Preoperative Cardiac Evaluation

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Goals

- Patient and procedure-related risk factors
- Revised cardiac risk index (RCRI)
- NSQIP surgical risk calculator
- Updated 2014 AHA/ACC guideline
- Role for perioperative beta-blockers?
- Role of perioperative statins
- Disappointing results for perioperative ASA
- Preoperative revascularization does not reduce risk
- Timing of noncardiac surgery after PCI
- Postop biomarker surveillance
Approach to Cardiac Risk Stratification

- Low risk
  - No further evaluation required
- High risk
  - Employ risk reduction strategies
  - No benefit from further evaluation
  - Negative test results likely to be false negative
- Intermediate risk
  - Most likely to benefit from additional testing to stratify risk
Patient-Related Risk Factors

- Coronary artery disease
- Recent MI
- Congestive heart failure
- Cerebrovascular disease
- Renal insufficiency
- Diabetes mellitus
- Advanced age
- Poor functional capacity
- Aortic stenosis
Coronary Artery Disease

- Any evidence of CAD confers risk
  - Any previous MI
  - MI within past 6 months particularly high risk
  - Q waves on ECG
  - Positive ETT
  - Symptoms consistent with angina
Patient-Related Risk Factors

- Congestive heart failure:
  - Any prior h/o CHF
  - Physical examination c/w CHF including rales, S3, or jugular venous distension
  - Chest x-ray findings c/w CHF
- Cerebrovascular disease
  - Any prior h/o stroke or TIA
  - Asymptomatic bruit does not clearly increase risk
Patient-Related Risk Factors

- Renal insufficiency
  - Relative risk even greater (3.0) than for known CAD (2.4)
  - Creatinine > 2.0 mg/dl
- Diabetes
  - Risk only for insulin treated patients
- Age
  - Risk for age > 70 (drops out of some multivariate analyses when co-morbidities considered)
Procedure-Related Risk Factors

- High risk surgery (relative risk 2.8)
  - Abdominal surgery
  - Chest surgery
  - Major intra-abdominal vascular surgery
- Emergency surgery
- General anesthesia
- Prolonged surgery
Revised Cardiac Risk Index

- 4315 patients aged > 50 years
- Derivation and validation cohorts
- Nonemergent, noncardiac surgery
- High risk surgery = aortic, intraperitoneal, intrathoracic
- Outperformed previous indices including original Goldman index, Detsky index and ASA class
- Limitation: Unable to stratify risk for patients undergoing AAA repair

Circulation 1999;100:1043
Revised Cardiac Risk Index: Significant Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adjusted OR (derivation cohort)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High-risk surgery</td>
<td>2.8</td>
</tr>
<tr>
<td>2. Ischemic heart disease</td>
<td>2.4</td>
</tr>
<tr>
<td>3. History of CHF</td>
<td>1.9</td>
</tr>
<tr>
<td>4. Cerebrovascular disease</td>
<td>3.2</td>
</tr>
<tr>
<td>5. Insulin treated diabetes</td>
<td>3.0</td>
</tr>
<tr>
<td>6. Creatinine &gt; 2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
Event Rates Stratified by RCRI Class: RCRI Predicts Risk

Event Rate (%)

Class # Factors

<table>
<thead>
<tr>
<th>Class</th>
<th># Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>3-6</td>
</tr>
</tbody>
</table>
Universal ACS NSQIP Surgical Risk Calculator: A Decision Aid

- Patient level data from 393 NSQIP hospitals
- N=1.4 million patients
- Evaluated risk factors for 30 day postop outcomes
- Risk factors based on prespecified NSQIP variables
- Developed risk predictor calculators for mortality, overall morbidity, and 6 specific outcomes
- Option for surgeon adjustment of risk
### Enter Patient and Surgical Information

**Procedure**

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+cholangiography"

**Reset All Selections**

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

Please 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.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Under 65 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female</td>
</tr>
<tr>
<td>Functional status</td>
<td>Independent</td>
</tr>
<tr>
<td>Emergency case</td>
<td>No</td>
</tr>
<tr>
<td>ASA class</td>
<td>I - Healthy patient</td>
</tr>
<tr>
<td>Wound class</td>
<td>Clean</td>
</tr>
<tr>
<td>Steroid use for chronic condition</td>
<td>No</td>
</tr>
<tr>
<td>Ascites within 30 days prior to surgery</td>
<td>No</td>
</tr>
<tr>
<td>Systemic sepsis within 48 hours prior to surgery</td>
<td>None</td>
</tr>
<tr>
<td>Ventilator dependent</td>
<td>No</td>
</tr>
<tr>
<td>Disseminated cancer</td>
<td>No</td>
</tr>
<tr>
<td>Diabetes</td>
<td>None</td>
</tr>
<tr>
<td>Hypertension requiring medication</td>
<td>None</td>
</tr>
<tr>
<td>Previous cardiac event</td>
<td>No</td>
</tr>
<tr>
<td>Congestive heart failure in 30 days prior to surgery</td>
<td>No</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>None</td>
</tr>
<tr>
<td>Current smoker within 1 year</td>
<td>No</td>
</tr>
<tr>
<td>History of severe COPD</td>
<td>No</td>
</tr>
<tr>
<td>Dialysis</td>
<td>No</td>
</tr>
<tr>
<td>Acute Renal Failure</td>
<td>No</td>
</tr>
</tbody>
</table>

**BMI Calculation**

- Height (in)
- Weight (lbs)
### Procedure

47600 - Cholecystectomy

### Risk Factors

Age: 65-74, Female, ASA III, Diabetes (insulin), HTN, Smoker, Obese (Class2)

### Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Estimated Risk</th>
<th>Chance of Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>1%</td>
<td>Above Average</td>
</tr>
<tr>
<td>Serious Complication</td>
<td>10%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Any Complication</td>
<td>19%</td>
<td>Above Average</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2%</td>
<td>Average</td>
</tr>
<tr>
<td>Cardiac Complication</td>
<td>1%</td>
<td>Above Average</td>
</tr>
<tr>
<td>Surgical Site Infection</td>
<td>10%</td>
<td>Above Average</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td>2%</td>
<td>Above Average</td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>1%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>1%</td>
<td>Above Average</td>
</tr>
<tr>
<td>Return to OR</td>
<td>4%</td>
<td>Average</td>
</tr>
</tbody>
</table>

**Predicted Length of Hospital Stay:** 3.0 days
ACC/AHA 2014: First Consider High and Low Risk Scenarios

1. Emergency surgery?
   - Yes → Proceed to OR
   - No

2. Acute coronary Syndrome?
   - Yes → Rx as per Guidelines
   - No

3. Estimate risk based on patient and surgical risks
   - Yes → 4. Low Risk → Proceed to OR
   - No or Unknown → 5. Elevated Risk

4. Low Risk
   - Yes → Proceed to OR
   - No or Unknown → Step 6

5. Elevated Risk
   - Yes → Proceed to OR
   - No or Unknown → Step 6

Moderate or greater functional capacity ≥ 4 METs?
ACC/AHA Functional Capacity

Good = ≥ 4 METs

**Functional Capacity**

1 MET
- Take care of yourself?
- Eat, dress, or use the toilet?
- Walk indoors around the house?
- Walk 100 m on level ground at 3 to 5 km per h?

4 METs
- Climb two flights of stairs or walk uphill?
- Run a short distance?
- Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?
- Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?

Greater than 10 METs
Step 6: Poor (< 4 METs) or Unknown Functional Capacity

Will further testing impact decision making or care?

Yes
Pharmacologic stress test
Abnormal
Revascularize as per guidelines

No

Pharmacologic stress test
Normal
Proceed to surgery or alternative lower risk Rx or palliation
ACC/AHA: Other Recommendations

- To estimate risk of MACE (step 3), either
  - RCRI
  - NSQIP surgical risk calculator
- Consider echo if unexplained dyspnea
- Noninvasive testing, either:
  - Dobutamine echo
  - Pharmacologic myocardial perfusion
- Clinically significant valvular disease:
  - Echo if none in past year
  - Intervention based on standard indications
- Choice of anesthetic agent does not impact MACE risk
Patient Level Meta-Analysis: Preop BNP Levels to Predict MACE After Vascular Surgery

Unadjusted ORs for a Preop BNP Above the Optimal Cut Point (116 pg/ml)

<table>
<thead>
<tr>
<th>Study</th>
<th>BNP above cut point n/N</th>
<th>BNP below cut point n/N</th>
<th>OR (random) 95%CI</th>
<th>Weight %</th>
<th>OR (random) 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibson</td>
<td>22/33</td>
<td>2/96</td>
<td></td>
<td>20.40</td>
<td>94.0 (19.43, 454.78)</td>
</tr>
<tr>
<td>Cuthbertson</td>
<td>2/57</td>
<td>0/13</td>
<td></td>
<td>10.14</td>
<td>1.22 (0.06, 26.84)</td>
</tr>
<tr>
<td>Mahla</td>
<td>14/85</td>
<td>5/133</td>
<td></td>
<td>25.31</td>
<td>5.05 (1.75, 14.59)</td>
</tr>
<tr>
<td>Bolliger</td>
<td>2/38</td>
<td>2/95</td>
<td></td>
<td>16.79</td>
<td>2.58 (0.35, 19.04)</td>
</tr>
<tr>
<td>Biccard</td>
<td>13/53</td>
<td>13/244</td>
<td></td>
<td>27.36</td>
<td>5.78 (2.50, 13.36)</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>266</td>
<td>581</td>
<td></td>
<td>100.00</td>
<td>7.36 (2.23, 24.31)</td>
</tr>
</tbody>
</table>

Total events: 53 (BNP above cut point) 22 (BNP below cut point)
Test for heterogeneity, Chi^2=13.37, df=4 (P=0.001), I^2=70.1 %
Test for overall effect: Z=3.27 (P=0.001)
POISE: Perioperative Beta Blockers

- 8351 patients > 45 y.o.
- Expected stay of > 1 day
- **At least one of:**
  - CAD
  - PVD
  - Stroke
  - CHF admit within < 3 yrs
  - Major vascular surgery

- **OR at least 3 of:**
  - High risk surgery
  - CHF
  - DM on meds
  - Creat > 2.0
  - Age > 70
  - H/o TIA
  - Urgent surgery

Metoprolol XL 100 mg vs placebo
2-4 hrs before surgery and 6 hrs after surgery

Metoprolol XL 200 mg qd vs placebo for 30 days after surgery
POISE: Higher Mortality and Stroke Rates with Fixed High Dose Metoprolol

![Bar chart showing mortality, composite endpoint, nonfatal MI, stroke, hypotension, and bradycardia rates for Metoprolol and Placebo.](Lancet 2008;371:1839)
Does Beta Blocker Choice Matter? Strongest Evidence for Bisoprolol

Eur Heart J 2009;30:2769
**Even Chronic Beta Blocker Use for Hypertension Increases MACE & Mortality**

### 30-day MACEs

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>OR (95% CI)</th>
<th>Events/Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAS inhibitors + thiazides</td>
<td>1 [Reference]</td>
<td>161/20745</td>
</tr>
<tr>
<td>β-blocker + RAS inhibitors</td>
<td>2.16 (1.54-3.04)</td>
<td>46/2789</td>
</tr>
<tr>
<td>β-blocker + calcium antagonists</td>
<td>2.17 (1.48-3.17)</td>
<td>35/1878</td>
</tr>
<tr>
<td>β-blocker + thiazides</td>
<td>1.56 (1.10-2.22)</td>
<td>41/3427</td>
</tr>
</tbody>
</table>

### 30-day all-cause mortality

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>OR (95% CI)</th>
<th>Events/Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAS inhibitors + thiazides</td>
<td>1 [Reference]</td>
<td>256/20745</td>
</tr>
<tr>
<td>β-blocker + RAS inhibitors</td>
<td>1.79 (1.33-2.42)</td>
<td>58/2789</td>
</tr>
<tr>
<td>β-blocker + calcium antagonists</td>
<td>1.68 (1.20-2.35)</td>
<td>44/1878</td>
</tr>
<tr>
<td>β-blocker + thiazides</td>
<td>1.65 (1.24-2.18)</td>
<td>73/3427</td>
</tr>
<tr>
<td>β-blocker + 2 others</td>
<td>1.31 (1.03-1.67)</td>
<td>107/6550</td>
</tr>
<tr>
<td>RAS inhibitors + calcium antagonists</td>
<td>1.15 (0.89-1.48)</td>
<td>93/6055</td>
</tr>
<tr>
<td>RAS inhibitors, thiazides, and</td>
<td>0.82 (0.64-1.05)</td>
<td>95/9248</td>
</tr>
<tr>
<td>calcium antagonists</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium antagonists + thiazides</td>
<td>1.24 (0.96-1.60)</td>
<td>94/4628</td>
</tr>
</tbody>
</table>

**N=55,320**

*JAMA Intern Med; Published Online Oct. 4, 2015*
ACC/AHA: Key Findings from Literature

1. Preoperative beta blockers reduce cardiac events
2. Benefit on mortality unproven
3. Beta blockers increase risk for stroke
4. Beta blockers increase potential for bradycardia
5. If started < 1 day before surgery, increased stroke, death, hypotension
6. Findings hold true even if exclude DECREASE or POISE trials
### ACC/AHA 2014 Beta Blocker Recommendations

<table>
<thead>
<tr>
<th>Class</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (recommend)</td>
<td>Continue if taking chronically</td>
</tr>
<tr>
<td>IIa (reasonable)</td>
<td>Use after surgery guided by clinical circumstances</td>
</tr>
<tr>
<td>IIb (consider)</td>
<td>Positive preop noninvasive test (at least moderate ischemia)</td>
</tr>
<tr>
<td></td>
<td>≥ 3 RCRI risk factors (of 6 total)</td>
</tr>
<tr>
<td></td>
<td>Begin long enough before surgery to assess safety, preferably at least 1 day before surgery</td>
</tr>
</tbody>
</table>

Circulation 2014 Aug (epub ahead of press)
Do Statins Decrease Risk? Meta-Analysis of 15 Cohort Studies: Perioperative Death or Acute Coronary Syndrome

Pooled OR 0.70 (0.57-0.87)

Favors Treatment

Favors Control
Cohort Studies: Perioperative Death

Pooled OR 0.58 (0.48-0.72)

Favors Treatment

Favors Control
• Statins probably reduce perioperative CV morbidity and mortality
• Effect may be due to anti-inflammatory effect but mechanism speculative
• Optimal dose, agent, and duration unknown
• Early d/c of statins after surgery increases risk
• AHA/ACC 2014:
  – Continue if taking chronically
  – Reasonable (IIa) in vascular surgery
  – Begin (IIb) if standard clinical indications and planning elevated risk surgery
POISE-2: Does Perioperative ASA Reduce CV Risk?

• N=10,010 patients, noncardiac surgery
• Aspirin 200 mg qd vs. placebo
• First dose immediately before surgery
• Rx for 30 days if new start for ASA
• Rx for 7 days if already on ASA, then resume usual dose
• Outcome = composite of death or nonfatal MI at 30 days
• More major bleeding in ASA group: 4.6% vs. 3.8%

Aspirin Does Not Reduce Composite CV Outcome

No. at Risk

<table>
<thead>
<tr>
<th></th>
<th>Placebo</th>
<th>Aspirin</th>
</tr>
</thead>
<tbody>
<tr>
<td>5012</td>
<td>4998</td>
<td></td>
</tr>
<tr>
<td>4724</td>
<td>4713</td>
<td></td>
</tr>
<tr>
<td>4696</td>
<td>4678</td>
<td></td>
</tr>
<tr>
<td>4680</td>
<td>4665</td>
<td></td>
</tr>
<tr>
<td>4669</td>
<td>4660</td>
<td></td>
</tr>
<tr>
<td>4662</td>
<td>4653</td>
<td></td>
</tr>
<tr>
<td>4659</td>
<td>4643</td>
<td></td>
</tr>
</tbody>
</table>

Hazard ratio, 0.99 (95% CI, 0.86–1.15); P=0.92
Subgroup Analysis: No Benefit from Aspirin in Any Subgroup

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value for Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>0.99 (0.86–1.15)</td>
<td>0.96</td>
</tr>
<tr>
<td>Aspirin strata</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initiation stratum</td>
<td>0.99 (0.81–1.21)</td>
<td></td>
</tr>
<tr>
<td>Continuation stratum</td>
<td>1.00 (0.81–1.23)</td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonvascular</td>
<td>0.95 (0.81–1.11)</td>
<td>0.16</td>
</tr>
<tr>
<td>Vascular</td>
<td>1.31 (0.84–2.02)</td>
<td></td>
</tr>
<tr>
<td>Revised Cardiac Risk Index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0.94 (0.69–1.29)</td>
<td>0.89</td>
</tr>
<tr>
<td>1</td>
<td>0.99 (0.78–1.25)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1.14 (0.86–1.51)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.74 (0.43–1.26)</td>
<td></td>
</tr>
<tr>
<td>≥4</td>
<td>0.88 (0.32–2.38)</td>
<td></td>
</tr>
<tr>
<td>Vascular disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0.99 (0.81–1.20)</td>
<td>0.92</td>
</tr>
<tr>
<td>Yes</td>
<td>1.00 (0.80–1.26)</td>
<td></td>
</tr>
</tbody>
</table>

The figure shows the hazard ratio and its 95% confidence interval (CI) for different subgroups, with the P value for interaction indicating whether the effect of aspirin varies across subgroups.
Does Coronary Revascularization Reduce Risk?
CARP Trial: RCT of Coronary Revascularization Before Major Vascular Surgery

- 510 patients
- Major vascular surgery
- Randomly assigned to revascularization or no revascularization
- Excluded patients with left main disease or LVEF <20%
- Revascularization group:
  - PCI 59%
  - CABG 41%
- All patients received usual care
- No difference in beta blocker or statin use

NEJM 2004;351:2795
Revascularization Does not Reduce 30 Day Mortality and Morbidity

<table>
<thead>
<tr>
<th>Outcome</th>
<th>CABG or PCI</th>
<th>Usual Care</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>3.1%</td>
<td>3.4%</td>
<td>0.37</td>
</tr>
<tr>
<td>MI by ECG and enzymes</td>
<td>8.4%</td>
<td>8.4%</td>
<td>0.99</td>
</tr>
<tr>
<td>MI by enzymes</td>
<td>11.6%</td>
<td>14.3%</td>
<td>0.37</td>
</tr>
<tr>
<td>LOS</td>
<td>6.5</td>
<td>7.0</td>
<td>0.29</td>
</tr>
</tbody>
</table>
Who to Revascularize Before Noncardiac Surgery?

- PCI or CABG do not reduce risk of noncardiac surgery
- PCI increases risk of subsequent noncardiac surgery if interval too brief
- AHA/ACC 2014: Indications are same as for patients not facing noncardiac surgery

Revascularize for survival benefit (class I):
- Unstable angina or MI
- Left main disease
- 3 vessel CAD with impaired LV function
- 2 vessel CAD with proximal LAD and impaired LV function
Don’t Revascularize Unless You Would Anyway!
Noncardiac Surgery after PCI: MACCE, Mortality, and Bleeding: Increased Risk for Up to 12 Months

JACC 2016;67:1038
ACC/AHA FOCUSED UPDATE

2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients With Coronary Artery Disease

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines

<table>
<thead>
<tr>
<th>Class</th>
<th>Level of Evidence</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>B-NR</td>
<td>Delay NCS 30 days after BMS and optimally 6 months after DES.</td>
</tr>
<tr>
<td>I</td>
<td>C-EO</td>
<td>For surgical procedures that mandate d/c of P2Y12 inhibitor therapy, continue aspirin if possible and restart the P2Y12 inhibitor as soon as possible after surgery.</td>
</tr>
<tr>
<td>IIa</td>
<td>C-EO</td>
<td>For patients currently taking a P2Y12 inhibitor, develop a consensus decision as to the relative risks of surgery and discontinuation or continuation of antiplatelet therapy</td>
</tr>
<tr>
<td>IIb</td>
<td>C-EO</td>
<td>Consider elective noncardiac surgery 3 months after DES if d/c P2Y12 inhibitor therapy required if the risk of further delay of surgery is greater than the expected risks of stent thrombosis.</td>
</tr>
<tr>
<td>III: Harm</td>
<td>B-NR</td>
<td>Do not perform elective noncardiac surgery &lt; 30 days after BMS or &lt; 3 months after DES if DAPT will need to be discontinued perioperatively.</td>
</tr>
</tbody>
</table>
Timing of Noncardiac Surgery after PCI

Patients Treated With PCI Undergoing Elective Noncardiac Surgery

BMS

- 0 d
- <30 d since BMS implantation: Class III: Harm, Delay surgery
- ≥30 d since BMS implantation: Class I: Proceed with surgery

DES

- 0 d
- <3 mo since DES implantation: Class III: Harm, Delay surgery
- 3-6 mo since DES implantation, discontinue DAPT; delayed surgery risk is great than stent thrombosis risk: Class IIb: Proceeding with surgery may be considered
- ≥6 mo since DES implantation, discontinue DAPT: Class I: Proceed with surgery
Routine Postoperative Surveillance: Most Myocardial Injury is Asymptomatic

POISE Substudy

- Study Patients With Events (n = 8351), %
- Isolated Cardiac Biomarker or Enzyme Level Elevation
- Asymptomatic MI
- Symptomatic MI

Time After Surgery, d
Mortality Similar for Symptomatic and Asymptomatic MI’s

- Asymptomatic MI: 12.5%
- Symptomatic MI: 9.7%
- Isolated Cardiac Biomarker or Enzyme Level Elevation: 2.2%
Postoperative Biomarker Surveillance: Implications for Practice

- 2/3 of perioperative MI’s are asymptomatic
- Mortality does not differ based on ischemic symptoms or not
- Most MI’s occur during first 48 hours
- ACC/AHA
  - Obtain troponins and EKG if signs or symptoms of ischemia
  - Value of surveillance troponins and EKG if high risk but no symptoms unknown
  - Routine surveillance not recommended
Historical Summary

“The heart... is the only one of the viscera, and indeed the only part of the body, that is unable to tolerate any serious injury.”

Aristotle (384-322 BC)
Summary: Patient-Related Risks

- Coronary artery disease
- Congestive heart failure
- Cerebrovascular disease
- Renal insufficiency
- Diabetes mellitus requiring insulin
- Advanced age
- Poor functional capacity
Summary: Procedure-Related Risks

• High risk surgical site
  – Abdominal surgery
  – Chest surgery
  – Major intra-abdominal vascular surgery
• Emergency surgery
• Prolonged surgery
Summary: Interventions

- Beta blockers
  - Positive noninvasive test
  - ≥ 3 RCRI risk factors
- Statins
  - All patients undergoing vascular surgery
  - Clinical indication for long term Rx and elevated risk surgery
- Aspirin:
  - No benefit, more major bleeding
- Revascularize only if would do so anyway…
- Delay noncardiac surgery after PCI; duration dependent on stent type