

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

*Eagle KA, Brundage BH, Chaitman, BR et al: *Circulation* 1996;93:1278-1317 and *JACC* 1996;27:910-948.

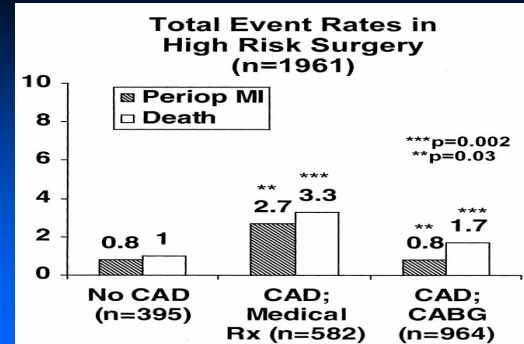
Updated 2002

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 NQMIs
- Perioperative MI's have up to 50% mortality rates



Eagle et al. *Circulation* 1997; 96:1502

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.
 - Peripheral vascular.
 - Anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss.

Type of Surgery

- Intermediate surgical risk (risk generally <5%):
 - Carotid endarterectomy.
 - Head and neck surgery.
 - Intraperitoneal and intrathoracic, orthopedic and prostate surgery.

Type of 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

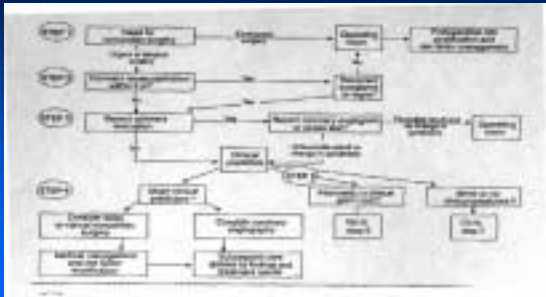
No need to apply noninvasive evaluation when risk is very low or very high!

- Intermediate clinical predictors, poor/indeterminable FC
- Intermediate clinical predictors, moderate/excellent FC, high risk surgery
- Minor or no clinical predictors, poor/indeterminate FC, high risk surgery

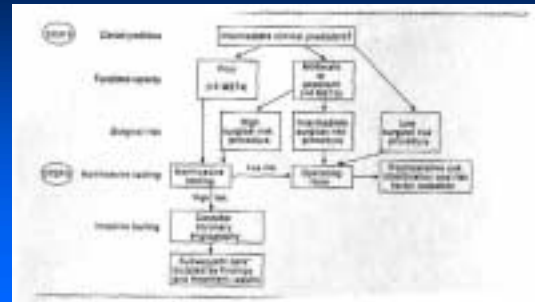
Indications for preoperative coronary angiography

- **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

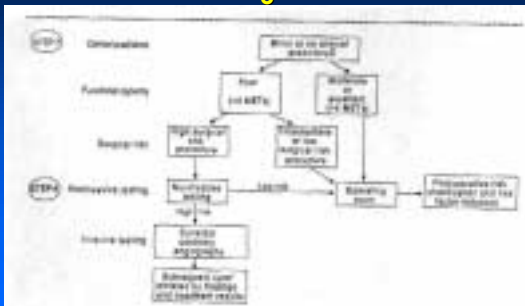
Algorithm for preoperative evaluation - 1



Algorithm for preoperative evaluation - 2



Algorithm for preoperative evaluation - 3



Preoperative CABG

- 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 PTCA

- 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 week 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 B-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 beta blockers (Mangano et al, 1996)

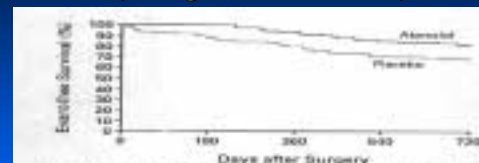


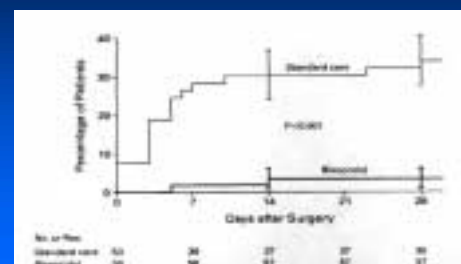
Figure 2. Survival from Survival in the Two Years after Noncardiac Surgery among 182 Patients in the Atenolol and Placebo Groups Who Survived to Hospital Discharge. The outcomes assessed included the following events: myocardial infarction, unstable angina, the need for coronary-artery bypass surgery, and congestive heart failure. The rate of survival at 6 months (180 days) was 100 percent in the atenolol group and 98 percent in the placebo group (P=0.44); at 1 year (360 days), the rates were 93 percent and 91 percent, respectively (P=0.009); and at 2 years (720 days), 83 percent and 80 percent (P=0.008).

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)

Perioperative beta blockers (Poldermans et al, 1999)



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
(Animesh et al JACC 1999; 33:220)

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.