Update on Perioperative Medicine
for the Office-based Practitioner

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Update on Perioperative Medicine
Predicting & Preventing Cardiac Complications:
• Clinical Prediction Tools
• Noninvasive Stress Testing
• Coronary Revascularization
• Beta-blockers
Other Updates & Advances:
• Endocarditis prophylaxis
• BNP for risk stratification
• Perioperative use of statins

Question 1: Clinical Risk Prediction

A 73 y.o. man will undergo open repair of a 6-cm abdominal aortic aneurysm. He has no cardiac history, but has long-standing diabetes & HTN.
Meds: lovastatin, atenolol, glyburide, benazepril, ASA
PEx: BP=115 / 70 HR=60; normal heart & lung exam
ECG: NSR, LVH, otherwise normal

How would you clinically assess this patient’s risk for cardiac complications?

73 y.o. man s/f repair of AAA. No cardiac history, but has long-standing diabetes & HTN. ECG: LVH only

How would you assess this patient’s risk of cardiac complications?

1. Assess risk with the Original (Goldman) Risk Index
2. Assess risk with the Revised (Lee) Risk Index
3. Assess risk with other risk index (Eagle, Detsky, etc.)
4. Risk index? We don’t need no stinking risk index!
Original Cardiac Risk Index

- Myocardial infarction in past 6 months: 10
- Age > 70 years: 5
- S 3 or jugular venous distention: 11
- Significant aortic stenosis: 3
- Rhythm other than sinus on last ECG: 7
- > 5 PVCs / min at any time: 7
- Poor medical status: 3
- Thoracic, abdominal, aortic surgery: 3
- Emergency surgery: 4

Risk Class | Points | CV Complic. | CV Death
--- | --- | --- | ---
I | 0 - 5 | 0.7% | 0.2%
II | 6 - 12 | 5% | 2%
III | 13 - 25 | 12% | 2%
IV | > 25 | 22% | 56%

Revised Cardiac Risk Index

Predictors:
- Higher risk operation*
- Ischemic heart disease
- Congestive heart failure
- Diabetes requiring insulin
- Creatinine > 2 mg/dL
- Stroke or TIA

Predictors | Complications**
--- | ---
0 | 0.5%
1 | 1.3%
2 | 4%
3 or more | 9%

* Defined as intraperitoneal, intrathoracic, or suprainguinal vascular surgery
** Defined as MI, pulmonary edema, cardiac arrest, complete heart block

How Good Are Prediction Rules?

Receiver Operating Characteristic (ROC) Curves

Illustrates trade-off between sensitivity & specificity
- Useless rule: AUC = 0.5
- "Perfect" rule: AUC ~ 1

1998 patients undergoing carotid endarterectomy
- 4% had cardiac complication

Goldman Index: .58
Revised (Lee) Index: .61
ASA Classification: .59
Halm CEA-specific: .62

Press et al., Arch Int Med, 2006
Question 2: Utility of Stress Testing

A 73 y.o. man will undergo open repair of a 6-cm abdominal aortic aneurysm. He has no cardiac history, but has long-standing diabetes & HTN.

Meds: lovastatin, atenolol, glyburide, benazepril, ASA
PEx: BP=115 / 70 HR=60; normal heart & lung exam
ECG: NSR, LVH, otherwise normal

Should this patient receive further preoperative tests?

Noninvasive Stress Testing

Predictive value:
- Mainly studied in vascular surgery patients
- Strong negative predictive value ~ 98% (neg LR = 0.1 - 0.2)
- Weak positive predictive value ~10 - 20% (pos LR = 2 - 3)
- Adds little information to lower risk patients
- More useful for cases with increased risk

73 y.o. man s/f repair of AAA. No cardiac history, but has long-standing diabetes & HTN. ECG: LVH only

Should this patient receive further preoperative tests?

1. Go to O.R. without further testing
2. Noninvasive stress test prior to surgery
3. Check B-type natriuretic peptide (BNP)

770 vascular patients with 1 or 2 of following:
- Age > 70, MI, angina, CHF, DM, stroke / TIA, Cr > 1.8

No stress test (n = 384)
- 352 with no or limited ischemia
- 34 with extensive ischemia (9%)
  - 12 had PCI or CABG
- 30-day CV Death or MI 1.8%

Stress test (n = 386)
- 27% 60%
- 13%
- 2.3% 15%
- 1.1%
2007 ACC/AHA Guideline

Good Functional Capacity?
- yes: Go to OR
- no or ?
  - no predictors*: Go to OR
  - 1 or 2 predictors
    - no: Vascular surgery?
      - yes: Control HR & go to OR
      - no: Consider stress test if results will change management
  - ≥ 3 predictors

* CAD, CHF, DM, CKD, CVA/TIA

Question 3: Revascularization

A 73 y.o. diabetic patient is scheduled for abdominal aortic aneurysm repair. A preoperative dobutamine stress echo reveals ischemic potential in 5 of 16 wall segments. He has no cardiac symptoms.

Meds: lovastatin, atenolol, glyburide, benazepril, ASA
PEx: BP=115 / 70 HR=60; normal CV & lung exam

What do you recommend to the patient & surgeon?

A 73 y.o. diabetic patient is s/f AAA repair. Dobutamine stress echo shows ischemia in 5 of 16 wall segments. Atenolol is at the maximum tolerated dose.

1. Go to O.R. without further intervention
2. Coronary angiogram, followed by CABG
3. Coronary angiogram, followed by PCI
4. Advise cancellation of planned operation

CARP Trial: Coronary Artery Revascularization Prophylaxis

510 patients undergoing vascular surgery
- At least 1 vessel with 70% occlusion
- Excluded left main dz, AS, or LVEF < 20%

Choice of CABG or PCI plus Medical management

Medical management alone

1°Endpoint: Long-term mortality
2°Endpoint: MI, Stroke, Limb loss, Dialysis

McFalls, et al. NEJM, 2004
**Short-term Outcomes**

<table>
<thead>
<tr>
<th>CABG or PCI</th>
<th>Med Mgt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients randomized</td>
<td>258</td>
</tr>
<tr>
<td>Died before vascular surgery</td>
<td>3.8%</td>
</tr>
<tr>
<td>Died &lt; 30 d after vascular surgery</td>
<td>3.1%</td>
</tr>
<tr>
<td>Postoperative MI</td>
<td>12%</td>
</tr>
</tbody>
</table>

*McFalls, et al. NEJM, 2004*

**Long-term Postoperative Survival**

![Graph showing long-term postoperative survival with and without revascularization.]

*McFalls, et al. NEJM, 2004*

**Cardiac Complications in Vascular Surgery**

*Patients with Dobutamine-induced Ischemia*

- 30% 36%
- 40% 33%
- 30% 33%
- 20% 6%
- 10% 2%
- 0% 0%

**Preoperative Revascularization in High-Risk Patients** (DECREASE-V pilot)

- 101 patients undergoing vascular surgery, all with:
  - ≥ 3 risk predictors for cardiac complications &
  - Extensive ischemia on DSE or P-Mibi

1. Coronary angiogram
2. CABG or PCI
3. Medical Management

**Medical management alone (no angiogram)**

- Endpoint: Cardiac Death or Nonfatal MI

*Boersma, JAMA 2001*

*Boersma, et al. JACC, 2007*
Preoperative Revascularization in High-Risk Patients

Beware of Coronary Stents

ACC/AHA Guidelines for PCI

Question 4: Beta-blockers

A 65 y.o. woman with diabetes and HTN will undergo total knee arthroplasty. Denies cardiac history or symptoms. She is not on a beta-blocker. Her examination and ECG are unremarkable.

1. Definitely start β-blocker
2. Probably start β-blocker
3. Probably avoid β-blocker
4. Definitely avoid β-blocker
**Trial of Perioperative β-blocker in Vascular Surgery Patients with Ischemia**

- 111 patients undergoing vascular surgery
  - *All had ischemia on dobutamine echo*

- **Bisoprolol** (1 week preop until 30 days postop)
  - **Standard Care**

- Patients followed for 30 days after surgery:
  - Serial ECG and cardiac enzymes
  - **Endpoints:** Cardiac mortality & Nonfatal MI

**Effect of Bisoprolol on Cardiac Mortality and Nonfatal MI after Vascular Surgery**

<table>
<thead>
<tr>
<th>Days after Surgery</th>
<th>Standard Care</th>
<th>Bisoprolol</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>21</td>
</tr>
<tr>
<td>28</td>
<td>40</td>
<td>28</td>
</tr>
</tbody>
</table>

**Casting Doubt on β-blockers**

Metoprolol after Vascular Surgery (MaVS):

- 496 vascular patients not previously on β-blocker
- Metoprolol or placebo started immediately before surgery, continued for maximum 5 days
- No difference in fatal or nonfatal cardiac outcomes
  - 12% placebo vs. 10% metoprolol (p = .57) at 30 days
  - Bradycardia & hypotension more common in treated pts.

**More Doubt on β-blockers**

Perioperative Ischemia Evaluation (POISE)

- 8351 patients not previously on β-blocker undergoing major surgery
- All had CAD, PVD, or multiple RCRI risk factors
- Metoprolol XL or placebo started immediately before surgery, continued for 30 days
- Primary endpoint: 30-day cardiac mortality & nonfatal arrest or MI
POISE Trial

- Reduced cardiac events (mostly ↓ nonfatal MI)
- Increased risk of stroke & total mortality

Metoprolol XL:

CV Death, Cardiac Arrest, Nonfatal MI

<table>
<thead>
<tr>
<th>Placebo</th>
<th>Metoprolol XL</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9%</td>
<td>5.8%</td>
</tr>
<tr>
<td>2.3%</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

Total Mortality

- 0%
- 1%
- 2%
- 3%
- 4%
- 5%
- 6%
- 7%
- 8%

Presented at AHA, 2007

2006 ACC/AHA Guidelines for β-blockers

Definite indications (class I):
- Already using β-blocker to treat angina, HTN, arrhythmia
- Patients with ischemic potential having vascular surgery

Probable indications (class IIa):
- CAD or multiple risk predictors* in vascular or other intermediate-to-high risk operation

Possible indications (class IIb):
- All vascular surgery patients
- Single risk predictor* in any intermediate-high risk surgery

*Predictors: Coronary disease, CHF, renal insufficiency, diabetes

Presented at AHA, 2007

Recommendations in 2008

Definite indications:
- Already using β-blocker to treat angina, HTN, arrhythmia
- Patients with ischemic potential having vascular surgery

Possible indications:
- Patients with ischemic potential having high-risk nonvascular surgery (e.g., > 5 hours or > 500 cc blood loss)
- Multiple risk predictors* in vascular or other high-risk surgery

*Coronary disease, Stroke/TIA, renal insufficiency, diabetes

Titrâte dose up gradually (don’t start immediately preop)

Question 5: Endocarditis Prophylaxis

50 y.o. woman with moderate calcific aortic stenosis should get endocarditis prophylaxis when undergoing which of the following procedures?

1. Tooth extraction
2. Colonoscopy with polypectomy
3. Laparoscopic cholecystectomy
4. All of the above
5. None of the above
Endocarditis Prophylaxis Guidelines

Key Points of 2007 AHA Guideline:
- Bacteremia from daily activities more likely to cause IE than procedures
- Prophylaxis can prevent very few cases of IE
- Limits prophylaxis to conditions with high risk for poor outcomes from IE
- Limits prophylaxis to dental/oral/respiratory tract procedures

Indications for IE Prophylaxis

High risk cardiac conditions:
- Prosthetic valve (mechanical or biological)
- Prior endocarditis
- Cyanotic congenital heart disease if unrepaired, incompletely repaired, or repaired with prosthetic material within prior 6 months
- Heart transplant with post-transplant valvulopathy

Procedures:
- Dental procedure manipulating gingival tissue or periapical region of teeth or perforating of the oral mucosa

IE Prophylaxis for Dental Procedures

Preferred:
- Amoxicillin 2 gm p.o.

Allergy to penicillin/ampicillin:
- Cephalexin 2 gm p.o.
- Clindamycin 600 mg p.o.
- Azithromycin 500 mg p.o. or Clarithromycin 500 mg p.o.

Parenteral route needed:
- Ampicillin 2 gm IM or IV
- Cefazolin 1 gm or Ceftriaxone 1 gm IM or IV
- Clindamycin 600 mg IM or IV

All regimens given as single dose, 30-60 min before procedure

BNP as Preoperative Prediction Tool

<table>
<thead>
<tr>
<th>Study</th>
<th>n</th>
<th>Surgery</th>
<th>Cutoff</th>
<th>ROC AUC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feringa, 2006</td>
<td>170</td>
<td>vascular</td>
<td>NT-BNP &gt; 533</td>
<td>AUC = 0.91</td>
</tr>
<tr>
<td>Dernellis, 2006</td>
<td>1590</td>
<td>various (some low risk)</td>
<td>BNP &gt; 189</td>
<td>AUC = 0.84 (Goldman = 0.61)</td>
</tr>
<tr>
<td>Gibson, 2007</td>
<td>149</td>
<td>vascular &amp; other major</td>
<td>BNP &gt; 108</td>
<td>AUC = 0.91</td>
</tr>
<tr>
<td>Cuthbertson, 2007</td>
<td>204</td>
<td>various major</td>
<td>BNP &gt; 40</td>
<td>AUC = 0.72 (RCRI = 0.54)</td>
</tr>
</tbody>
</table>
BNP: Unanswered Questions

- What is appropriate cutoff & does it vary by population?
- How might BNP fit into overall risk assessment?
  - Double check clinically "low risk" patients?
  - Determine which intermediate or high risk patients need stress testing?
  - Replace stress testing in most patients?
  - Should surgery be delayed until BNP improves?

Can Statins Prevent Perioperative Cardiac Complications?

Growing Evidence of Benefit:
- Systematic review: 13 observational studies and 1 randomized trial of statins in noncardiac surgery
- Statins associated with lower mortality (OR = 0.7) and fewer postoperative MI

DECREASE-IV
- Current trial of bisoprolol and / or fluvastatin in 6000 patients undergoing major surgery

Schouten, O et al. Am J Cardiol, 2007

Can Statins Prevent Perioperative Cardiac Complications?

Danger of Statin Withdrawal?
- Prospective cohort study of 298 vascular surgery patients on statins
- Interruption of statin treatment associated with higher risk of cardiac death and MI (hazard ratio = 7)
- Effect persisted after controlling for confounders and propensity score

Take Home Points

Be familiar with the Revised Cardiac Risk Index:
- It's not really any better but is the "new standard"

Reserve stress testing for highest risk patients:
- Vascular surgery patients with multiple RCRI predictors
- Extensive ischemia in vascular patients predicts high risk that may not be modifiable -- will you cancel surgery?
- Limited ischemia predicts acceptable risk if beta-blocked
### Take Home Points

**Avoid perioperative coronary revascularization:**
- Indications are the same as for non-surgical patients
- Don’t perform PCI if patient may have upcoming surgery that requires stopping antiplatelet therapy:
  - Balloon angioplasty: 2 - 4 weeks
  - Bare metal stent: 4 - 6 weeks
  - Drug eluting stent: 12 months
- Continue aspirin perioperatively if possible in patients with coronary stents who are no longer on clopidogrel

**Caution with \(\beta\)-blockers:**
- Continue perioperatively if already on \(\beta\)-blocker
- Start only for patients with ischemic potential going for vascular surgery & possibly other high-risk populations
- Start well in advance of surgery; titrate slowly

**Endocarditis Prophylaxis:**
- Now indicated for very few conditions (prosthetic valves, prior IE, cyanotic CHD) and procedures (dental/oral)