Ann Intern Med*. 2006;144:575-80. [PMID: 16618955]

## in the clinic Tool Kit

### Preoperative Evaluation

#### PIER Modules

[www.pier.acponline.org](http://www.pier.acponline.org)

Access PIER modules on Preoperative Risk Assessment, Preoperative Pulmonary Risk Assessment, Preoperative Cardiac Risk Assessment, Perioperative Management of Alcohol Abuse, Perioperative Management of Adrenal Insufficiency, Perioperative Management of Diabetes Mellitus, Perioperative Management of the Obese Patient, Perioperative Management of the Hyperthyroid Patient, Perioperative Management of Hypertension, Perioperative Management of Congestive Heart Failure, Perioperative Management of Rhythm and Conduction Disorders, and Perioperative Valvular Disease Assessment.

#### Patient Information

[www.annals.org/intheclinic/toolkit-preop.html](http://www.annals.org/intheclinic/toolkit-preop.html)

Download copies of the Patient Information sheet that appears on the following page for duplication and distribution to your patients.

[www.abrq.gov/consumer/quicktips/tipsurgery.htm](http://www.abrq.gov/consumer/quicktips/tipsurgery.htm)

Access the Agency for Healthcare Research and Quality: Quick Tips—When Planning for Surgery

[pier.acponline.org/physicians/diseases/periopr879/tables/periopr879-tables.html](http://pier.acponline.org/physicians/diseases/periopr879/tables/periopr879-tables.html)

Access patient instructions for management of diabetes drugs in the preoperative period.

#### Quality Measures

[pier.acponline.org/qualitym/index.html](http://pier.acponline.org/qualitym/index.html)

Access information about the quality measures included in the 2009 Physician Quality Reporting Initiative.

#### Clinical Guidelines

<http://circ.abajournals.org/cgi/reprint/116/17/1971.pdf>

Access the American College of Cardiology Foundation/American Heart Association 2007 guideline.

<http://circ.abajournals.org/cgi/content/full/113/22/2662>

Access the American College of Cardiology/American Heart Association 2006 guideline on perioperative  $\beta$ -blocker therapy.

[www.annals.org/cgi/content/full/144/8/575](http://www.annals.org/cgi/content/full/144/8/575)

Access the American College of Physicians 2006 Guideline on Risk Assessment for and Strategies to Reduce Perioperative Pulmonary Complications for Patients Undergoing Noncardiothoracic Surgery.

in the clinic

# WHAT YOU SHOULD KNOW ABOUT PREOPERATIVE EVALUATION

In the Clinic  
Annals of Internal Medicine  
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## What is a preoperative evaluation?

- Most patients have a check-up before having surgery. This is to see if there is anything that puts you at high risk for complications around the time of your surgery.
- Talk with your doctor about your risks for surgery complications and what you can do to lower them.
- If you are at high risk, the doctor will help you make changes to lower your risk. Sometimes your doctor might suggest that you delay nonemergency surgery so that the things that put you at risk can be controlled better.
- Heart problems, lung problems, stroke, bleeding problems, blood clots, and infections are some of the serious medical problems that can happen around the time of surgery.
- The risks of surgery depend on the type of surgery, your age, how healthy you are, and your health habits.
- There are usually few complications with such surgeries as cataract surgery, other outpatient surgeries, and surgery without general anesthesia. Complications happen more often with major surgeries, such as those in which the chest or abdomen are opened or surgery with general anesthesia.



dietary or herbal supplements or treatments. Your doctor will tell you whether you should stop or keep taking these around the time of surgery.

- Keep a healthy body weight and stay active so that you go into surgery in good physical shape.
- Tell your doctor if you have problems with bleeding, bruise easily, or if anyone in your family has a bleeding problem.

## What can you do to lower the risk of surgical complications?

- If you drink alcohol, stop all alcohol 4 weeks before surgery or at least have no more than 2 drinks a day.
- If you smoke, you should quit before surgery. It is best if you quit 4 to 8 weeks before surgery.
- Tell your doctor about all prescription and over-the-counter drugs that you take, including any

## Will my doctor do tests before surgery?

- If you are healthy and having minor surgery, you may not need any tests.
- If you have medical problems, you may need blood tests, a chest X-ray, or heart tests.
- If you had tests in the 4 months before your surgery, tell your doctor. You may not need the tests again.

## For More Information

### Web Sites With Information on Preoperative Evaluation

[www.ahrq.gov/consumer/quicktips/tipsurgery.htm](http://www.ahrq.gov/consumer/quicktips/tipsurgery.htm)

Agency for Healthcare Research and Quality:  
Quick Tips—When Planning for Surgery

[www.facs.org/public\\_info/operation/wnao.html](http://www.facs.org/public_info/operation/wnao.html)

American College of Surgeons: When You Need an Operation

[www.sambahq.org/patient-info/faqs.html](http://www.sambahq.org/patient-info/faqs.html)

Society for Ambulatory Anesthesia: Frequently Asked Questions

# ACP<sup>SM</sup>

AMERICAN COLLEGE OF PHYSICIANS  
INTERNAL MEDICINE | Doctors for Adults

1. A 74-year-old man is being evaluated before cataract replacement and intra-ocular lens implantation. The patient has type 2 diabetes mellitus, coronary artery disease with history of congestive heart failure after bypass surgery 4 years ago, and hypertension. His most recent hemoglobin A<sub>1c</sub> level was 7.2%. Medications include glyburide, amlodipine, lisinopril, furosemide, and aspirin.

Which of the following laboratory evaluations is indicated in preoperative evaluation of this patient?

- A. No laboratory tests are needed
- B. Chest radiography
- C. Prothrombin time
- D. Electrocardiography
- E. Complete blood count with platelet count

2. A 56-year-old man with rheumatoid arthritis needs a preoperative assessment before a scheduled total knee replacement. His only other medical problem is hypertension. His medications include prednisone, 5 mg/d; naproxen, 500 mg twice daily; atenolol, 50 mg/d; hydrochlorothiazide, 25 mg/d; and omeprazole, 20 mg/d. On physical examination, his pulse rate is 70/min and his blood pressure is 142/80 mm Hg. He has facial plethora and central obesity. His heart and lungs are normal on examination.

What is the most appropriate regimen for perioperative management of his corticosteroid therapy?

- A. Hydrocortisone, 50 mg intravenously every 8 hours for 3 doses; followed by hydrocortisone, 25 mg intravenously every 8 hours for 3 doses; then resume usual outpatient regimen
- B. Hydrocortisone, 100 mg intravenously every 8 hours for 3 doses; then hydrocortisone, 50 mg intravenously every 8 hours for 3 doses; then hydrocortisone, 25 mg intravenously every 8 hours for 3 doses; then resume usual outpatient regimen
- C. Prednisone, 10 mg on the day of surgery and the first

postoperative day; then resume usual dose of prednisone

- D. Prednisone, 5 mg on the day of surgery; prednisone, 10 mg on the first postoperative day; then resume usual outpatient regimen

3. A 35-year-old man with a 20-year history of type 1 diabetes mellitus is undergoing preoperative evaluation for renal transplantation. His clinical course has been complicated by hypertension, diabetic retinopathy, and peripheral neuropathy that limit his ability to walk. His blood pressure is 142/85 mm Hg. His low-density lipoprotein cholesterol level is 3.62 mmol/L (140 mg/dL) and his high-density lipoprotein cholesterol level is 0.78 mmol/L (30 mg/dL). He currently smokes one half of a pack of cigarettes daily. His electrocardiogram is consistent with left ventricular hypertrophy based on an S wave in lead V<sub>2</sub> plus an R wave in lead V<sub>6</sub> greater than 35 mV, left axis deviation, and lateral ST-T changes. Left atrial enlargement is also present. Medical consultation is requested for evaluation of his preoperative cardiovascular risk.

Which of the following is the most appropriate recommendation at this time?

- A. No further evaluation is needed
- B. Serum C-reactive protein level
- C. 24-hour electrocardiographic monitoring
- D. Pharmacologic stress nuclear study
- E. Coronary angiography

4. A 68-year-old man undergoes preoperative evaluation before abdominal aortic aneurysm repair. His history is significant for coronary artery disease, hypertension, and hyperlipidemia. His medications include lisinopril, hydrochlorothiazide, simvastatin, and daily aspirin. He has not had angina since undergoing 3-vessel coronary artery bypass graft 4 years ago. He plays golf weekly, walking and carrying his clubs on a hilly course; walks 2 miles in 35 to 40 minutes 3 to 4 times weekly; and vacuums his house.

On physical examination, the pulse rate is 78/min and the blood pressure is 140/87 mm Hg. The rest of the examination is

unremarkable. Results of electrocardiography are consistent with his most recent electrocardiogram, with evidence of an old inferior infarction. Laboratory studies, including complete blood count, serum electrolyte level, and renal function, are normal.

Which of the following is the most appropriate perioperative management in this patient?

- A. Atenolol
- B. Exercise stress testing
- C. Echocardiography
- D. Intraoperative right heart catheterization

5. A 45-year-old man undergoes preoperative evaluation before elective arthroscopic knee repair of a sports-related injury. His medical history includes hypertension treated with atenolol, hydrochlorothiazide, and daily aspirin. He has no bleeding problems associated with previous tooth extractions or an appendectomy he underwent as a teenager or any other medical problems. He usually drinks 1 to 2 glasses of wine with dinner, does not smoke, and does not use illicit drugs. Results of laboratory studies performed 6 months ago, including serum electrolyte levels, creatinine level, and lipid profile, were normal.

On physical examination, pulse rate is 64/min, and blood pressure is 120/72 mm Hg. The remainder of the examination is normal.

Which of the following is the most appropriate approach to preoperative laboratory testing in this patient?

- A. Electrocardiography and serum electrolyte and creatinine measurement
- B. Chest radiography, complete blood count, and serum electrolyte measurement
- C. Electrocardiography, serum electrolyte measurement, complete blood count, and urinalysis
- D. Complete blood count, prothrombin time/international normalized ratio, and urinalysis

Questions are largely from the ACP's Medical Knowledge Self-Assessment Program (MKSAP). Go to [www.annals.org/intheclinic/](http://www.annals.org/intheclinic/) to obtain up to 1.5 CME credits, to view explanations for correct answers, or to purchase the complete MKSAP program.