Medical Management of the Surgical Patient

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Pre-operative visit
Continued…

• Meds:
  – ASA, lisinopril, hydrochlorothiazide
• Walks 2 miles/day
• No CHF/angina
• Exam:
  – HR 74, BP 138/80
  – Cardiopulmonary unremarkable

• ECG: NSR, LVH
• CBC, lytes, Creat Ni

Objectives

• Understand recommended preoperative evaluation strategies
• Understand appropriate patient selection for perioperative beta blockers
• Understand potential perioperative roles of other medications

Our Patient

• 64 y/o woman with isolated left colon cancer
• Hemicolecotmy planned
• PMH:
  – Hypertension
  – Borderline lipids

Outline

• Background
• Cardiovascular risk assessment
• Preoperative revascularization
• Medications
• Perioperative pulmonary complications
• Postoperative monitoring

Disclosures: None
Perioperative Cardiovascular Events - High Morbidity

- 30+ million noncardiac surgical cases/year
- 30% CAD or risk factors
- 1 million cardiovascular complications
- Perioperative MI → 30 - 50% mortality

Procedure Risk

> 5%
- Aortic, peripheral vascular
- Big Cases
- Emergent major (elderly)

≤1%
- Endoscopic
- Superficial procedures
- Cataract
- Breast surgery

1-5%
- All other procedures

Determinants of Perioperative Cardiac Risk

Procedure Risk
- Type
- Urgency
- Duration

Patient Risk
- CAD Risk
- Functional Capacity

Patient Risk: Revised Cardiac Risk Index (RCRI)

- Six independent predictors of cardiovascular complications
  - History of ischemic heart disease
  - History of CHF
  - History of cerebrovascular disease
  - Preoperative treatment with insulin
  - Preoperative creatinine >2.0 mg/dL
  - High risk surgery

Circulation 1999:100:1043
Outcome Prediction of RCRI

Class: 2 3 4

Risk Assessment

Circulation 1999;100:1043

Outcome Prediction of RCRI

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Circulation 1999;100:1043

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Circulation 1999;100:1043

Outcome Prediction of RCRI

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Risk Assessment

Circulation 1999;100:1043

“Simplified” ACC Guideline

Risk Assessment

Circulation 1999;100:1043
ACC Guideline Major Principles

• Search for “active cardiac conditions”
  ✓ Decompensated CHF
  ✓ Active ischemia/recent MI
  ✓ Significant rhythm abnormalities
  ✓ Severe valvular disease

ACC Guideline Major Principles

• Search for “active cardiac conditions”
  • Does the planned surgery have low risk?
  • Functional assessment

ACC Guideline Major Principles

• Search for “active cardiac conditions”
  • Does the planned surgery have low risk?
  • Functional assessment
  ✓ > 4 Metabolic Equivalents (METS)
  ✓ “Can you walk 4 mph or go up 2 flights of stairs?”

ACC Guideline Major Principles

• Search for “active cardiac conditions”
  • Does the planned surgery have low risk?
  • Preoperative CABG/percutaneous coronary interventions infrequently necessary
RCT evaluating PCI or CABG vs. medical therapy
Patients: stable CAD
Primary endpoint: long-term mortality

**CARP Study**

Methods
- 510 Patients: stable symptoms; at risk
- Excluded: Left main disease, EF <20%, severe AS, need urgent/emergent surgery
- Majority: 1-2 vessel disease
- Approximately 3 PCI : 2 CABG
- Median f/u time: 2.8 years

**CARP: No Survival Benefit**

Why Wouldn’t Prophylactic Coronary Revascularization Work?
- Delay of needed surgery
- Pro-inflammatory/Pro-thrombotic state
- “Wrong” lesions addressed
"...the literature suggests that PCI (percutaneous coronary intervention) before noncardiac surgery is of no value in preventing perioperative cardiac events, except in those patients in whom PCI is independently indicated for acute coronary syndrome."

**Ischemic Testing - When?**
- Uncertainty: new ischemic symptoms?
- Willingness to forgo elective surgery if very high risk?
- Probably NOT: poor functional status, intermediate risk surgery.

**Our Patient - Risk Assessment**
- Intermediate risk - colectomy
- No “active cardiac conditions”
- Good functional capacity (> 4 METS)
- Cardiovascular Risk ~ 1%

- No further testing

**Perioperative Medical Interventions - are they helpful?**
- Nitrates
- Alpha 2 agonists
- Beta blockers
- Statins
- Antiplatelet/stent issues
Perioperative Medical Interventions - are they helpful?

• Alpha 2 agonists
• Beta blockers
• Statins
• Antiplatelet/stent issues

DECREASE (Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echocardiography) Trial

• Aim: Evaluate effect of bisoprolol on perioperative mortality/MI in patients undergoing vascular surgery
• RCT, very high risk patients
  – clinical risk factors + positive dobutamine ECHO
• Drug: bisoprolol 5-10mg/Day (IV metoprolol if NPO)
• End-point: 30 day composite of MI + cardiac death

NEJM 1999;341:1789

DECREASE Bisoprolol Study

Cardiac death or non-fatal MI at 30 days

59 Bisoprolol + standard care
112 patients
3.4%

53 standard care
34% (17% were deaths)

NEJM 1999;341:1789

Evolving Perioperative Beta-Blocker Science

Pre-1996
No clinically relevant outcomes

2000
2+ trials ⇒ great enthusiasm

2009- present
Newer trials: no benefit
POISE: significant risk

DECREASE: High Event Rate

Kaplan-Meier Estimates: cumulative percentages with cardiac death or nonfatal MI

NEJM 1999;341:1789
Beta-Blocker Negative Trials

• DiPOM*: Diabetic Postoperative Mortality and Morbidity Trial
• MaVS*: Metoprolol after Vascular Surgery

Effects of Extended-Release Metoprolol Succinate in Patients Undergoing Non-Cardiac Surgery (POISE)

• Aim: Evaluate impact of perioperative, long-acting metoprolol on cardiovascular death, non-fatal MI/cardiac arrest
• 8351 patients
• Randomized: metoprolol or placebo
• Target dosing: 200 mg/day
• 30 days of therapy

POISE Trial- Methods

• Initiation of treatment: 2-4 hours pre-op
• Hold parameters: HR <50; SBP <100
• Pre-specified secondary outcomes
  – Clinically significant hypotension
  – Stroke
  – Total mortality
POISE: Reduced Composite Endpoint with Metoprolol

POISE: Increased Stroke Risk with Beta Blocker

POISE: Increased Total Mortality with Beta Blocker

POISE Critiques

- High-dose beta blocker
- Immediate preoperative initiation
- Liberal hemodynamic parameters
- Data inconsistencies

Beta blocker Literature- Trends

- Higher risk patients appear to benefit
- Dose titration (to resting HR< ~65)
- Immediate pre-op drug initiation: more likely to cause harm

2009 ACC/AHA Beta Blocker Recommendations

- Class I:
  - patients currently taking beta blockers should continue them through the perioperative period

JACC 2009: 22
2009 ACC/AHA Beta Blocker Recommendations

Class IIa ("reasonable to consider"):
- vascular surgery patients who are at high risk (established CAD or pre-operative ischemia or >1 clinical risk factor)
- patients undergoing intermediate risk surgery with CHD/high clinical risk

2009 ACC/AHA Beta Blocker Recommendations

2009 update: emphasis on titration to heart rate and blood pressure to avoid hypotension!

Perioperative Medical Interventions - are they helpful?

- Beta blockers
- Statins
- Antiplatelet/stent issues

Perioperative Beta Blocker Caveats

- Watch for bradycardia/hypotension post-op and adjust
- Unknowns:
  - Best drug: long-acting favored
  - Timing: days to weeks pre-op
  - Duration: continue ~ 1+ month

Perioperative MI Prevention - Role for Perioperative Statins?

- Prospective, double-blind RCT. 100 patients
- Aim: analyze effect of perioperative atorvastatin 20 mg/day (vs. placebo)
- Endpoint: 6-month composite (death, nonfatal MI, unstable angina)
- Started <14 Days pre-op. Duration: 45 days

Perioperative Atorvastatin Reduced Event Rate


Reduced CV Death/Nonfatal MI in Fluvastatin Group

NEJM 2009;361

Fluvastatin and Perioperative Events in Patients Undergoing Vascular Surgery

Olaf Schouten, M.D., Ph.D., Eric Boersma, Ph.D., Sanny E. Hoeks, M.Sc.,

- Aim: evaluate impact of perioperative statin on adverse cardiovascular events
- Double-blind, placebo-controlled RCT: extended release fluvastatin vs. placebo
- Primary outcome: perioperative ischemia
- Secondary outcome: 30-day composite CV mortality/non-fatal MI

NEJM 2009;361:980

Reduced Perioperative Ischemic Events in Fluvastatin Group

NEJM 2009;361

Perioperative Statin Systematic Review

• Aim- evaluate evidence of statin impact on perioperative events
• 18 studies- 800,000 patients
• Mostly retrospective

Limitations
- Lack of detail- dose, medication, LDL, timing
- Incomplete safety data

BMJ 2006;333:1149

Perioperative Statin Systematic Review- Benefit Associated with Statin Use

<table>
<thead>
<tr>
<th>Perioperative Death or ACS Event Rates in Cohort Studies</th>
<th>Perioperative Death Rates in Cohort Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odds Ratio 0.70 (0.57 - 0.87)</td>
<td>0.58 (0.48-0.72)</td>
</tr>
</tbody>
</table>

BMJ 2006;333:1149
**Perioperative Statin - ACC Guideline Recommendations**

**Class I**  
Patients currently taking statins + scheduled for noncardiac surgery: **statins should be continued**

**Class IIa**  
Patients undergoing vascular surgery: **statin use is reasonable**

*JACC 2007;50:e159*

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**Coronary Stents and Surgery**

- In-stent thrombosis - concern early/ with drug-eluting stents
- Surgery = pro-thrombotic state
- Increased risk during first:
  - 30 - 45 days after bare metal stent
  - 12 months following drug-eluting stent

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**Perioperative Statin - Caveats**

- Manufacturers suggest holding perioperatively
- "perioperative risk reduction" not FDA approved use
- Ideal LDL levels unknown
- Timing/Dosing questions

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**Medications**

**Perioperative Medical Interventions - are they helpful?**

- Beta blockers
- Statins
- Antiplatelet/stent issues

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**Stent/antiplatelet**

**Bare Metal Stent - Endothelialized Early**

**Drug-Eluting Stent - Inhibited Endothelialization**
Predictors of Stent Thrombosis

### Table 1. Independent Predictors of Stent Thrombosis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hazard Ratio (95% Confidence Interval)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early discontinuation of antiplatelet therapy</td>
<td>89.8 (10.6-790.8)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Duration of early discontinuation</td>
<td>0.95 (0.92-0.99)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Stent length</td>
<td>0.11 (0.01-0.21)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Left main lesion</td>
<td>0.92 (0.85-0.99)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Cumulative stent length</td>
<td>0.97 (0.96-0.99)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Cumulative antiplatelet therapy discontinuation</td>
<td>0.90 (0.82-0.97)</td>
<td>&lt;.008</td>
</tr>
</tbody>
</table>

Hazard Ratio: 89.8 associated with early antiplatelet therapy discontinuation and stent thrombosis

Implanted Stent Recommendations

- Delay surgery if at all possible:
  - for 6 weeks after bare metal stent
  - for 12 months after drug-eluting stent
- If surgery needed: consider dual antiplatelet therapy continuation
- If dual antiplatelet therapy interruption: communication!
- Always continue ASA if possible

Our Patient - Preoperative Medication Issues

- No perioperative beta blocker
- Review last lipids - consider usual indications (NCEP)

Perioperative Risk Following Recent Bare Metal Stent

- 40 consecutive patients undergoing noncardiac surgery; 13 days post stent implantation
- 8 deaths, 7 MI, 11 major bleeding episodes
- Deaths and MI’s due to stent thrombosis
- Conclusion: Delay surgery for 6 weeks if possible

Pulmonary Complications - Systematic Review

- Inclusion criteria: clinical outcomes
- Findings:
  1. Limited number of patient and procedure related risk factors
  2. Limited number of risk-reducing interventions

JACC 2000:35:1288

JACC 2007:50:e159

Ann Int Med 2006:144:596
### Patient-Related Risk Factors for Perioperative Pulmonary Complications

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>2.1 - 3</td>
</tr>
<tr>
<td>ASA Class</td>
<td>4.8</td>
</tr>
<tr>
<td>Abnormal CXR</td>
<td>4.8</td>
</tr>
<tr>
<td>CHF</td>
<td>2.9</td>
</tr>
<tr>
<td>Functional Dependence</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Ann Int Med 2006;144:596*

### Procedure-Related Risk Factors for Perioperative Pulmonary Complications

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Site</td>
<td></td>
</tr>
<tr>
<td>• Aortic</td>
<td>6.9</td>
</tr>
<tr>
<td>• Thoracic</td>
<td>4.2</td>
</tr>
<tr>
<td>• Any abdominal</td>
<td>3.0</td>
</tr>
<tr>
<td>• Upper abdominal</td>
<td>2.9</td>
</tr>
<tr>
<td>• Neurosurgery</td>
<td>2.5</td>
</tr>
<tr>
<td>Emergency Surgery</td>
<td>2.2</td>
</tr>
<tr>
<td>General Anesthesia</td>
<td>1.8</td>
</tr>
</tbody>
</table>

### Risk Reduction- Effective Strategies

- Selective use of postoperative nasogastric tubes
- Postoperative lung expansion- incentive spirometry, chest physical therapy

### Postoperative Monitoring- What to Do?

- Postoperative MI
  - relatively infrequent
  - Asymptomatic/atypical presentations common
  - NSTEMI, first 3 days
- Extensive literature- outdated

Definition of MI: symptoms or ECG Δ + elevated troponin

### Postoperative Monitoring- Routine Troponins Problematic

- Elevated troponin: sepsis, PE, CHF, renal insufficiency, hypotension
- Postop elevated troponin more likely from non-MI causes (without ischemic symptoms/ECG Δ)
- Routine postoperative troponin not recommended

### Recommended Monitoring

- Who: 1) symptomatic  2) high clinical concern
- What: serial ECG
- When:
  - Immediately postoperatively
  - Daily x 2 days

*JACC 2007;50:e159*
Our Patient - Postoperative Interventions

- Incentive spirometry
- Pharmacologic venous thromboembolic disease prophylaxis

Thank You
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OSA

- Review chest 2008;133:1128 and ann surgery 2008;247:617
- Prospective assessment of 172 pts w/ 2+ risk factors
- Overnight oximetry; >5 desats/hour
  - Cohort w/ 15% vs. 3% adjusted odds ratio for periop pulm comp. OR 7.2
- Post op CPAP lowers overall postop pulm comp in those unable to tol active muscle training-- see ann surg paper above
- Prob not screen all yet -- evolving data

What’s New: Rivaroxaban

- Oral Anticoagulant
- Direct Factor direct Xa inhibitor, once daily
- Indications: NO existing FDA approvals; VTE prophylaxis-hip and knee arthroplasty
- Dose- fixed
- Contraindications- liver disease?
- Adverse events: increased bleeding risk, hepatic
- NEJM 2008;358:2765

Extended Prophylaxis

- Most clots- 1st/2nd post-operative week
- Recommended for high risk orthopedics
  - Hip fracture/hip replacement surgery
  - 28-35 days

Venous Thromboembolic Disease Prophylaxis- General Surgery Patients

- 10 - 30% risk
- Higher in cancer patients
- Pharmacologic therapy favored
- Exception- minor general surgery, < 1 hour → “early/aggressive ambulation”

American College of Chest Physicians- Antithrombotic and Thrombolytic Therapy, 8th Ed.

- ASA alone not adequate
- General surgery
  - Low molecular weight heparin, low dose unfractionated heparin (TID), or fondiparinux
  - Start within 24 hours
  - Duration- minimally to hospital discharge
  - Consider extended prophylaxis- 28 days in higher risk subpopulations (cancer, prior VTE)

J Thromb Haem 2006; 4:2384
Chest 2008;133:67s