

HOSPITAL PHYSICIAN®

GENERAL SURGERY BOARD REVIEW MANUAL

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The *Hospital Physician General Surgery Board Review Manual* is a peer-reviewed study guide for residents and practicing physicians preparing for board examinations in general surgery. Each quarterly manual reviews a topic essential to the current practice of general surgery.

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Preoperative Cardiac Evaluation of Noncardiac Surgical Patients

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Table of Contents

Introduction	2
Preoperative Clinical Assessment of Cardiac Risk	2
Preoperative Cardiac Diagnostic Testing	4
Role of Coronary Revascularization Prior to Surgery	10
Conclusion	10
References	11

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Preoperative Cardiac Evaluation of Noncardiac Surgical Patients

Jamal J. Hoballah, MD, MBA, FACS, and Alan F. Ross, MD

INTRODUCTION

Cardiovascular complications are a major concern for patients undergoing noncardiac surgery. Many patients with coronary artery disease (CAD) such as stable angina pectoris undergo noncardiac surgery without complications. Yet others, including some with no obvious cardiac disease, have suffered devastating postoperative myocardial infarction (MI). How does one determine the risks for a particular patient? This review will address both clinical assessment of preoperative cardiac risk and the application of invasive and noninvasive technologies. The indications for preoperative cardiac screening testing will be discussed, and a practical approach to the preoperative management of patients undergoing noncardiac surgery will be presented.

PREOPERATIVE CLINICAL ASSESSMENT OF CARDIAC RISK

CASE PRESENTATION

A 71-year-old woman is referred to the vascular surgery service with an asymptomatic 5.8-cm abdominal aortic aneurysm. Her past medical history is significant for hypertension, insulin-dependent diabetes, and chronic renal insufficiency. She denies any previous MI and has a sedentary lifestyle. She has no cardiac murmurs or abnormal cardiac sounds. Her blood urea nitrogen level is 35 mg/dL, and her serum creatinine level is 2.1 mg/dL. She is not a candidate for endovascular treatment and a standard open surgical replacement is recommended. Her electrocardiogram (ECG) is normal.

- **How can the cardiac risks of the proposed procedure be estimated based on clinical assessment in this patient?**

CLINICAL RISK INDICES

Cardiac complications following noncardiac surgical

procedures account for a major portion of perioperative mortality and morbidity. Several clinical criteria and algorithms¹⁻⁴ have been developed to stratify patients and identify those at increased risk of developing perioperative myocardial events. Many clinicians regard the publication of Goldman's cardiac risk index (CRI)⁵ in 1977 as the beginning of clinical cardiac risk assessment for noncardiac surgery. However, major contributions were made prior to this time. Risk factors identified prior to Goldman's study included age over 60 years; emergency surgery; intraperitoneal and intrathoracic surgery; prior coronary disease; recent (< 3 months) MI; cardiac enlargement; congestive heart failure; aortic valve disease; and preoperative ECG abnormality such as atrial fibrillation, atrial flutter, heart block, or bundle branch block. The most important risk factor identified by the early studies was that a MI within 6 months of surgery significantly increased the risk of postoperative reinfarction.

Goldman Cardiac Risk Index

In 1977, Goldman and colleagues proposed a landmark CRI in a study of 1001 patients older than 40 years undergoing major noncardiac surgery.⁵ Nine independent preoperative characteristics were identified that correlated to adverse postoperative outcomes of MI, pulmonary edema, or ventricular tachycardia. Each risk factor was assigned a point value based on its significance (**Table 1**), and 4 risk classes were established by point totals (**Table 2**). According to the Goldman criteria, the patient in this case study had 2 risk factors: age older than 70 years and aortic operation. Her cardiac risk score would be 9, placing her in a Goldman CRI class II, which is associated with a 7% cardiac complication rate.

The Goldman CRI was widely accepted. It provided a simple, yet statistically valid means of prioritizing cardiac risk assessment. The analysis found that many characteristics, such as smoking, diabetes, hypertension, and angina, were not significant for predicting adverse cardiac outcomes.

One criticism of the Goldman study was that detection of