Postoperative And Post-Procedural Myocardial Infarctions: Evaluation, Risk Factors And Optimal Prevention And Treatment

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Background

• Post Op MI a feared complication
• Recent data suggests about 1-5% rate
  – Depends on how it is defined
• Etiology not exactly known

Post Op MI

2009;119:2038

The Vascular Study Group of New England Cardiac Risk Index (VSG-CRI) predicts cardiac complications more accurately than the Revised Cardiac Risk Index in vascular surgery patients

The Development and Validation of a Risk Calculator for Prediction of Cardiac Risk After Surgery

Method and Results—Patients who underwent surgery were identified from the American College of Surgeons’ 2001 National Surgical Quality Improvement Program database, a multicenter >250 hospitals prospective database. Of the 214,650 patients, 171 (0.08%) developed perioperative myocardial infarction or cardiac arrest. On multivariate logistic-regression analysis, 5 predictors of perioperative myocardial infarction or cardiac arrest were identified: type of surgery, dependent functional status, abnormal creatinine, American Society of Anesthesiologists’ class, and increasing age. The risk model based on the 2007 data set was subsequently validated on the 2008 data set (n=237,963). The model performance was very similar between the 2007 and 2008 data sets, with C statistics (also known as area under the receiver operating characteristics curve) of 0.690 and 0.693, respectively. Application of the Revised Cardiac Risk Index to the 2006 National Surgical Quality Improvement Program data set yielded a relatively lower C statistic (0.574). The risk model was used to develop an interactive risk calculator.
Methods

- Used 17 hospitals from our state wide QI consortium to ascertain consecutive postMI, with additional variables beyond the ACS-NSQIP
- Roughly matched by CPT procedural codes for non-MI controls
- Outcome Measures:
  - Po MI
  - Death
  - Medications
  - po interventions
- Statistical analysis with univariable, multivariable analysis. Used C-statistic and Hosmer-Lemeshow goodness of fit assessments for models

Population

- Top five case types for Control Non MI: CEA (35301); Lap chole (47562); lap gastric bypass (43644); colectomy (44140); EVAR(34802)
  - N = 304
- Top five case types for MI: CEA (35301); iliocecectomy (44160); SB resection (44120); colectomy (44140); laminectomy (63047)
  - N = 222

| Characteristic     | MI (N = 222) | NO (N = 304) | P
|--------------------|--------------|--------------|---
| age                | 72±11.3      | 68±16.5      | <.0001
| Height, in         | 66.3±4.1     | 66.5±4.2     | 0.5205
| Weight, kg         | 81.2±23.2    | 82.0±20.9    | <.0001
| Preop_Glucose      | 122.4±40     | 113.2±33.5   | 0.0059
| Creatinine         | 1.3±1.0      | 1.1±1.0      | 0.0078
| BUN                | 21.9±13.4    | 16.8±10.4    | <.0001
| WBC                | 7.8±2.8      | 7.8±3.3      | 0.8911
| Sodium             | 213.8±2.8    | 138.5±3.4    | 0.8362
| HCT                | 36.7±5.7     | 35.1±4.8     | <.0001
| Platelet count     | 238.8±83.9   | 243.1±74.3   | 0.536
| Preop_Echo         | 3.97±1.7     | 3.98±1.3     | 0.9223
| Preop_Choes_to_HD  | 55.6±9.0     | 56.0±9.0     | 0.4995

Preop medications

| Medication       | Non MI (N = 304) | MI (N = 222) | P
|------------------|------------------|--------------|---
| β- blocker       | 114 (38)         | 127 (57)     | <.0001
| Statin           | 149 (49)         | 128 (58)     | .05
| ASA              | 138 (45)         | 122 (55)     | .03
| ACEI             | 99 (33)          | 88 (40)      | .09
| ARB              | 25 (8)           | 29 (13)      | .07
| Plavix           | 34 (11)          | 46 (21)      | .002

Table 2: Independent Predictors of Perioperative MI

<table>
<thead>
<tr>
<th>Independent Predictor</th>
<th>Adjusted OR Ratio</th>
<th>95% CI for OR Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 10 Micro units increase in Baseline creatinine</td>
<td>1.29 (1.05-1.58)</td>
<td></td>
</tr>
<tr>
<td>Hemoglobin iso allergic dose</td>
<td>1.34 (1.20-4.80)</td>
<td></td>
</tr>
<tr>
<td>Undergoing major vascular surgery</td>
<td>2.21 (0.85-6.28)</td>
<td></td>
</tr>
<tr>
<td>Peroperative stress cardiomyopathy</td>
<td>4.73 (1.02-20.45)</td>
<td></td>
</tr>
<tr>
<td>Age per decade increase</td>
<td>1.03 (1.00-1.10)</td>
<td></td>
</tr>
<tr>
<td>Emergency or urgent surgery</td>
<td>2.34 (0.65-8.10)</td>
<td></td>
</tr>
<tr>
<td>Serial Blinding</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* = not assessed
### Preoperative factors: poMI

<table>
<thead>
<tr>
<th>Preop Factors</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVD</td>
<td>2.6</td>
<td>1.3 – 5.3</td>
<td>.01</td>
</tr>
<tr>
<td>PTCA</td>
<td>2.8</td>
<td>1.6 – 5.0</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Tob</td>
<td>1.7</td>
<td>1.0 – 2.9</td>
<td>.04</td>
</tr>
<tr>
<td>Age (per year &gt; 60 yrs)</td>
<td>1.05</td>
<td>1.03-1.07</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Preop ASA</td>
<td>.59</td>
<td>0.4 – .97</td>
<td>.036</td>
</tr>
<tr>
<td>PreOP Hct &gt; 35</td>
<td>.51</td>
<td>.32 – .82</td>
<td>.005</td>
</tr>
</tbody>
</table>

C-stat = .81; H – L * P = .19

### Post operative complications

- **Death:**
  - No MI = 1 (.3%)
  - MI = 25 (11%)
  - P < .001
- **Complications:**
  - No MI (4%) vs. MI (93%)
  - In those with complications:
    - 18 had MI first, then others
    - 204 had other complications first, then MI
    - Death: primary MI = 5.6% vs. 12% secondary MI, P = .70

### Post op MI management

- Post MI medication usage not significantly different (except B-blockers): statin, ASA ~ 60-70%
- Post op MI aggressive intervention:
  - PCI/CABG done in 32%
  - Performed in 34% alive and 20% who died
  - P = .16

### Conclusions

- Most poMIs occur in the setting of other po complications – not an isolated event
- Consideration of po anemia, particularly if Hct < 25, may warrant transfusion
- Continue perioperative ASA
- Use β-blockade in those with poMI

### Biomarkers

<table>
<thead>
<tr>
<th>Biomarker</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRP</td>
<td>70%</td>
<td>60%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>S100A12</td>
<td>50%</td>
<td>80%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>t-PA</td>
<td>60%</td>
<td>70%</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>VEGF</td>
<td>60%</td>
<td>70%</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Legend: CRP: C-reactive protein; S100A12: S100 calcium-binding protein A12; VEGF: vascular endothelial growth factor*
2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

Update in preoperative risk assessment in vascular surgery patients

Noninvasive pharmacological stress testing before noncardiac surgery
- If is reasonable for patients at increased risk for noncardiac surgery with poor functional capacity to undergo either TEE or MRI if it will change management
- Routine screening with noninvasive stress testing is not useful for low-risk noncardiac surgery

Veith Symposium
Connecting the Vascular Community