

Should all patients have a resting 12-lead ECG before elective noncardiac surgery?

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If risk is low, an ECG could unnecessarily delay surgery, drive up costs, trigger further testing, and increase anxiety

A 55-YEAR-OLD LAWYER with hypertension well controlled on lisinopril and amlodipine is scheduled for elective hernia repair under general anesthesia. His surgeon has referred him for a preoperative evaluation. He has never smoked, runs 4 miles on days off from work, and enjoys long hiking trips. On examination, his body mass index is 26 kg/m² and his blood pressure is 130/78 mm Hg; his cardiac examination and the rest of the clinical examination are unremarkable. He asks if he should have an electrocardiogram (ECG) as a part of his workup.

A preoperative ECG is not routinely recommended in all asymptomatic patients undergoing noncardiac surgery.

Consider obtaining an ECG in patients planning to undergo a high-risk surgical procedure, especially if they have one or more clinical risk factors for coronary artery disease, and in patients undergoing elevated-cardiac-risk surgery who are known to have coronary artery disease, chronic heart failure, peripheral arterial disease, or cerebrovascular disease. However, a preoperative ECG is not routinely recommended for patients perceived to be at

low cardiac risk who are planning to undergo low-risk surgery. In those patients it could delay surgery unnecessarily, cause further unnecessary testing, drive up costs, and increase patient anxiety.

Here we discuss the perioperative cardiac risk based on type of surgery and patient characteristics and summarize the current guidelines and recommendations on obtaining a preoperative 12-lead ECG in patients undergoing noncardiac surgery.

■ RISK DEPENDS ON TYPE OF SURGERY AND PATIENT FACTORS

Physicians, including primary care physicians, hospitalists, cardiologists, and anesthesiologists, are routinely asked to evaluate patients before surgical procedures. The purpose of the preoperative evaluation is to optimize existing medical conditions, to identify undiagnosed conditions that can increase risk of perioperative morbidity and death, and to suggest strategies to mitigate risk.^{1,2}

Cardiac risk is multifactorial, and risk factors for postoperative adverse cardiac events include the type of surgery and patient factors.^{1,3}

Cardiac risk based on type of surgery

Low-risk procedures are those in which the risk of a perioperative major adverse cardiac event is less than 1%.^{1,4} Examples:

- Ambulatory surgery
- Breast or plastic surgery
- Cataract surgery
- Endoscopic procedures.

Elevated-risk procedures are those in which the risk is 1% or higher. Examples:

- Intraperitoneal surgery
- Intrathoracic surgery
- Carotid endarterectomy

Smart Testing is a joint project of the *Cleveland Clinic Journal of Medicine* and the American College of Physicians (ACP). The series, an extension of the ACP High Value Care initiative (hvc.acponline.org/index.html), provides recommendations for improving patient outcomes while reducing unnecessary testing and treatment.

doi:10.3949/ccjm.81a.13141

- Head and neck surgery
- Orthopedic surgery
- Prostate surgery
- Aortic surgery
- Major vascular surgery
- Peripheral arterial surgery.

Cardiac risk based on patient factors

The 2014 American College of Cardiology and American Heart Association (ACC/AHA) perioperative guidelines list a number of clinical risk factors for perioperative cardiac morbidity and death.¹ These include coronary artery disease, chronic heart failure, clinically suspected moderate or greater degrees of valvular heart disease, arrhythmias, conduction disorders, pulmonary vascular disease, and adult congenital heart disease.

Patients with these conditions and patients with unstable coronary syndromes warrant preoperative ECGs and sometimes even urgent interventions before any nonemergency surgery, provided such interventions would affect decision-making and perioperative care.¹

The risk of perioperative cardiac morbidity and death can be calculated using either the Revised Cardiac Risk Index scoring system or the American College of Surgeons National Surgical Quality Improvement Program calculator.¹⁵⁷ The former is fairly simple, validated, and accepted, while the latter requires use of online calculators (eg, www.surgicalriskcalculator.com/miorcardiacarrest, www.riskcalculator.facs.org).

The Revised Cardiac Risk Index has six clinical predictors of major perioperative cardiac events:

- History of cerebrovascular disease
- Prior or current compensated congestive heart failure
- History of coronary artery disease
- Insulin-dependent diabetes mellitus
- Renal insufficiency, defined as a serum creatinine level of 2 mg/dL or higher
- Patient undergoing suprainguinal vascular, intraperitoneal, or intrathoracic surgery.

A patient who has 0 or 1 of these predictors would have a low risk of a major adverse cardiac event, whereas a patient with 2 or more would have elevated risk. These risk factors must be taken into consideration to determine the need, if any, for a preoperative ECG.

What an ECG can tell us

Abnormalities such as left ventricular hypertrophy, ST-segment depression, and pathologic Q waves on a preoperative ECG in a patient undergoing an elevated-risk surgical procedure may predict adverse perioperative cardiac events.^{3,6}

In a retrospective study of 23,036 patients, Noordzij et al⁷ found that in patients undergoing elevated-risk surgery, those with an abnormal preoperative ECG had a higher incidence of cardiovascular death than those with a normal ECG. However, a preoperative ECG was obtained only in patients with established coronary artery disease or risk factors for cardiovascular disease. Hence, although an abnormal ECG in such patients undergoing elevated-risk surgery was predictive of adverse postoperative cardiac outcomes, we cannot say that the same would apply to patients without these characteristics undergoing elevated-risk surgery.

In a prospective observational study of patients with known coronary artery disease undergoing major noncardiac surgery, a preoperative ECG was found to contain prognostic information and was predictive of long-term outcome independent of clinical findings and perioperative ischemia.⁸

■ CURRENT GUIDELINES AND RECOMMENDATIONS

Several guidelines address whether to order a preoperative ECG but are mostly based on low-level evidence and expert opinion.^{1,2,6,9}

Current guidelines recommend obtaining a preoperative ECG in patients with known coronary, peripheral arterial, or cerebrovascular disease.^{1,6,9}

Obesity and associated comorbidities such as coronary artery disease, heart failure, systemic hypertension, and sleep apnea can predispose to increased perioperative complications. A preoperative 12-lead ECG is reasonable in morbidly obese patients (body mass index ≥ 40 kg/m²) and in obese patients (body mass index ≥ 30 kg/m²) with at least one risk factor for coronary artery disease or poor exercise tolerance, or both.¹⁰

Liu et al¹¹ looked at the predictive value of a preoperative 12-lead ECG in 513 elderly patients (age ≥ 70) undergoing noncardiac

Before elevated-risk surgery, ECG abnormalities may predict adverse perioperative cardiac events

surgery and found that electrocardiographic abnormalities were not predictive of adverse cardiac outcomes. In this study, although electrocardiographic abnormalities were common (noted in 75% of the patients), they were nonspecific and less useful in predicting postoperative cardiac complications than was the presence of comorbidities.¹¹ Age alone as a cutoff for obtaining a preoperative ECG is not predictive of postoperative outcomes and a preoperative ECG is not warranted in all elderly patients. This is also reflected in current ACC/AHA guidelines on perioperative cardiovascular evaluation¹ and is a change from prior ACC/AHA guidelines when age was used as a criterion for preoperative ECGs.¹²

Current guidelines do not recommend getting a preoperative ECG in asymptomatic patients undergoing low-cardiac-risk surgery.^{1,4,9}

Although the ideal time for ordering an ECG before a planned surgery is unknown, obtaining one within 90 days before the surgery is considered adequate in stable patients in whom an ECG is indicated.¹

■ BACK TO OUR PATIENT

On the basis of current evidence, our patient does not need a preoperative ECG, as it is unlikely to alter his perioperative management and instead may delay his surgery unnecessarily

if any nonspecific changes prompt further cardiac workup.

■ CLINICAL BOTTOM LINE

Although frequently ordered in clinical practice, preoperative electrocardiography has a limited role in predicting postoperative outcome and should be ordered only in the appropriate clinical setting.¹ Moreover, there is little evidence that outcomes are better if we obtain an ECG before surgery. The clinician should consider patient factors and the type of surgery before ordering diagnostic tests, including electrocardiography.

In asymptomatic patients undergoing non-emergent surgery:

- It is reasonable to obtain a preoperative ECG in patients with known coronary artery disease, significant arrhythmia, peripheral arterial disease, cerebrovascular disease, chronic heart failure, or other significant structural heart disease undergoing elevated-cardiac-risk surgery.
- Do not order a preoperative ECG in asymptomatic patients undergoing low-risk surgery.
- Obtaining a preoperative ECG is reasonable in morbidly obese patients and in obese patients with one or more risk factors for coronary artery disease, or poor exercise tolerance, undergoing high-risk surgery. ■

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