

PREOPERATIVE CARDIAC EVALUATION

Key Elements of Cardiac Clearance

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General Approach

- ▣ Determination of Type of Noncardiac Surgery
- ▣ Elective or Emergency Surgery
- ▣ History and Physical Exam
- ▣ Identification of underlying cardiovascular disease
- ▣ Assessment of functional status

Primary Factors to Address

- ▣ Determining the stability of the patient's cardiovascular status
- ▣ Assessing whether the patient's medical condition is optimally treated.
- ▣ Recommending preoperative testing and/or modifications in medical regimen to better risk stratify and improve patient's stability.
- ▣ Timing of surgical intervention

Revised Goldman cardiac risk index (RCRI)

Six independent predictors of major cardiac complications*

High Risk Surgery

Hx of ischemic heart disease

Hx of Heart Failure

Hx of cerebrovascular disease

Diabetes mellitus requiring treatment with insulin

Pre-operative serum creatinine > 2.0 mg/dL

Rate of Cardiac death, nonfatal MI & nonfatal cardiac arrest according to the number of predictors**

No risk factors - 0.4% (95% CI 0.1 - 0.8 %)

One risk factors - 1.0% (95% CI 0.5 - 1.4 %)

Two risk factors - 2.4% (95% CI 1.3 - 3.5 %)

Three or more risk factors - 5.4% (95% CI 2.8 -7.9%)

*From Lee, TH, Marcantonio, ER, Mangione, CM Circulation 1999; 100: 1043

**From Devereaux, PJ, Goldman, L, Cook, DJ et al CMAJ 2005: 173:167

Stepwise Approach to Perioperative Evaluation

- ▣ *Patient specific clinical variables:*

Does patient have one of the specified active cardiac conditions?

- i.e. unstable angina, decompensated HF, severe arrhythmias, significant valvular heart disease

- ▣ *Surgery-specific risk:*

Determine the urgency of noncardiac surgery

- Emergency vs. elective

Is the patient undergoing high or low risk surgery?

- ▣ *Exercise capacity:*

Does the patient have a functional capacity greater or equal to 4 METS?

Clinical Predictors of Cardiovascular Risk

- History
- Physical Exam
- ECG

Clinical Risk Assessment

Clinical Risk Factors -Active Medical Conditions associated with- *Major risk*

Acute coronary syndromes

-Unstable or severe angina

-Recent MI

Decompensated CHF

Significant arrhythmias

Severe valvular disease

-generally nonemergency surgery cancelled/delayed until condition stabilized

Clinical Risk Assessment

Clinical Risk Factors -*Intermediate –risk*

- Hx of ischemic heart disease
- Hx of compensated or prior CHF
- Hx of cerebrovascular disease
- Diabetes mellitus
- Renal insufficiency

Clinical Risk Assessment

Clinical Risk Factors – *Minor predictors*

- Not shown to be independent predictors of peri-operative risk
 - Advanced age (> 70 years old)
 - Abnormal ECG (LVH, LBBB, ST-T wave abnormalities)
 - Rhythm other than sinus (e.g. atrial fibrillation)
 - Uncontrolled HTN

Cardiac Risk Stratification for Type of Noncardiac Surgical Procedures

Risk Stratification

High – Vascular

(reported cardiac risk often > 5%)

Intermediate

(reported cardiac risk generally 1%-5%)

Low

(reported cardiac risk generally <1%)

Procedure Examples

Aortic and other major vascular surgery

Peripheral vascular surgery

Intraperitoneal and intrathoracic surgery
Carotid endarterectomy

Head and neck surgery
Orthopedic surgery
Prostate surgery

Endoscopic procedures

Superficial procedure /Breast surgery

Cataract surgery
Ambulatory surgery

Functional Capacity : METs (metabolic equivalents)

- ▣ Resting/basal oxygen consumption (V_{O_2}) is approximately 3.5 mL/kg/min. or 1 MET
- ▣ Perioperative cardiac and overall risks are increased in patients unable to meet a 4 MET demand in daily life.
- ▣ Examples of activities requiring 4 METs:
 - Climbing flight of stairs or walking up hill)
 - METS can be determined by Exercise Stress Testing or estimated using activity scales (e.g. Duke Activity Status Index)

Preoperative Evaluation Algorithm ACC/AHA 2007 Guidelines

- ▣ Patients with ACTIVE Cardiac conditions – manage according to ACC/AHA guidelines
- ▣ Patients without ACTIVE Cardiac conditions undergoing low risk surgery or those with good functional capacity (MET level ≥ 4)- no pre-op testing other than ECG

Preoperative Evaluation Algorithm ACC/AHA 2007 Guidelines

- ▣ Patients undergoing **Intermediate risk** or **Vascular surgery** are managed according to number of clinical risk factors-
 - No clinical risk factors- proceed to surgery
 - One or two risk factors- proceed to surgery*
 - Three or more risk factors when **Intermediate risk** surgery planned- proceed to surgery*
 - Three or more risk factors when **Vascular surgery** planned- noninvasive testing recommended

*may consider testing if it will alter management

Revised cardiac risk index (RCRI)

- ▣ Hx of ischemic heart disease
- ▣ Hx of heart failure
- ▣ Hx of cerebrovascular disease
- ▣ Diabetes mellitus requiring treatment with insulin
- ▣ Pre-operative serum creatinine > 2.0 mg/dL

Noninvasive Cardiac Testing

Exercise Stress Testing:

Recommended for :

- High risk** patients undergoing vascular surgery with (> 3 revised cardiac index criteria) and
- poor functional capacity (< 4 METS)
(IIa)

Evidence for benefit less clear in the:

- Intermediate risk** pool
- consider with at least one risk factor in:
 - Intermediate risk surgery and poor functional capacity (METs < 4) (IIb)
 - Vascular surgery and good functional capacity (METs ≥ 4) (IIb)

ACC/AHA 2007 Guidelines

Noninvasive Cardiac Testing

Exercise Stress Testing:

Exercise is usually preferred since it measures exercise tolerance and the ECG response

High negative predictive value

Pharmacologic Stress Testing:

- Used in patient who cannot walk or with resting ECG abnormalities
- Dipyridamole –thallium myocardial perfusion imaging nuclear imaging vs. dobutamine echocardiography

Noninvasive Cardiac Testing

Echocardiography :

Primary indications for preoperative testing-
similar to those in nonsurgical patients (e.g.
evaluation of murmur or LV function)

Recommended for LV assessment in patients with:

- Current heart failure or hx prior heart failure with worsening dyspnea
- Dyspnea of unknown origin

ACC/AHA 2007 Guidelines

Rate of cardiac death and nonfatal MI, cardiac arrest or ventricular fibrillation, pulmonary edema, and complete heart block according to the number of predictors and the nonuse or use of beta blockers

- ▣ No risk factors – 0.4 to 1.0% vs. < 1% with BBs
- ▣ 1 or 2 risk factors – 2.2 - 6.6% vs. 0.8 – 1.6% with BBs
- ▣ 3 or more risk factors - > 9% vs. > 3% with BBs

From Auerbach, A, Goldman, L. Circulation 2006; 113: 1361

Role of Beta Blocker Therapy

- Rationale for use of beta blockers in patients undergoing noncardiac surgery based on data showing a reduction in perioperative ischemia

- **POISE Trial:**

Largest trial (n = 8351) of pts with 1 or 2 RCRI undergoing noncardiac surgery randomized to:

metoprolol XL 100 mg vs. placebo

2 - 4 hrs before surgery followed by 200 mg /day for 30 days

Primary end point of CV death, nonfatal MI or nonfatal cardiac arrest less in the metoprolol group: 5.8 vs. 6.9% (HR 0.84)

but

Total mortality and stroke increased in the metoprolol group:

3.1 vs. 2.3 and 1.0 vs.0.5 respectively

From Devereaux, PJ, Beattie, WS, Choi, PT Lancet 2008; 371:1839

Summary of Perioperative Beta Blocker Use

- ▣ All patients currently on beta blocker therapy (stable angina, post-MI, stress-induced ischemia, chronic CHF) (I)
- ▣ Highest risk pts (inducible ischemia under-going vascular surgery) are most likely to benefit (IIa).
- ▣ Patients undergoing vascular or intermediate risk surgery who have CAD or > 1 clinical risk factor may also benefit (IIa)
- ▣ Patients without CAD and 1 clinical risk factor may benefit (IIb)
- ▣ All studies showing CV benefit have used moderately selective (atenolol or metoprolol) or highly selective agents (bisoprolol)
- ▣ Beta blocker therapy should be initiated early (one month prior to surgery) and titrated to BP and heart rates 60 – 70 / minute

Coronary Artery Revascularization (CARP) Trial

- ▣ Coronary artery revascularization (CABG or PCI) before elective major vascular surgery did *not* improve long-term survival or alter early post-op outcomes in stable angina patients*
- ▣ Lack of benefit attributed to significant recent increase in use of beta-blockers, anti-platelet agents, ACE inhibitors and statins
- ▣ Coronary Artery Surgery Study (CASS) registry showed any benefit of CABG offset by the 1.4% mortality associated with CABG procedure

*LMCA stenosis > 50%, LVEF < 20% and severe aortic stenosis excluded

From McFalls, EO, Ward, HB, Moritz TE NEJM 2004; 351: 2795

Preoperative Revascularization with CABG or PCI

- ▣ Significant left main coronary artery stenosis and stable angina
- ▣ 3 vessel disease and stable angina (esp. EF<.50)
- ▣ 2 vessel disease, stable angina and significant proximal LAD disease (esp. EF< .50)
- ▣ Unstable CAD including NSTEMI and acute STEMI
- ▣ Patients with poorly controlled angina
- ▣ May be useful in patients with high risk imaging stress tests

Using ACC/AHA guidelines < 2% of patients likely to require preoperative revascularization

Coronary Artery Stenting

- ▣ It is not recommended that routine prophylactic coronary revascularization be performed in patients with stable CAD before noncardiac surgery

- ▣ Elective noncardiac surgery is not recommended within:
 - 4-6 weeks of bare metal coronary stent implantation or within
 - 12 months of drug-eluting coronary stent implantation in patients in whom thienopyridine therapy (or ASA & thienopyridine therapy) will need to be discontinued perioperatively.
 - 4 weeks of coronary revascularization with balloon angioplasty

Preoperative Evaluation Summary

- ▣ A unique opportunity to identify individuals at risk for future CV events and plan post-op evaluation and treatment
- ▣ Intermediate risk patients most likely to benefit from noninvasive cardiac testing
- ▣ Perioperative use of beta blockers remains effective for severe HTN, to reduce the incidence of coronary ischemic events and to prevent post-op atrial fibrillation
- ▣ Recent evidence demonstrates a limited role for coronary revascularization before non-cardiac surgery except when revascularization is indicated independently of non-cardiac surgery