

β -Blockers and Reduction of Cardiac Events in Noncardiac Surgery

Clinical Applications

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CARDIAC EVENTS SUCH AS MYOCARDIAL infarction or cardiac death are a common complication of noncardiac surgery,¹⁻⁶ increase mortality,^{7,8} result in higher costs,^{6,9} and are the most common reason for preoperative evaluations.¹⁰⁻¹²

Until recently, methods to reduce the incidence of these complications depended on preoperative clinical assessment followed by additional tests or procedures, if indicated.¹³ Newer information suggests that a substantial proportion of cardiac complications may be prevented with use of β -blockers perioperatively.¹⁴⁻¹⁹ In fact, such a use has recently been endorsed as a key process to improve patient safety²⁰ and has been included in published guidelines of perioperative cardiac risk management.^{13,21} Unfortunately, use of β -blockers has not been explicitly incorporated into published guidelines regarding preoperative cardiac evaluation,^{13,21} and physicians seeking to use β -blockers for their patients in an evidence-based manner must amalgamate their approach according to several sources of information.

Patient 1

Patient 1 is a 70-year-old man who is to undergo a right hemicolectomy for

See also p 1435.

Recent studies suggest that β -blockers administered perioperatively may reduce the risk of adverse cardiac events and mortality in patients who have cardiac risk factors and undergo major noncardiac surgery. The objective of this article is to provide practicing physicians with examples of perioperative β -blocker use in practice by using several hypothetical cases. Although current evidence describing the effectiveness of perioperative β -blockade may not address all possible clinical situations, it is possible to formulate an evidence-based approach that will maximize benefit to patients. We describe how information from several sources can be used to guide management of patients with limited exercise tolerance, those at highest risk for perioperative cardiac events, patients who are taking β -blockers long-term, and those with relative contraindications to β -blockade. Even though fine points of their use remain to be elucidated, perioperative β -blocker use is important and can be easily applied in practice by any physician involved with the care of patients perioperatively.

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removal of a recently discovered cecal carcinoma. He has hypertension that is well controlled by an angiotensin-converting enzyme (ACE) inhibitor and has smoked 1 pack of cigarettes daily for 50 years. He is able to rake his yard and walk at length without difficulty. Electrocardiogram and physical examination results are normal.

According to American Heart Association/American College of Cardiology (AHA/ACC) criteria, this patient has a low to intermediate risk for coronary artery disease and good exercise tolerance and is to undergo a procedure that is generally associated with an intermediate (<5%) risk of perioperative cardiac events.²¹ American College of Physicians (ACP) guidelines,

which endorse use of the Modified Cardiac Risk index²² to assess perioperative risk, also suggest that this patient is at low risk because he meets none of the clinical criteria included in this risk index.¹³ Similarly, he meets none of the criteria included in the original Risk Index²³ or in the Revised Cardiac Risk Index.⁵ Thus, he has a low predicted risk for perioperative cardiac events and would require no additional testing

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or risk stratification before surgery, according to recommendations from several sources.^{13,21,24}

Despite low predicted risk for perioperative cardiac events, the patient has clear risk factors for coronary artery disease and is a candidate for perioperative atenolol according to criteria used by Mangano.²⁵ In addition to including patients with known coronary disease, this study included patients at risk, defined as those who met at least 2 of the following criteria: older than 65 years, hypertension, current smoker, a serum cholesterol concentration of at least 240 mg/dL (6.21 mmol/L), or diabetes mellitus. Although they observed no difference in in-hospital mortality caused by β -blockade, a relative reduction in all-cause mortality of nearly 55% became evident at 2 years. This difference, which appeared within the first 8 months of follow-up, was ascribed to a marked relative reduction in cardiac events in the first year of therapy (67% reduction at year 1 and 48% at year 2).

Broader use of β -blockade was subsequently endorsed by the ACP,²² which suggested that physicians consider using atenolol for all patients meeting the criteria of Mangano et al. This recommendation was made according to the results of the study and the concordance of these findings with earlier non-randomized trials. Given this patient's substantial risk for coronary disease, current evidence suggests he may benefit from perioperative β -blockade, begun preoperatively and continued at least through hospitalization.

Patient 2

This patient is a 75-year-old man who is to undergo resection of an abdominal aortic aneurysm. He smokes, has diabetes mellitus, and had a myocardial infarction 5 years ago. He reports no anginal symptoms, but his physical activity is limited by leg claudication. He is receiving aspirin, digoxin, an ACE inhibitor, and insulin twice daily. On examination, he has a prominent abdominal bruit and absent distal pulses; his cardiac and lung examination and electrocardiogram results are normal. He has

a baseline serum creatinine level of 2.0 mg/dL (177 μ mol/L).

According to Revised Cardiac Risk Index criteria (4 points), this patient is predicted to have a perioperative cardiac event rate well above 10% without β -blockade; his risk may be as high as 7% even if β -blockers are prescribed appropriately. Thus, β -blockade alone may not be adequate to reduce cardiac risk in patients at the highest risk for perioperative cardiac events. This level of risk would prompt additional risk stratification according to ACP and AHA/ACC guidelines.^{13,21}

In high-risk patients such as patient 2, noninvasive tests of myocardial perfusion (ie, stress scintigraphy or dobutamine echocardiography) are recommended initially.^{13,21,24} Stress scintigraphy and dobutamine echocardiography have negative predictive values generally higher than 98%,²¹ and if this patient were to have a normal noninvasive test result, he could receive β -blockers and proceed to surgery without additional testing. Evidence from Boersma et al¹⁵ suggests that this approach effectively identifies high-risk patients who can proceed to surgery safely while receiving β -blockers, with an estimated adverse event rate of 1.2% or less.

If a noninvasive test result is positive, evidence to support this patient's care is limited by a lack of data from prospective trials. As a result, neither the AHA/ACC nor the ACP recommends preoperative revascularization unless the patient has indications (ie, unstable coronary symptoms or multivessel disease with depressed ejection fraction) in the absence of the planned surgical procedure.^{13,21} These recommendations were made according to studies suggesting that the risk of preoperative coronary artery bypass surgery offset its benefit.²⁶ Recent studies of patients who underwent noncardiac surgery following angioplasty suggest that this modality may have benefit, but care strategies that include preoperative angioplasty remain to be evaluated prospectively.²⁷

Despite a history of coronary artery disease and myocardial infarction, pa-

tient 2 was not taking a β -blocker preoperatively. Strong evidence exists to suggest that β -blockers are underused in appropriate patients such as this one.²⁸⁻³³ Thus, this case represents an example in which the perioperative period is an opportunity to initiate long-term β -blocker use not only to reduce perioperative risk, but also to provide secondary prevention of cardiac events following the patient's myocardial infarction. Unless he has a clear contraindication for these medications, this patient's perioperative β -blocker use should be continued indefinitely.

Patient 3

This patient is a 69-year-old woman who is to undergo elective total knee replacement. An avid walker, she was until recently able to exercise for 30 minutes without limitation. She has no history of knee problems and takes no medications. Her physical examination and electrocardiogram results are normal.

According to AHA/ACC and ACP criteria, patient 3 has a low risk for coronary artery disease, has good exercise tolerance, and is to undergo a procedure that is generally associated with an intermediate (<5%) risk of perioperative cardiac events.²¹ She meets none of the criteria included in the Revised Cardiac Risk Index⁵ or the original Risk Index²³ and has no clinical criteria used to detect patients at risk for coronary disease.²⁵

Given her low risk of perioperative cardiac events, it seems unlikely that she will gain any benefit, in absolute or relative terms, from use of perioperative β -blockade. In addition, this patient does not meet criteria for use of β -blockers used in any studies published to date. In fact, results from Boersma et al¹⁵ suggest that β -blockade provides little additional benefit in patients with no clinical risk factors. Patients who have no or minimal cardiac risk factors may be as likely to experience adverse effects from β -blockers as to experience a cardioprotective benefit. Thus, evidence does not support use of β -blockade in this patient's care.

Comment

The advent of perioperative β -blockade represents an important advance in the management of cardiac risk in patients undergoing noncardiac surgery. Clinicians should be aware of the limitations of the current evidence base describing the effectiveness of this therapy. In particular, the studies have en-

rolled fewer than 700 patients, many of whom were selected according to specific research or critical criteria. Thus, we await the results of large clinical trials for evidence that can guide decision making in specific clinical situations.

Despite limitations of the literature describing the effectiveness of periop-

erative β -blockade, it is possible to formulate a coherent approach based on strong evidence describing the ability to predict cardiac risk and on longstanding experience with β -blockers. In the meantime, physicians can promote effective implementation of this therapy through an evidence-based rational approach.

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