

Assessment of Perioperative Cardiac Risk for Non-Cardiac Surgery



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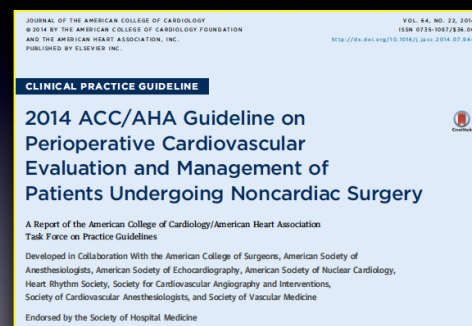
Your Cardiology Consult

Avoid hypoxemia
and hypotension!



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JACC 2014; 64 (22)



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Levels of Evidence

ACC/AHA Task Force on Practice Guidelines. Circulation 2009; 120: e169-276

Class	I	2a	2b	3
Benefit	>>> risk	>> risk	≥ risk	≤ risk
Recommend	"should"	"useful"	"may consider"	no benefit / harmful

Level	A	B	C
populations	multiple	limited	very limited

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The Goal:

to avoid a

Major Adverse Cardiac Event
(MACE)

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Major Adverse Cardiac Events

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

- Myocardial infarction (MI)
- Pulmonary edema
- Complete heart block (CHB)
- Ventricular fibrillation (VF)
 - primary cardiac arrest

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Is it ever obvious that
I should just cancel
the case?

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Active Cardiac Syndromes (IB)

ACC/AHA Task Force on Practice Guidelines. Circulation 2009; 120: e169-276

- Unstable coronary syndromes, recent MI
- Acute decompensated heart failure (ADHF)
- Significant arrhythmias
 - symptomatic bradycardia, Mobitz II, CHB
 - SVT / AF > 100/min, ventricular arrhythmias
- Severe valvular disease
 - symptomatic aortic stenosis, mitral stenosis

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Mobitz Type I and II (Second Degree Heart Block)

Mobitz Type I
(Wenckebach)



Mobitz Type II



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OK, what if the patient does not meet these criteria?

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Assessment of Cardiac Risk

(History, Examination, Resting ECG)

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Revised Cardiac Risk Index (RCRI)

Lee TH et al. Circulation 1999; 100: 1043-9

1. History of ischemic heart disease (IHD)
2. History of congestive heart failure (CHF)
3. History of cerebrovascular disease (CVA)
4. Insulin-dependent diabetes (IDDM)
5. Chronic kidney disease (CKD) (SCr >2 mg/dL)
6. Suprainguinal surgery
 - vascular, intraperitoneal or intrathoracic

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Cardiac Risk of Non-Cardiac Surgery

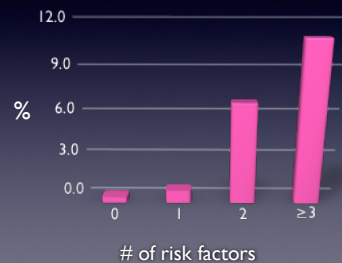
ACC/AHA Task Force on Practice Guidelines. Circulation 2009; 120: e169-276

Risk	Examples
High > 5%	Aortic, major, peripheral vascular surgery
Intermediate (1-5%)	Abdominal / thoracic surgery, carotid endarterectomy, head & neck, orthopedic, prostate surgery
Low < 1%	Endoscopic, cataract, breast, superficial, ambulatory surgery

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Risk Factors and Perioperative Complications

Lee TH et al. Circulation 1999; 100: 1043-9



- High risk surgery
- IHD
- CHF
- CVA
- IDDM
- CKD

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Newer Risk Assessment Tools

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

American College of Surgeons (ACS)
NSQIP Database

www.riskcalculator.facs.org

www.surgicalriskcalculator.com

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Enter Patient and Surgical Information

Procedure: 47562 - Laparoscopy, surgical; cholecystectomy

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a "+" in between, for example: "cholecystectomy+cholelithiasis".

Are there other potential appropriate treatment options? ☐ Other Surgical Options ☐ Other Non-operative options ☐ None

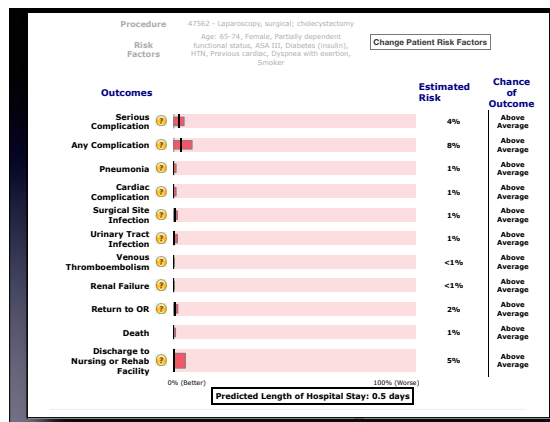
Phase enter as much of the following information as you can to receive the best risk estimates. A rough estimate will still be generated if you cannot provide all of the information below.

Age Group: 65-74 years Diabetes: Insulin Functional status: Partially Dependent Previous cardiac event: Yes Congestive heart failure in 30 days prior to surgery: No ASA class: II - Severe systemic disease Wound class: Clean Steroid use for chronic condition: No Ascler within 30 days prior to surgery: No Systemic sepsis within 48 hours prior to surgery: No Ventilator dependent: No Disseminated cancer: No

BMI Calculation: Height (in): 65 Weight (lbs): 135

riskcalculator.facs.org

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Enter Patient and Surgical Information

Procedure: 13877 - Repair of thoracoabdominal aortic aneurysm with graft, with or without cardiopulmonary bypass

Begin by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the desired procedure to properly select it. You may also search using two words (or two partial words) by placing a "+" in between, for example: "cholecystectomy+cholelithiasis".

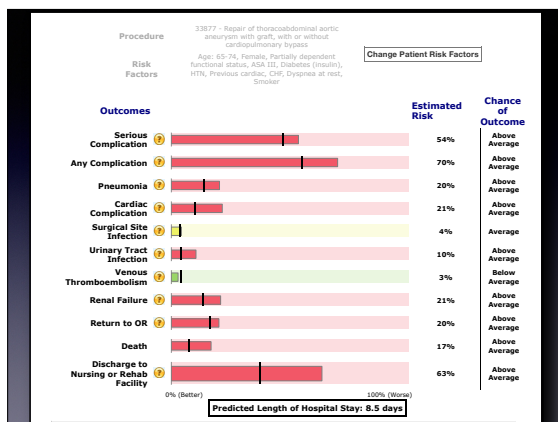
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Assessment of Functional Status and Diagnosis of Ischemic Heart Disease

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Defining Poor Exercise Tolerance

Reilly DF et al. Arch Intern Med 1999; 159: 2185-92

- Unable to walk four blocks
- Unable to climb two flights of stairs
- Serious complications after non-cardiac surgery: 20% vs. 10%
- Risk of serious complication inversely related to number of blocks able to be walked or stairs able to be climbed

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Estimated Energy Requirements: Metabolic Equivalents (METS)

ACC/AHA Task Force on Practice Guidelines. Circulation 2009; 120: e169-276

1 MET = Resting (basal) VO_2 of a 70 kg, 40-yr old man

= 3.5 mL/kg/min

= 245 mL/min

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Estimated Energy Requirements: Metabolic Equivalents (METS)

ACC/AHA Task Force on Practice Guidelines. Circulation 2009; 120: e169-276

Mets	Examples
1-3	Eat, dress, use toilet, walk around at home, walk 1-2 blocks on level
4	Light housework, dusting, washing dishes
4-10	Climb a flight of stairs, run a short distance, heavy housework, play golf, dance
>10	Swimming, singles tennis, football, skiing

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Duke Activity Status Index (DASI)

Hlatky MA et al. Am J Cardiol 1989; 64: 651-4

Can you

- Take care of yourself (dressing, bathing, toilet)?
- Walk indoors, 1-2 blocks, up a hill?
- Run a short distance, do light housework?
- Do moderate or heavy housework?
- Do yardwork, have sexual relations?
- Engage in moderate or strenuous sports?

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Severity of Angina

Canadian Cardiovascular Society Website: www.ccs.ca

- Grade I: vigorous exercise (> 10 METS)
- Grade II: moderate exercise (4 -10 METS)
- Grade III: minimal exercise (1- 3 METS)
- Grade IV (unstable):
 - new onset, at rest or during sleep
 - increasing in intensity
- Subendocardial ischemia
 - new onset dyspnea with non-Q wave MI



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A Caveat

- Myocardial ischemia can present as acute dyspnea:
 - left ventricular diastolic stiffness
 - elevated left atrial pressure
 - acute pulmonary congestion/edema
- (remember the definition of subendocardial ischemia?)

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Absence of Angina ("Silent Ischemia")

- Subclinical disease
- Restricted activity (PVD)
- Autonomic neuropathy
 - diabetes, CKD
 - marker is peripheral neuropathy
- Transplanted (denervated) heart

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Electrocardiogram (ECG)

- Resting ECG: variable risk assessment
 - bradycardia, heart block, arrhythmias
 - previous MI
- Induction of myocardial ischemia: **stress**
 - increased myocardial O_2 demand (VO_2) in the face of fixed supply
 - exercise ECG: 33% false negative
 - single vessel CAD: 50% false negative

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Stress Testing



- Increased myocardial O_2 demand
 - exercise ECG
 - dobutamine stress echo
- Decreased myocardial O_2 supply (*coronary steal*)
 - dipyridamole-thallium scan
 - adenosine-thallium scan

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Exercise Stress Testing: Prediction of Diffuse or Left Main Disease

Lee TH, Boucher CA. New Engl J Med 2001; 344: 1840-5

- Ischemia at low exercise intensity
 - (< 4 METS)
- Hypotension during exercise
- Diffuse ST changes during exercise
- Persistent angina after cessation



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Limitations of Exercise ECG

Lee TH, Boucher CA. New Engl J Med 2001; 344: 1840-5

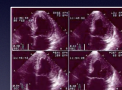
- Left bundle branch block (LBBB)
- Ventricular pacing
- Pre-excitation syndromes (WPW)
- ST depression > 1 mm at rest
- Exercise restriction (e.g. PVD)



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Dobutamine Stress Echo (DSE)

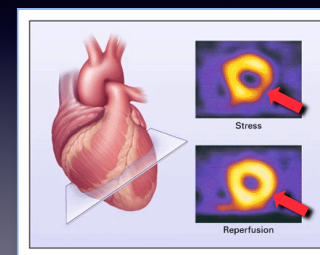
- Simple, reproducible, no radioactive tracer
 - high dose dobutamine + atropine + contrast
- Baseline ejection fraction (EF)
 - decreased EF during DSE:
 - diffuse disease
- New or worsened wall motion abnormality
 - risk increases with low threshold, extent of WMA
- Assess ischemic heart rate threshold



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Thallium-Dipyridamole Scan

Lee TH, Boucher CA. New Engl J Med 2001; 344: 1840-5



reversible
cardiac
ischemia

- Risk increases with size of defect
- Strong negative predictive value

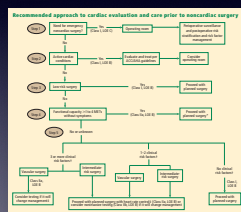
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Risk Evaluation and Care Strategy

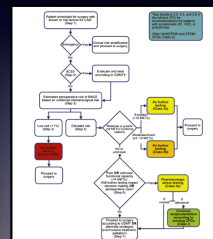
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ACC/AHA Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)



2009



2014

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Cardiac Risk of Non-Cardiac Surgery

ACC/AHA Task Force on Practice Guidelines. Circulation 2009; 120: e169-276

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Cardiac Evaluation and Care Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

Patient with CAD or risk factors

Step 1

Emergency Surgery?

If YES: Proceed to OR, with surveillance
If NO, go to Step 2

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Cardiac Evaluation and Care Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

Step 2

Active Cardiac Syndromes?

- Unstable coronary syndromes
- Advanced decompensated heart failure
- Heart block or arrhythmias
- Symptomatic aortic or mitral stenosis

If YES: Evaluate and treat appropriately
If NO, go to Step 3

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Cardiac Evaluation and Care Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

Step 3

Estimate Perioperative Risk

Revised Cardiac Risk Index (RCRI)
American College of Surgery (ACS)
Risk Nomograms

If LOW: Proceed to surgery (Step 4)
If HIGH, go to Step 5

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Cardiac Evaluation and Care Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

Step 5

≥ 4 METS without symptoms?

- Climb a flight of stairs
- Run a short distance
- Heavy housework, golf
- Swimming, singles tennis, skiing

If YES: Proceed to surgery
If no, or unknown, go to Step 6

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Cardiac Evaluation and Care Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

Step 6

Will further testing impact
decision-making or
perioperative care?

If NO:
Proceed to surgery or non-invasive treatment
If YES:
Pharmacologic stress testing

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Cardiac Evaluation and Care Algorithm

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

Step 7

Pharmacologic Stress Test

If NORMAL:
Proceed to surgery or non-invasive treatment
If ABNORMAL:
Coronary revascularization

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Can We Decrease Risk Preoperatively?

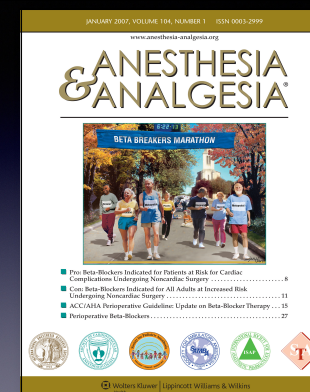
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Guideline-Directed Medical Therapy (GDMT)

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- Lifestyle modification
 - diet, exercise, weight loss
- Drug-based therapies
 - aspirin, statin, beta-blockade
- Device-based therapies
 - percutaneous coronary intervention (PCI)

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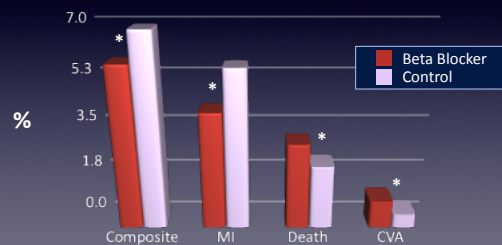


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POISE: PeriOperative ISchemia Evaluation Trial

Devereaux PJ et al, Lancet 2008; 371: 1839-47

Metoprolol 200 mg preop;
n = 8,531



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Perioperative Beta Blockade

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

- Continue chronic beta blocker therapy
- RCRI ≥ 3 : Initiate preoperative beta blockade
 - Do NOT start beta blockade ≤ 1 day preop
 - Ideal is 2-7 days before surgery
- RCRI < 3 : Initiate postoperative beta blockade
- Utilize IV beta blockade as clinically indicated

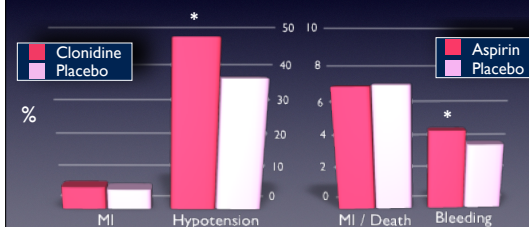
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Poise-2 Trial

Devereaux PJ et al, NEJM 2014; 370: 1494-1513

Clonidine 0.2 mg preop;
0.2 mg/d x 72 hr. n = 10,010

Aspirin 200 mg preop;
100 mg/d 7-30 d. n = 10,010



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What Does the Evidence Tell Us?

One size does not fit all!

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Preoperative Coronary Revascularization

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Preoperative CABG or PCI*: Level 1A Recommendations

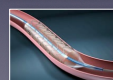
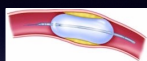
ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)

- Left main disease
- Stable angina, 3-vessel disease
 - especially if EF $< 50\%$
- Stable angina, 2-vessel disease, proximal LAD
 - EF $< 50\%$ or ischemia on non-invasive testing
- High-risk unstable angina, NSTEMI*
- Acute STEMI*

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Percutaneous Coronary Intervention (PCI)

- Percutaneous transluminal coronary angioplasty (PTCA)
- Bare metal stent (BMS)
- Drug-eluting stent (DES)
 - sirolimus, paclitaxel, everolimus



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PCI and Timing of Surgery

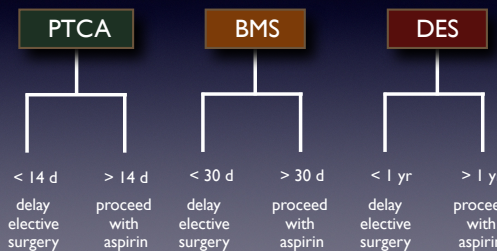
Kaluza et al. J Amer Coll Cardiol 2000; 35: 1288-94

- PCI: dual antiplatelet therapy (DAPT)
 - clopidogrel
 - aspirin
- If continued within 3-5 days preop
 - increased risk of surgical bleeding
- If held more than 3-5 days preop
 - increased risk of stent thrombosis

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PCI and Timing of Surgery

ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. JACC 2014; 64 (22)



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Summary (What You Should Know)

- MACE
- Active cardiac syndromes
- Revised Cardiac Risk Index
- Estimated energy requirements (METS)
- Non-invasive cardiac testing
- Cardiac risk of non-cardiac surgery
- ACC/AHA Cardiac Care Algorithm
- Implications of PCI
- POISE 1 and 2



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Totsiens!

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