

Cardiac Risk Assessment

Key Points:

1. Patients with a high cardiac risk index have a markedly increased risk of perioperative cardiac complications.
2. Take into consideration whether the surgery is elective or emergent.
3. Consider delaying or canceling surgery if a high risk patient can not be medically optimized prior to surgery.

Assessing Patient Specific Risk

Due to the mortality and cost from post-operative myocardial infarction and cardiac complications, ways to reduce mortality have been studied. The first step is to identify intermediate and high risk patients. For years, patients have been risk stratified into low, intermediate, and high for developing perioperative cardiac complications.

In 1977 Goldman, et al., developed the first preoperative cardiac risk index by looking at nine variables (preoperative third heart sound or jugular venous distention; myocardial infarction in the preceding six months; more than five premature ventricular contractions per minute documented at any time before operation; rhythm other than sinus or presence of premature atrial contractions on preoperative electrocardiogram; age over 70 years; intraperitoneal, intrathoracic or aortic operation; emergency operation; important valvular aortic stenosis; and poor general medical condition), which increased the risk of perioperative cardiac complications¹⁰. Since 1977, multiple cardiac risk indices have been developed, as well as guidelines for preoperative cardiac evaluation.

In 1986, Detsky, et al., modified the original Goldman criteria (1977) adding unstable angina and pulmonary edema to the variables⁷. A point scale is assigned to each variable, which are then added to determine the patient's "class" and cardiac risk.

Detsky's Modified Cardiac Risk Index⁷ (Chart 1)

	Points
Age > 70 years old	5
Myocardial Infarction within 6 months	10
Myocardial Infarction after 6 months	5
Canadian Cardiovascular Society (CCS) of Angina (see table below)	
Class III	10
Class IV	20
Unstable angina within 6 months	10
Alveolar pulmonary edema	
Within one week	10
Ever	5
Critical Aortic Stenosis	20
Arrhythmia	
Rhythm other than sinus + PACs	5
> PVCs	5
Emergency Operation	10
Poor General Medical Status	5

Detsky's Modified Cardiac Risk Index(cont)⁷ (Chart 2)

Class	Points	Cardiac Risk
I	0-15	Low
II	20-30	
III	31+	High

CCS Classification of Angina (Chart 3)

0	asymptomatic
I	Angina with strenuous exercise
II	Angina with moderate exertion
III	Angina with walking 1-2 blocks or climbing one flight of stairs or less at normal pace
IV	Inability to perform any activity without angina

In 1999, Lee, et al, revised Goldman's criteria for cardiac risk index and developed six independent predictors/variables which correlated with postoperative cardiac complications. Patients with more than 2 variables have a postoperative cardiac complication rate of ~10% and are considered to be **high risk**⁸.

Lee Variables

1. high-risk type of surgery
2. ischemic heart disease (includes any of the following: history of myocardial infarction, history of a positive exercise test, current complaint of chest pain that is considered to be secondary to myocardial ischemia, use of nitrate therapy, or electrocardiography with pathologic Q waves)
3. congestive heart failure
4. history of cerebrovascular disease
5. preoperative treatment with insulin
6. preoperative serum creatinine >2.0 mg/dL

Lee Criteria-Revised Cardiac Risk Index⁸ (Chart 4)

Number of Variables	Risk of major postoperative cardiac complication
0	0.4%
1	0.9%
2	7.0%
≥3	11.0% High Risk

Separately, Eagle 1989 and Vanzetto 1996 looked at clinical predictors which could predict the probability of cardiac disease. These clinical predictors are considered low risk variables and are cumulative in predicting morbidity.

The Eagle criteria (1989) looked at five clinical predictors of postoperative cardiac events: 1) Q waves on ECG, 2) angina, 3) ventricular ectopy, requiring therapy, 4) diabetes on therapy, and 5) age >70 years old. Patients without clinical predictors had only a 3% incidence of perioperative morbidity. Patients with three or more clinical risk factors had a morbidity rate of 50%. Neither group could be further risk stratified with noninvasive testing¹³.

In 1996, Vanzetto G, et al. added a history of myocardial infarction, ST-segment abnormalities on ECG, hypertension with left ventricular hypertrophy, and history of congestive heart failure to Eagle's clinical predictors. A patient with ≥2 variables is considered low to intermediate risk (3%-10%) and may benefit from further investigation⁹.

Low Risk Indices/Variables (Chart 5)

Eagle 1989¹³	Vanzetto 1996⁹
<ul style="list-style-type: none"> • Q waves on ECG • Angina • Ventricular ectopy • Diabetes • Age >70 years old 	<ul style="list-style-type: none"> • Age >70 years • Diabetes • History of congestive heart failure • Previous MI (at any time) • Angina (any) • Hypertension with severe LVH • ST abnormalities on rest ECG Q waves

The American College of Cardiology and the American Heart Association (ACC/AHA) and the American College of Physicians (ACP) have published preoperative guidelines/algorithms. The ACC/AHA created guidelines for Perioperative Cardiovascular Evaluation for Noncardiac Surgery, last updated 2002¹¹. Their recommendations are based on a patient’s clinical predictors, patient’s functional status, and urgency of the surgery.

The American College of Physicians (1997) uses Detsky’s modified cardiac index to determine whether a patient is Class I (low or intermediate risk) or II/ III (high risk). A Class I patient needs to be further stratified by calculating the number of low risk variables in the Modified Cardiac Risk Index (Eagle and Vanzetto criteria). This determines whether a patient remains a low risk (0-1 cardiac risk factors) or intermediate risk patient (>2 cardiac risk factors). Those intermediate risk patients undergoing vascular surgery are recommended to have further noninvasive testing. High risk patients need further intervention whether it is noninvasive or invasive testing, medical optimization, or modifying/canceling surgery.

The main differences in the two guidelines are:

- ACC/AHA incorporates functional status, ACP **DOES NOT**
- ACC/AHA requires noninvasive testing for poor functional status
- ACP requires noninvasive testing for scheduled vascular surgery

Please see the respective links for their algorithms/guidelines.

Assessing Surgical Related Risk

Cardiac Risk Stratification for Noncardiac Surgical Procedures¹¹ (Chart 6)

<p>High</p> <p>Cardiac Event Risk > 5%</p>	<ul style="list-style-type: none"> • Emergent operations, particularly elderly • Aortic and other major vascular surgery • Peripheral vascular surgery • Prolonged surgical procedures associated with large fluid shifts and/or blood loss
<p>Intermediate</p> <p>Cardiac Event Risk < 5%</p>	<ul style="list-style-type: none"> • Carotid endarterectomy surgery • Head and neck surgery • Intraperitoneal and intrathoracic surgery • Orthopedic surgery • Prostate surgery
<p>Low</p> <p>Cardiac Event Risk <1%</p>	<ul style="list-style-type: none"> • Endoscopic procedures • Superficial procedure • Cataract surgery • Breast surgery

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