



# Preoperative Evaluation

## 2007 ACC/AHA Guidelines

Maj Cina, M.D.



# Preoperative Evaluation

- Overview
- History
- Exam
- Management of Comorbidities
- Algorithm
- Stress Tests and Troponins
- Beta Blockers and Other Medications
- Examples



# General Statement

- Not “cardiac clearance” or “cleared for OR”
- Risk assessment to guide treatment
- These are guidelines: don’t ignore logic and judgment
- Don’t order a test if it won’t change your decision-making



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- Not “cardiac clearance” or “cleared for OR”
- Risk assessment to guide treatment
- These are guidelines: don’t ignore logic and judgment
- **Don’t order a test if it won’t change your decision-making**



# The Rationale

- Perioperative MI has mortality of 40%-70% (limitations on Rx postop)



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- Risk of MI may be as high as 10% for some types of surgeries
- Diagnosis of active ischemia before surgery may prevent perioperative MI



# In Practice . . .

- **Cardiology consultants**
  - 40% of consultations recommended:
    - “Proceed with case”
    - “Cleared for surgery”
    - or “Continue current medications”
- **Medical consultants**
  - 42.5% left no recommendations
  - In only 3.4% was a new finding unveiled



# Guidelines and Cost

- Cost analysis after guidelines implemented (compared to previous)  
*J Vasc Surg.* 2002;36:758–63
  - Less stress testing (88% vs. 47%)
  - Less catheterization (24% vs. 11%)
  - Less PTCA/PCI (24% vs. 2%)
  - Lower cost per preop (\$1,087 vs. \$171)
  - Less periop death/MI (11% vs. 4%)



# History

- Active Cardiac Conditions
  - Severe angina (CCS class III/IV) or recent MI (<1 month)
  - Decompensated (NYHA class IV) or new heart failure
  - Significant arrhythmias\*
  - Severe valve disease\*
- All of these should be addressed before elective noncardiac surgeries



# “Significant Arrhythmias”

- High grade AV block (Mobitz II or third-degree)
- Symptomatic ventricular arrhythmias
- SVTs (including afib, HR > 100 at rest)
- Symptomatic bradycardia
- New diagnosis of v-tach



# “Severe Valve Disease”

- Severe AS: 10% periop mortality
  - Mean pressure gradient  $>40$
  - AV area  $<1.0 \text{ cm}^2$
  
- Symptomatic MS



# History

- ICD/pacer presence
- Orthostatic intolerance
- Modifiable CHD risk factors
- Co-morbidities  
(PAD, CVA, DM2, CKD, COPD)
- Functional capacity
  - Correlates with max O<sub>2</sub> uptake by treadmill testing



# Functional Capacity

1 MET



4 METs

Can you take care of yourself?  
Eat, dress, or use the toilet?  
Walk indoors around the house?  
Walk a block or two on level ground  
at 2 to 3 mph or 3.2 to 4.8 km per h?

Do light work around the house like  
dusting or washing dishes?

4 METs



Greater than 10 METs

Climb a flight of stairs or walk up a hill?  
Walk on level ground at 4 mph or 6.4 km per h?  
Run a short distance?

Do heavy work around the house like scrubbing floors  
or lifting or moving heavy furniture?

Participate in moderate recreational activities like golf,  
bowling, dancing, doubles tennis, or throwing a  
baseball or football?

Participate in strenuous sports like swimming, singles  
tennis, football, basketball, or skiing?



# Physical Exam

- **Chronic HF**
  - JVD/HJR more sensitive than edema/pulm exam/CXR



# Physical Exam

- **Chronic HF**
  - JVD/HJR more sensitive than edema/pulm exam/CXR
  
- **Carotid bruits**
  - Presume CAD



# Physical Exam

- **Chronic HF**
  - JVD/HJR more sensitive than edema/pulm exam/CXR
- **Carotid bruits**
  - Presume CAD
- **Murmurs**
  - Don't forget about endocarditis risk



# Hypertension

- Stage 1 or 2 HTN ( $<180/110$ ) is not an independent risk factor for periop cardiac events
  - As evidenced by at least six studies
- Stage 3 HTN (BP  $\geq 180/110$ ) should be treated before OR
  - Acute treatment may be as effective as delaying surgery and treating slowly
    - *J Clin Anesth.* 2003;15:179–83



# Hypertension

- Hypertensive patients more likely than non-hypertensives to have intraop *hypotension*
- Withdrawal of anti-hypertensives is not recommended (especially beta blockers and clonidine)
  - Equivocal data on ACE-inh and ARB medications (optionally hold these on morning of surgery)



# Pulmonary Disease

- Consider preop chest x-ray if:
  - Smoker
  - Recent URI
  - COPD diagnosis
  - Cardiac disease
  
- Evidence is not strong!



# Diabetes

- CABG patients on insulin drip had less postoperative wound infections than standard care patients
  - *Ann Thorac Surg*, 1999;67:352–60
- This is suggested, but less well established for noncardiac surgery
  - *J.Parenter Enteral Nutr.* 1998;22:77–81



# CKD

- Patients  $>70$  undergoing CABG have much greater risk for needing chronic postop HD if  $Cr > 2.6$ 
  - *J Thorac Cardiovasc Surg.* 1989;98:1107–12
- $Cr > 2$  is independent risk factor for periop cardiac complication in noncardiac surgery
  - *Circulation.* 1999;100:1043–9



# Anemia

- Hct<28% increases risk of periop ischemia & postop complications in prostate and vascular surgeries
  - *Crit Care Med.* 1993;21:860–6
  - *Transfusion.* 1998;38:924–31
  - *Eur Urol.* 1997;31:199–203



# Preop ECG

- May be helpful unless patient is asymptomatic and undergoing low-risk procedure
- LVH, pathologic Qs, and ST depression linked to increased periop cardiac events
- Probably no need to repeat if done in last 30 days



# The Algorithm

Step-Wise Approach

Boiled Down Version



# Step-Wise Approach

- **Step 1: Emergent Surgery?**
  - If so, proceed to OR



# Step-Wise Approach

- **Step 1: Emergent Surgery?**
  - If so, proceed to OR
- **Step 2: Active Cardiac Condition?**
  - If so, address before elective noncardiac surgeries (I-B)



# Active Cardiac Conditions

- Severe angina (CCS class III/IV) or recent MI (<1 month)
- Decompensated (NYHA class IV) or new heart failure
- Significant arrhythmias  
(high grade AVB, symptomatic ventricular, SVT, afib/RVR, symptomatic bradycardia, new VT)
- Severe valve disease  
(severe AS, symptomatic MS)



# Step-Wise Approach

- **Step 1: Emergent Surgery?**
  - If so, proceed to OR
- **Step 2: Active Cardiac Condition?**
  - If so, address before elective noncardiac surgeries (I-B)
- **Step 3: Low Risk Surgery?**
  - If so, proceed to OR (class III-C)



# Low Risk Surgery

- Cardiac risk <1%
- Endoscopy
- Superficial procedures
- Cataract surgery
- Breast surgery
- Ambulatory surgery



# Step-Wise Approach

- **Step 1: Emergent Surgery?**
  - If so, proceed to OR
- **Step 2: Active Cardiac Condition?**
  - If so, address before elective noncardiac surgeries (I-B)
- **Step 3: Low Risk Surgery?**
  - If so, proceed to OR (III-C)
- **Step 4:  $\geq 4$  METs activity tolerance?**
  - If so, proceed to OR



# Activity Tolerance

- Risk higher if pt can't meet 4 METs
  - *Arch Intern Med.* 1999;159:2185–92
- Examples of 4 METs:
  - Slow ballroom dancing
  - Golfing with a cart
  - Playing a musical instrument
  - Walking at 2-3 MPH
  - Climbing a flight of stairs
  - Dusting or washing dishes



# Step-Wise Approach

- **Step 5: Any Clinical Risk Factors?**
  - If no, proceed to OR (III-C)



# Clinical Risk Factors

- Shown to increase periop risk of death or cardiac events
- **h/o ischemic heart disease**
- **h/o compensated or prior HF**
- **h/o CVA**
- **DM (especially insulin-requiring)**
- **CKD (Cr > 2)**



# Step-Wise Approach

- **Step 5: Any Clinical Risk Factors?**
  - If no, proceed to OR (III-C)
  - If  $\geq 3$  risks and planned vascular surgery, consider stress test if it might change management (IIa-B)



# Vascular Surgery

- Cardiac risk >5%
  - Coincidence with CAD risk factors
  - PAD limits symptoms of CAD
  - Large intravascular volume fluctuation
- Aortic and other major vascular surgery (non-endovascular)
- Peripheral vascular surgery



# Step-Wise Approach

- **Step 5: Any Clinical Risk Factors?**
  - If no, proceed to OR (III-C)
  - If  $\geq 3$  risks and planned vascular surgery, consider stress test if it might change management (IIa-B)
  - If  $\geq 3$  risks and intermediate risk surgery *or* 1-2 risks and vascular or intermediate risk surgery, unclear if stress test needed (IIb-B)



# Intermediate Risk Surgery

- Cardiac risk 1-5%
- Intraperitoneal & intrathoracic
- Endovascular AAA repair
- CEA
- Head/neck
- Orthopedic
- Prostate



# 1-2 Clinical Risk Factors

- Two RCTs in vascular surgery patients with 1-2 risk factors showed no outcome difference between stress test group vs. only optimal medical management group
  - *J Cardiothorac Vasc Anesth.* 2003;17:694–8
  - *J Am Coll Cardiol.* 2006;48:964 –9



# Step-Wise Approach

- **Step 5: Any Clinical Risk Factors?**
  - If no, proceed to OR (III-C)
  - If  $\geq 3$  risks and planned vascular surgery, consider stress test if it might change management (IIa-B)
  - If  $\geq 3$  risks and intermediate risk surgery *or* 1-2 risks and vascular or intermediate risk surgery, unclear if stress test needed (IIb-B)



# Algorithm: Boiled Down

- If emergent surgery, go to OR
- If active cardiac issue, address it 1<sup>st</sup>
- If patient needs a stress independent of surgery, get a stress test
- Stress if all of the following:
  - Vascular surgery
  - Poor exercise tolerance (<4 METs)
  - 3+ risk factors (CAD, HF, CVA, DM, CKD)



# Stress Test: Changing Management

- Abnormal stress test leading to coronary angiogram +/- PCI/CABG
- Abnormal stress test changing decision to operate at all
  - 4-5 cm AAA
  - Symptomatic PAD



# Which Stress Test?

- If normal baseline ECG, exercise ECG
  - Even safe if AAA (fear of rupture)
    - *Ann Intern Med.* 1998;129:628 –31
- If abnormal baseline ECG:
  - LBBB: not exercise (do DSE or pharmacologic/nuclear imaging)
  - Others: exercise unless impossible



# Pharmacologic Stress: Contraindications

- **Adenosine**
  - Bronchospasm
  - Critical carotid stenosis
  - Active theophylline use
- **Dobutamine**
  - Serious arrhythmias
  - Severe hypertension



# Postop: troponin?

- Unclear if helpful routinely in asymptomatic, clinically stable patients from vascular or intermediate risk surgery (IIb-C)
- Not indicated if asymptomatic, clinically stable from low risk surgery (III-C)



# Postop: troponin?

- Unclear if helpful routinely in asymptomatic, clinically stable patients from vascular or intermediate risk surgery (IIb-C)
- Not indicated if asymptomatic, clinically stable from low risk surgery (III-C)



# Perioperative Beta Blocker

- Who should get it?
  - Those already on it (I-B to I-C)
  - Vascular surgery with one or more clinical risk factors (IIa-B)
  - Intermediate risk surgery with two or more clinical risk factors (IIa-B)
  - Vascular surgery with no clinical risk factors (IIb-B)
  - Intermediate risk surgery with one clinical risk factor (IIb-C)



# Perioperative Beta Blocker

- Who should get it?
  - Those already on it (I-B to I-C)
  - Vascular surgery with one or more clinical risk factors (IIa-B)
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  - Vascular surgery with no clinical risk factors (IIb-B)
  - Intermediate risk surgery with one clinical risk factor (IIb-C)



# How and Why

- Earlier the better, if possible (i.e., days to weeks before surgery)
- Titrate to resting HR of 60
- Reduces intraop ischemia and BP fluctuation
  - As evidenced by six separate studies
- Reduces postop afib
  - *J Cardiothorac Vasc Anesth.* 1997;11:746–51



# Which Beta Blocker?

- Least evidence for short-acting agents, including short-acting metoprolol!
  - *BMJ*. 2005;331:932
  - *BMJ*. 2006;332:1482



# Statins

- If on it before OR, continue it (I-B)
- If vascular surgery and no clinical risk factors, start it (IIa-B)



# Clonidine (and mivazerol)

- If any clinical risk factors, alpha agonists may be considered to treat periop hypertension (I Ib-B)



# Recap

Active Cardiac Issues

Clinical Risk Factors

Boiled-Down Algorithm

Perioperative Beta Blockers



# Active Cardiac Conditions

- Severe angina (CCS class III/IV) or recent MI (<1 month)
- Decompensated (NYHA class IV) or new heart failure
- Significant arrhythmias  
(high grade AVB, symptomatic ventricular, SVT, afib/RVR, symptomatic bradycardia, new VT)
- Severe valve disease  
(severe AS, symptomatic MS)



# Clinical Risk Factors

- h/o ischemic heart disease
- h/o compensated or prior HF
- h/o CVA
- DM (especially insulin-requiring)
- CKD (Cr>2)



# Algorithm: Boiled Down

- If emergent surgery, go to OR
- If active cardiac issue, address it 1<sup>st</sup>
- If patient needs a stress independent of surgery, get a stress test
- Stress if all of the following:
  - Vascular surgery
  - Poor exercise tolerance (<4 METS)
  - 3+ risk factors (CAD, HF, CVA, DM, CKD)



# Perioperative Beta Blocker

- Who should get it?
  - Those already on it (I-B to I-C)
  - Vascular surgery with one or more clinical risk factors (IIa-B)
  - Intermediate risk surgery with two or more clinical risk factors (IIa-B)



# Examples

Apply Algorithm

Recommend Beta Blocker if Indicated



# Examples

- 85 year old woman with CHF class III, known CAD, COPD, DM2 admitted with ruptured aortic aneurysm



# Examples

- 85 year old woman with CHF class III, known CAD, COPD, DM2 admitted with ruptured aortic aneurysm
  - Emergency → OR



# Examples

- 85 year old woman with CHF class III, known CAD, COPD, DM2 admitted with ruptured aortic aneurysm
  - Emergency → OR
  - Beta blocker contraindicated (active bleed, presumed hypotension)



# Examples

- 49 year old man with CAD s/p PCI 3 years ago, doing well, planned for knee surgery



# Examples

- 49 year old man with CAD s/p PCI 3 years ago, doing well, planned for knee surgery
  - Not vascular surgery → OR



# Examples

- 49 year old man with CAD s/p PCI 3 years ago, doing well, planned for knee surgery
  - Not vascular surgery → OR
  - Should already be on beta blocker (h/o CAD), and if so continue it



# Examples

- 52 year old Veteran with stable angina, EF 30%, DM2, HTN preop for fem-pop bypass because his claudication limits him to ½ city block



# Examples

- 52 year old Veteran with stable angina, EF 30%, DM2, HTN preop for fem-pop bypass because his claudication limits him to ½ city block
  - Vascular surgery
  - <4 METs activity tolerance
  - 3 clinical risk factors
  - Therefore, stress test



# Examples

- 52 year old Veteran with stable angina, EF 30%, DM2, HTN preop for fem-pop bypass because his claudication limits him to ½ city block
  - Even if stress is negative, needs beta blocker (vascular surgery + clinical risk factors)



# Examples

- 67 year old woman admitted for CHF, also needs urgent repair of cerebral aneurysm



# Examples

- 67 year old woman admitted for CHF, also needs urgent repair of cerebral aneurysm
  - Treat CHF first (active cardiac condition)
  - Thereafter, if nothing else in history, exam, labs, and ECG suggests active ischemia, proceed to OR



# Examples

- 67 year old woman admitted for CHF, also needs urgent repair of cerebral aneurysm
  - Treat CHF first (active cardiac condition)
  - Thereafter, if nothing else in history, exam, labs, and ECG suggests active ischemia, proceed to OR
  - Beta blockers indicated for CHF long-term, but may hold off until after OR



# Examples

- 42 year old man admitted with classic, new onset angina, found to have large mediastinal mass with need for thoracoscopic surgery to biopsy



# Examples

- 42 year old man admitted with classic, new onset angina, found to have large mediastinal mass with need for thoracoscopic surgery to biopsy
  - Stress test (or maybe even cath) indicated even if no surgery planned



# Examples

- 42 year old man admitted with classic, new onset angina, found to have large mediastinal mass with need for thoracoscopic surgery to biopsy
  - Stress test (or maybe even cath) indicated even if no surgery planned
  - If w/u shows no CAD, no need for beta blocker



# Examples

- 50 year old man s/p NSTEMI in CCU 2 weeks ago, no PCI/CABG, still in hospital, now seen by vascular surgery for ischemic foot/dry gangrene with need for peripheral revascularization



# Examples

- 50 year old man s/p NSTEMI in CCU 2 weeks ago, no PCI/CABG, still in hospital, now seen by vascular surgery for ischemic foot/dry gangrene with need for peripheral revascularization
  - If not emergent, consider waiting until 30 days post-MI before OR



# Examples

- 50 year old man s/p NSTEMI in CCU 2 weeks ago, no PCI/CABG, still in hospital, now seen by vascular surgery for ischemic foot/dry gangrene with need for peripheral revascularization
  - If not emergent, consider waiting until 30 days post-MI before OR
  - Needs beta blocker (vascular surgery + clinical risk factor)



# Examples

- 70 year old woman planned for breast surgery telling you that for the past 3 months, she has been getting substernal pressure whenever she walks a city block, relieved by rest



# Examples

- 70 year old woman planned for breast surgery telling you that for the past 3 months, she has been getting substernal pressure whenever she walks a city block, relieved by rest
  - Stress test (or maybe even cath) indicated even if no surgery planned



# Examples

- 70 year old woman planned for breast surgery telling you that for the past 3 months, she has been getting substernal pressure whenever she walks a city block, relieved by rest
  - Stress test (or maybe even cath) indicated even if no surgery planned
  - No beta blocker needed for OR (low risk surgery)



# Examples

- 72 year old woman with severe AS by echo, deemed not a surgical candidate for its repair, preop for ventral hernia repair



# Examples

- 72 year old woman with severe AS by echo, deemed not a surgical candidate for its repair, preop for ventral hernia repair
  - Cancel surgery (10% mortality)
  - If hernia strangulates, emergent surgery



# Examples

- 62 year old diabetic man admitted with cellulitis, found to be in afib with HR 130, planned for foot debridement



# Examples

- 62 year old diabetic man admitted with cellulitis, found to be in afib with HR 130, planned for foot debridement
  - Afib/RVR is an active cardiac issue and should be rate-controlled before OR
  - Afterward, if no ischemia, OR (not vascular surgery)



# Examples

- 62 year old diabetic man admitted with cellulitis, found to be in afib with HR 130, planned for foot debridement
  - Afib/RVR is an active cardiac issue and should be rate-controlled before OR
  - Afterward, if no ischemia, OR (not vascular surgery)
  - Beta blocker indicated for afib rate control



# Examples

- 56 year old woman with HTN, DM2, chronic R side weakness, walks slowly with walker, history of “weak heart,” preop for L side CEA



# Examples

- 56 year old woman with HTN, DM2, chronic R side weakness, walks slowly with walker, history of “weak heart,” preop for L side CEA
  - Vascular surgery
  - <4 METs activity tolerance
  - 3 clinical risk factors (DM2, CVA, HF)



# Examples

- 56 year old woman with HTN, DM2, chronic R side weakness, walks slowly with walker, history of “weak heart,” preop for L side CEA
  - Vascular surgery
  - <4 METs activity tolerance
  - 3 clinical risk factors (DM2, CVA, HF)
  - . . . but CEA is intermediate risk surgery!  
→ OR



# Examples

- 56 year old woman with HTN, DM2, chronic R side weakness, walks slowly with walker, history of “weak heart,” preop for L side CEA
  - Needs beta blocker (intermediate risk surgery + 2 or more clinical risk factors; also indicated for CHF chronically)



# Examples

- 41 year old man with CKD (5.6), HTN, works as mechanic, planned for renal transplant



# Examples

- 41 year old man with CKD (5.6), HTN, works as mechanic, planned for renal transplant
  - Vascular surgery, but less than 3 clinical risk factors and good exercise tolerance  
→ OR per guidelines



# Examples

- 41 year old man with CKD (5.6), HTN, works as mechanic, planned for renal transplant
  - Vascular surgery, but less than 3 clinical risk factors and good exercise tolerance  
→ OR per guidelines
  - However, many transplant centers routinely cath patients before any transplantation (high cost or surgery)



# Examples

- 41 year old man with CKD (5.6), HTN, works as mechanic, planned for renal transplant
  - Vascular surgery, but less than 3 clinical risk factors and good exercise tolerance  
→ OR per guidelines
  - Needs beta blocker (vascular surgery + clinical risk factor)



# Examples

- 62 year old woman with DM2, HTN, compensated HF, CKD (2.4) planned for knee surgery



# Examples

- 62 year old woman with DM2, HTN, compensated HF, CKD (2.4) planned for knee surgery
  - Not vascular surgery → OR



# Examples

- 62 year old woman with DM2, HTN, compensated HF, CKD (2.4) planned for knee surgery
  - Not vascular surgery → OR
  - Needs beta blocker (intermediate risk surgery + 2 or more clinical risk factors)



# Examples

- 70 year old man with CAD, stable angina with ~7 mets, planned for cholecystectomy; Mobitz II on ECG



# Examples

- 70 year old man with CAD, stable angina with  $\sim 7$  mets, planned for cholecystectomy; Mobitz II on ECG
  - Active cardiac issue: install pacemaker before elective surgery
  - Not vascular surgery  $\rightarrow$  no need for stress before OR



# Examples

- 70 year old man with CAD, stable angina with  $\sim 7$  mets, planned for cholecystectomy; Mobitz II on ECG
  - Active cardiac issue: install pacemaker before elective surgery
  - Not vascular surgery  $\rightarrow$  no need for stress before OR
  - After pacemaker, should be on beta blocker (CAD history)



# Examples

- 80 year old woman, severe knee arthritis, h/o MI many years ago, planned for 5 cm AAA repair



# Examples

- 80 year old woman, severe knee arthritis, h/o MI many years ago, planned for 5 cm AAA repair
  - Vascular surgery
  - <4 METs exercise tolerance
  - Only one clinical risk factor
  - Proceed to OR (maybe do endovascular) with beta blocker (vascular surgery + clinical risk factor)



# Examples

- 80 year old woman, severe knee arthritis, h/o MI many years ago, planned for 5 cm AAA repair
  - *or* don't operate at all (advanced age!)



# Examples

- 66 year old veteran with CAD, COPD, HTN, DM2, CKD (3.0), PAD, prostate CA planned for EGD/colonoscopy



# Examples

- 66 year old veteran with CAD, COPD, HTN, DM2, CKD (3.0), PAD, prostate CA planned for EGD/colonoscopy
  - Not vascular surgery → OR



# Examples

- 66 year old veteran with CAD, COPD, HTN, DM2, CKD (3.0), PAD, prostate CA planned for EGD/colonoscopy
  - Not vascular surgery → OR
  - Should already be on beta blocker (h/o CAD), and if so continue it, but not needed for this OR (low risk surgery)