Perioperative Beta Blockade

Jennifer Lynn Irani, MD¹

¹ Department of Surgery, Harvard Medical School, Brigham and Women's Hospital, Boston, Massachusetts

Clin Colon Rectal Surg 2013;26:160–162.

Address for correspondence Jennifer Lynn Irani, MD, Department of Surgery, Brigham and Women's Hospital, 75 Francis Street, Boston, Massachusetts 02115 (e-mail: jirani@partners.org).

Abstract

Keywords

- ▶ β blockers
- ▶ perioperative
- ▶ coronary artery disease
- ▶ colon and rectal surgery

The use of preoperative beta (β) blockade has been through several changes, and it is clear that large, randomized controlled trials on the subject are in need. Currently, a judicious approach to perioperative β blockade is supported. Continuation of β blockers is recommended for the patient taking them prior to surgery. Patients undergoing large colorectal procedures, with coronary artery disease or high cardiac risk, should have β blockers titrated to heart rate and blood pressure. Dosages should be titrated to heart rate and blood pressure rather than using fixed, long-acting dosages. When β blockers are indicated, they should be initiated weeks before surgery.

Objective: On completion of this article, the reader should be able to summarize the recommendations for perioperative beta (β) blockade, determine which patients should undergo β blockade, and understand the risks and benefits of perioperative β blockade.

Background

The prevalence of cardiovascular disease increases with age, and the number of elderly patients undergoing surgery is increasing. Noncardiac surgery is associated with major cardiovascular complications¹ and a cardiac event mortality rate of 1%.² Therefore, perioperative cardiovascular morbidity and mortality are targets for study and practice improvement. Many studies have associated postoperative myocardial ischemia with adverse outcomes. Myocardial ischemia is associated with elevated heart rate. Therefore, beta (β) blockers have been used to decrease heart rate with the purpose of reducing myocardial ischemia and death.³ Although initially used more indiscriminately, accumulating evidence suggests more refined use of β blockers to achieve improvements in perioperative cardiac complications.

A task force has been assembled by the American College of Cardiology Foundation and the American Heart Association to determine recommendations for periopera-

tive β blockade.⁴ These will be used as the foundation for the recommendations set forth herein.

Preoperative Cardiac Testing

Patients with known coronary artery disease or those with new onset of signs or symptoms suggestive of coronary artery disease should undergo preoperative evaluation by a cardiologist. The surgeon should have a low threshold for cardiology referral in the face of comorbid conditions such as pulmonary disease, diabetes mellitus, renal impairment, and hematologic disorders. The “simple index” for prediction of cardiac risk during major noncardiac surgery identifies six independent risks correlated with higher complications.⁵ The six independent predictors of complications identified and included in the Revised Cardiac Risk Index are as follows:

- High-risk type of surgery (abdominal aortic aneurysm or other suprainguinal vascular, thoracic, abdominal procedure)
- Ischemic heart disease (defined as history of myocardial infarction [MI], history of positive treadmill test, use of nitroglycerin, current complaints of chest pain thought to be secondary to coronary ischemia, or electrocardiogram [ECG] with abnormal Q waves),
- Congestive heart failure (defined as history of heart failure, pulmonary edema, paroxysmal nocturnal dyspnea,

peripheral edema, bilateral rales, S3, or x-ray with pulmonary vascular distribution)

- Cerebrovascular disease (history of transient ischemic attack or stroke)
- Preoperative insulin treatment for diabetes mellitus
- Preoperative serum creatinine > 2.0 mg/dL

The greater the number of risk factors, the greater the operative risk.⁵

Colorectal abdominal procedures are generally considered intermediate risk (reported cardiac risk 1–5%).⁶

The Task Force⁴ lists active cardiac conditions for which the patient should undergo cardiology evaluation and treatment before noncardiac surgery: unstable coronary syndromes, decompensated heart failure, significant arrhythmias (high-grade AV block, Mobitz 2 AV block, third-degree AV heart block, supraventricular arrhythmias with uncontrolled ventricular rate, symptomatic bradycardia, newly recognized ventricular tachycardia), and severe valvular disease (severe aortic stenosis, symptomatic mitral stenosis). If one or more of these are present prior to nonemergent surgery, the surgery should be delayed for workup and management of the condition.

As long as residual myocardium is not at risk, patients with recent MIs are advised to wait 4 to 6 weeks after MI before undergoing elective surgery.⁴

Perioperative Beta Blockers

There are some conflicting data on the use of perioperative β blockade as there are a dearth of quality randomized controlled trials on the subject. We have evolved from ubiquitous perioperative β blockade to a more thoughtful approach given that some recent trials have reported potential harm from β blockade. Furthermore, there is currently controversy regarding the research conducted at Erasmus University by Don Poldermans (DECREASE studies⁷) in which an investigative committee found serious shortcomings in the procedure used to record consent obtained from patients to participate in studies, the submission of publications based on unreliable data, and scientifically inaccurate data collection.⁸ Studies performed by this group are purposely omitted from this review.

Initial studies supported the use of perioperative β blockade. Mangano et al³ in 1996 performed a randomized controlled trial comparing the effect of atenolol with placebo in patients with or at risk for coronary artery disease undergoing noncardiac surgery. Atenolol was started the day of surgery and continued until discharge. They showed 55% lower overall mortality in the atenolol group compared with placebo. They concluded that patients who have or are at risk for coronary artery disease who undergo noncardiac surgery enjoy reduced mortality and incidence of cardiovascular complications after treatment with atenolol. Benefits remained for up to 2 years after surgery. This trial has been criticized for significant nonuniformity in the two study groups and also for exclusion of deaths in the immediate postoperative period, an inclusion which would have negated the study outcomes.⁹

In 2002, Auerbach and Goldman⁹ performed a MEDLINE review on perioperative β blockade and included five ran-

domized controlled trials. They reported modest numbers needed to treat (NNT) to improve upon myocardial ischemia (NNT = 2.5 to 6.7) and also cardiac or all-cause mortality (NNT = 3.2 to 8.3). These authors concluded that despite heterogeneous trials, the literature suggests a benefit of β blockade in preventing perioperative cardiac morbidity.¹⁰

Subsequent studies, however, raised concerns about adverse effects of perioperative β blockers on certain populations, especially those at low to moderate risk of cardiac events.⁹ In 2005, Lindenauer et al¹⁰ conducted a large retrospective cohort study of patients who underwent major noncardiac surgery across the United States. They found that the relationship between perioperative β blocker treatment (within the first 2 days in the hospital) and the risk of death varied directly with the cardiac risk (measured by the Revised Cardiac Risk Index [RCRI]). In patients with RCRI score of 0 to 1, treatment was associated with no benefit and possible harm owing to bradycardia and hypotension. With increasing RCRI scores from 2 to > 4, there was increasing benefit to β blocker use (decreasing odds ratios for in-hospital death).¹¹

Most recently, the POISE (Perioperative Ischemic Evaluation) Trial¹ showed the benefit of a perioperative β blockade in terms of reduction in cardiovascular death and MI, but with an increased risk of stroke and total mortality. This randomized controlled trial assigned patients with or at risk for atherosclerotic disease, who were undergoing noncardiac surgery to receive fixed-dose extended-release metoprolol or placebo starting 2 to 4 hours before surgery and continued for 30 days postoperatively. Post hoc multivariate analysis suggests that clinically significant hypotension, bradycardia, and stroke account for the increased risk of death. The authors conclude that assuming a perioperative β – blocker regimen has benefit without substantial harm has risk thus, there is a clear need for large randomized trials.¹

The ACCF/AHA Task Force⁴ notes that available evidence suggests, but does not definitively prove, that “when possible and where indicated, beta blockers should be started days to weeks before elective surgery. The dose should be titrated perioperatively to achieve adequate heart rate control to increase the likelihood that the patient will receive the benefit of beta blockade, while seeking to minimize the considerable risks of hypotension and bradycardia seen in POISE.” Goal heart rate is 60 to 80 beats per minute. See **Table 1** for ACCF/AHA recommendations.

The Task Force⁴ does not support fixed dose or long-acting oral β blockers, as these cannot be titrated appropriately. Overall, they concluded that available evidence suggests that β blockers, if used, should be appropriately titrated throughout the preoperative, intraoperative, and postoperative period to achieve effective heart rate control, while avoiding frank hypotension and bradycardia.

The Surgical Care Improvement Project (SCIP) best practices initiative guidelines include the following prevention strategy: Administer β blocker during the perioperative period to patients on β blocker prior to arrival.¹² The perioperative period for the SCIP cardiac measures is defined as 24 hours prior to surgical incision through discharge from postanesthesia care/recovery area. Similarly, the American

Table 1 Recommendations for perioperative beta – blocker therapy (as noted in ACCF/AHA perioperative guidelines, 2009)⁴

Class I
Beta blockers should be continued in patients undergoing surgery who are receiving β blockers for treatment of conditions with ACCF/AHA Class I guideline indications for the drugs.
Class IIa
Beta blockers titrated to heart rate and blood pressure are reasonable for patients in whom preoperative assessment identifies coronary artery disease or high cardiac risk, as defined by the presence of more than 1 clinical risk factor,* who are undergoing intermediate-risk surgery.
Class IIb
The usefulness of β blockers is uncertain for patients who are undergoing either intermediate-risk procedures or vascular surgery in whom preoperative assessment identifies a single clinical risk factor* in the absence of coronary artery disease.
Class III
Beta blockers should not be given to patients undergoing surgery who have absolute contraindications to β blockade.
Routine administration of high-dose β blockers in the absence of dose titration is not useful and may be harmful to patients not currently taking β blockers who are undergoing noncardiac surgery.

Abbreviations: ACCF/AHA = American College of Cardiology Foundation/American Heart Association; β , beta.

*Clinical risk factors: history of ischemic heart disease, history of compensated or prior heart failure, history of cerebrovascular disease, diabetes mellitus, and renal insufficiency.

College of Cardiology and the American Heart Association cite continuation of β -blocker therapy in the perioperative period in patients previously taking β blockers as a class I recommendation.¹³

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