Guidelines for Perioperative Cardiovascular Evaluation for Noncardiac Surgery*

Based on a Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Updated 2002

Purpose of Preoperative Evaluation

- Evaluate patient’s current medical status.
- Provide clinical risk profile.
- Provide recommendations for management of cardiac risk over entire perioperative period.

Epidemiology

- 50% of perioperative deaths are cardiac
- Most occur within 72 hours post op (peak 48 h)
- Most perioperative MI’s present atypically, and are NQMI’s
- Perioperative MI’s have up to 50% mortality rates

Goldman’s risk index

(NEJM 1977, 297:845)

- Age > 70: 5 points
- MI within 6 months: 10 points
- S3 gallop or JVD: 11 points
- Important AS: 3 points
- Non-sinus rhythm: 7 points
- > 5 PVCs / min: 7 points
- Hypoxia, acidosis, CRF, bedridden pt.: 3 points
- Abdominal/thoracic operation: 3 points
- Emergency operation: 4 points

Risk of complications: Class I (0-5p.): 0.9%; cl. II (6-12p.): 7%; cl. III (13-25p.): 13%; cl. IV (>25p.): 78%

Simple index

(Lee et al, Circulation 1999; 100:1043)

PREDICTORS:
- High risk surgery
- History of CAD
- History of CHF
- History of CVA/TIA
- Insulin treatment
- Creatinine > 2

RISKS of MAJOR CARDIAC COMPLICATIONS:
- 0 - 0.5%
- 1 - 1.3%
- 2 - 4%
- 3 - 9%
General Approach to the Patient

- Preoperative consultation may be the first careful cardiovascular evaluation in many years!
- History, including prior CABG/PTCA, prior ischemia evaluation, and special emphasis on functional capacity
- Physical Examination
- Comorbid Diseases
  - Pulmonary
  - Diabetes Mellitus
  - Renal Impairment
  - Hematologic Disorders
- Ancillary Studies (minimum - ECG and CXR)

Clinical evaluation of functional capacity

- Preoperative consultation may be the first careful cardiovascular evaluation in many years!
- Classify FC: poor (<4 METS), moderate (4-7 METS), excellent (>7 METS), indeterminate.
- Perioperative risk markedly increased in patients with poor FC (unable to climb one flight of stairs walk @ 3.5-5 kph)
- Perioperative risk low in patients with excellent FC (walk fast uphill, fast cycling, fast swimming, moving heavy furniture)
- Perioperative risk unknown in patients with indeterminate FC

Clinical Predictors of Increased Perioperative Cardiovascular Risk

- **Major**
  - Unstable coronary syndromes.
  - Decompensated CHF.
  - Significant Arrhythmias.
- **Intermediate**
  - Mild angina pectoris.
  - Prior MI.
  - Compensated or prior CHF.
  - Diabetes Mellitus.
- **Minor**
  - Advanced Age.
  - Abnormal ECG.
  - Rhythm other than sinus.
  - Low functional capacity.
  - History of stroke.
  - Uncontrolled HTN.

Type of Surgery

- **Urgency - emergent major operation, especially in the elderly is always high risk.**
- **High surgical risk (Risk often > 5%):**
  - Aortic and other major vascular.
  - Anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss.
- **Intermediate surgical risk (risk generally <5%):**
  - Carotid endarterectomy.
  - Head and neck surgery.
  - Intraperitoneal and intrathoracic, orthopedic and prostate surgery.
- **Low surgical risk (<1% risk):**
  - Endoscopic and superficial procedures.
  - Cataract surgery.
  - Breast surgery.
Supplemental Preoperative Evaluation

- Noninvasive resting left ventricular function:
  - Risk of complications greatest with EF<35%.

- Recommendations
  - Class I: Poorly controlled CHF.
  - Class II: Prior CHF or dyspnea of unknown etiology.
  - Class III: Routine test without prior CHF.

Assessment of Risk for Coronary Artery Disease and Functional Capacity (1)

- Goal:
  - Provide objective measure of functional capacity.
  - Identify presence of preoperative myocardial ischemia or cardiac arrhythmias.
  - Estimate perioperative cardiac risk and long-term prognosis.

Assessment of Risk for Coronary Artery Disease and Functional Capacity (2)

- Specific Approaches:
  - Exercise stress testing.
  - Nonexercise stress testing:
    - Dobutamine stress echocardiography.
    - Dipyridamole/adenosine thallium testing.
    - 10-30% PPV, 95% NPV in vascular patients.
    - Ambulatory electrocardiographic monitoring.

Assessment of Risk for Coronary Artery Disease and Functional Capacity (3)

- Recommendations:
  - Test of choice is exercise ECG testing.
    - Provides estimate of functional capacity.
    - Detects myocardial ischemia.
    - Has excellent correlation with outcome.
  - Other tests indicated when:
    - Abnormal baseline ECG.
    - Cannot perform exercise - use pharmacological stress.

Indications for noninvasive testing of ischemia

- No need to apply noninvasive evaluation when risk is very low or very high.
- Intermediate clinical predictors, poor/indeterminable FC
- Intermediate clinical predictors, moderate/excellent FC, high risk surgery
- Minor or no clinical predictors, poor/indeterminable FC, high risk surgery

Indications for preoperative coronary angiography

CLASS I
- High risk noninvasive testing
- Intractable angina
- Unstable angina pectoris
- Indeterminate noninvasive testing in high risk patients undergoing high risk surgical procedures

CLASS II
- Intermediate risk noninvasive testing
- Indeterminate noninvasive testing in low risk patients undergoing high risk surgery
- Urgent surgery shortly after MI
- Perioperative MI
Algorithm for preoperative evaluation

1. Prior CABG is a favorable risk predictor
   Patients with prognostic high risk coronary anatomy in whom long-term outcome would likely be improved (usual indications for CABG).
   Noncardiac elective surgical procedure of high or intermediate risk.
   Very rarely - CABG “to get the patient through the operation”

Preoperative CABG

- No randomized clinical trials documenting decreased incidence of perioperative cardiac events.
- No prospective studies to determine optimal period of delay.
- Best timing?
- Problem of discontinuation of anti-platelet agents following coronary stenting / operating on anti-platelet agents

Catastrophic outcomes of noncardiac surgery soon after coronary stenting (Kaluza et al, JACC 2000; 35:1288)

- 40 pts underwent coronary stenting less than six weeks prior to noncardiac operation
- There were 7 / 40 MIs (18%), 11/40 major bleeding (27%), and 8/40 (20%) fatalities!
  The vast majority occurred with surgery within two weeks of stenting

Conclusions
- Surgery should be postponed for 2-4 weeks following coronary stenting
Perioperative Medical Therapy

- Recommendations: Medical Therapy.
- Few randomized trials.
- Preliminary studies suggest β-blockers reduce perioperative ischemia and may reduce risk of MI and death.

Preoperative Therapy with B-Blockers

- Class I. B-blockers required in recent past to control symptoms of angina; patients with symptomatic arrhythmias or hypertension.
- Class II. Preoperative assessment identifies untreated hypertension, known coronary disease, or major risk factors for coronary disease.
- Class III. Contraindications to B-blockade.

Perioperative Atenolol
(Mangano et al, NEJM 1996, 335:1713)

- N=200 pts with or at risk for CAD undergoing elective noncardiac surgery under general anesthesia
- 1:1 randomization placebo: Atenolol
- Atenolol 5-10 mg IV 1 h. before and immediately after surgery, then 50-100 mg daily for seven days (15%/7% discharged on BB)
- Very few deaths/MI during hospitalization, no difference between groups
- Significant reduction in 6m, 1y, and 2y death and cardiovascular outcomes in the treatment group
- Mechanism - prevention of catecholamine-induced changes in the coronaries that render patients more susceptible to later complications?

Perioperative Bisoprolol
(Poldermans et al, NEJM 1999, 341:1789)

- Patients with CAD and ischemia by Dobutamine-echo undergoing vascular surgery were randomized to Bisoprolol (59) vs placebo (53)
- Bisoprolol 5 - 10 mg / day, 1 week pre --> 1 month post operation
- One month cardiac death: 3.4% vs 17% (P=0.02)
- One month non fatal MI: 0% vs 17% (p<0.001)
Disease Specific Approaches

- Coronary Artery Disease (CAD).
- Patients with known CAD.
- Patients with major risk factors for CAD.
- Hypertension.
- Congestive Heart Failure.
- Valvular Heart Disease.
- Arrhythmias and Conduction Defects.
- Pulmonary Vascular Disease.

Hypertension

- Mild - moderate HTN - continue medications
- Severe HTN - delay surgery. Consider beta blockers

Valvular Heart Disease

- Severe AS → AVR or PAOV prior to intermediate to high risk operation
- Severe MS → consider MVR or BMVP
- Moderate MS → control heart rate
- Severe MR/AR - usually OK (consider hemodynamic monitoring?)

Preoperative Valve Surgery

- Overall, valvular stenosis more problematic than valvular insufficiency
- Valvular heart disease severe enough to warrant surgical treatment should have valve surgery before elective noncardiac surgery.
- Patients with severe mitral or aortic stenosis who require urgent noncardiac surgery may benefit from catheter balloon valvuloplasty.

Perioperative Arrhythmias

- Independent risk factor for complications
- Look for underlying disease
- PAF - better to operate in sinus rhythm with antiarrhythmic treatment
- CAF - ensure rate control
- Conduction defects - indications for TPM similar to indications for PPM
- Use external pacing patches for borderline cases

Pulmonary Hypertension

- Cannot tolerate perioperative hypoxia
- Analogous to labor in Eisenmenger syndrome
- Systemic hypotension increases R to L shunting
- Increased risk for thromboembolic complications, including paradoxical emboli
- Very high mortality and complication rate
- 7% death in recent series of Eisenmenger (Ammash et al, JACC 1999; 33:222)
Preoperative Intensive Care (1)

- Goal
  - Optimize and augment oxygen delivery in patients at high risk.
- Hypothesis
  - Indices derived from pulmonary artery catheter and invasive blood pressure monitoring can be used to maximize oxygen delivery, which leads to reduction in organ dysfunction.

Preoperative Intensive Care (2)

- Recommendations:
  - Based on scant evidence, preoperative preparation in intensive care unit may benefit certain high risk patients, particularly those with decompensated CHF.

Anesthetic Considerations and Intraoperative Management (1)

- No study clearly demonstrated improved outcome from use of:
  - Pulmonary artery catheter.
  - ST-segment monitoring.
  - Transesophageal echocardiography.
  - Intravenous nitroglycerin.
  - Prophylactic placement of intra-aortic balloon counterpulsation device.

Anesthetic Considerations and Intraoperative Management (2)

- Choice of anesthetic and intraoperative monitoring best left to discretion of anesthesia care team.

Perioperative Surveillance

- Post operative myocardial ischemia:
  - Strongest predictor of perioperative cardiac morbidity.
  - May go untreated until overt symptoms of cardiac failure develop.
  - Diagnosis of perioperative MI has short and long-term prognostic value.
  - 30% to 50% perioperative mortality and reduced long-term survival.

Perioperative Surveillance: Intraoperative and Postoperative Use of Pulmonary Artery Catheters

- Class I: Patients at risk for major hemodynamic disturbances most easily detected by a pulmonary artery catheter undergoing procedure likely to cause these hemodynamic changes in setting with experience in interpreting results.
- Class II: Either patients' condition or surgical procedure (but not both) places patient at risk for hemodynamic disturbances.
- Class III: No risk of hemodynamic disturbances
Perioperative Surveillance: Potential Myocardial Infarction (1)

- Patients without evidence of CAD:
  - Surveillance restricted to those who develop perioperative signs of cardiovascular dysfunction.

Perioperative Surveillance: Potential Myocardial Infarction (2)

- Patients with known or suspected CAD:
  - ECGs at baseline, immediately after procedure, and daily x 2 days.
  - Measurements of cardiac enzymes best reserved for patients at high risk or who demonstrate ECG or hemodynamic evidence of cardiovascular dysfunction.

Perioperative Surveillance: Arrhythmia/Conduction Disease (1)

- Often due to remedial noncardiac problems:
  - Infection.
  - Hypotension.
  - Metabolic derangements.
  - Hypoxia.

Perioperative Surveillance: Arrhythmia/Conduction Disease (2)

- Cardioversion not recommended until precipitating causes corrected or modified.
- Electrical cardioversion for supraventricular or ventricular arrhythmias causing hemodynamic compromise.

Postoperative Therapy/Future Management

- Assessment and management of risk factors for:
  - CAD.
  - Heart failure.
  - Hypertension.
  - Stroke.
  - Other cardiovascular disease.

Conclusions (1)

- Successful perioperative evaluation and management of high-risk cardiac patients undergoing noncardiac surgery requires careful teamwork and communication between surgeon, anesthesiologist, primary care physician, and consultant.
Conclusions (2)

- Indications for further cardiac testing and treatments are the same as in the nonoperative setting, but timing is dependent on several factors, including:
  - The urgency of the noncardiac surgery.
  - Patient-specific risk factors.
  - Surgery-specific considerations.

Conclusions (3)

- Use of both noninvasive and invasive preoperative testing should be limited to circumstances in which the results of the tests clearly affect patient management.

Conclusions (4)

- The consultant best serves the patient by making recommendations aimed at:
  - Lowering immediate perioperative cardiac risk.
  - Assessing need for subsequent postoperative risk stratification and interventions directed to modify coronary risk factors.