Updates and Controversies in Perioperative Medicine

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How long should we delay surgery:
• After ischemic stroke?
• After acute myocardial infarction
• After drug-eluting stent implantation?

Should we bridge patients on anticoagulants?

Postoperative anemia:
• How much evaluation is needed?
• When should patients be transfused?

Delaying Surgery After Stroke

A 63-year-old man suffers an acute stroke that is managed without thrombolysis. Brain MRI incidentally detects a large meningioma. The neurosurgeon wants to resect the tumor in 2 weeks. Because of his stroke, you recommend delaying surgery for:

A. 1 month
B. 3 months
C. 6 months
D. 9 months
E. At least a year

Danish cohort study of all adults undergoing elective noncardiac surgery from 2005-2011:
• 7137 patients had prior stroke (1.5% of total cohort)
• Outcome: 30-d postop Major Adverse Cardiac Events (MACE): nonfatal MI, ischemic stroke, cardiovascular death
• Looked at effect of time since stroke on MACE rate

Jorgenson ME et al. JAMA 2014; 312:269-277
Delaying Surgery After Stroke

<table>
<thead>
<tr>
<th>Time Between Acute Stroke &amp; Surgery</th>
<th>CV Death</th>
<th>Ischemic Stroke</th>
<th>Acute MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 months</td>
<td>15%</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>3-6 months</td>
<td>5%</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>6-12 months</td>
<td>5%</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>&gt; 12 months</td>
<td>5%</td>
<td>15%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Conclusions:
- Surgery after CVA associated with high CV risk
- Risk falls over 9 months, biggest drop after first 3 months

Caveats:
- Nonrandomized, observational study

My take-away:
- Delay elective surgery for at least 3 months (up to 9 months) if possible

Delaying Surgery After MI

A 63-year-old man suffers an acute myocardial infarction treated without PCI. He was already scheduled for prostate cancer surgery in one month. Because of his recent MI, you recommend delaying surgery for:

A. 1 month  
B. 2 months  
C. 3 months  
D. 6 months  
E. At least a year

Delaying Surgery After Acute MI

- How does time between acute MI and surgery affect the risk of postoperative MI?

563,842 patients (1999-2004) discharged after hip surgery, colectomy, cholecystectomy, AAA repair, or lower extremity amputation:
- 2.9% of cohort had experienced acute MI in prior year
- Outcome: 30-day postoperative MI


How Long to Wait after CVA?

Conclusions:
- Surgery after CVA associated with high CV risk
- Risk falls over 9 months, biggest drop after first 3 months

Caveats:
- Nonrandomized, observational study

My take-away:
- Delay elective surgery for at least 3 months (up to 9 months) if possible
**Delaying Surgery after Acute MI**

- **30-Day Postop MI**
  - < 30: 35%
  - 31-60: 25%
  - 61-90: 15%
  - 91-180: 10%
  - 181-365: 5%

**Time (days) Between Acute MI & Surgery**

**Conclusions:**
- Surgery within one year of acute MI associated with high risk of postoperative MI
- Risk falls over time, most of the reduction within 2 months
- Trend is similar when only elective surgery considered

**Caveats:**
- Nonrandomized, observational study

**ACC/AHA Guidelines:**
- Delay elective surgery for at least 2 months

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**Surgery After Drug Eluting Stent**

A 75-y.o. man sustains an unstable cervical spine fracture. He had a drug-eluting stent placed 6 months ago for stable angina. The spine surgeon wants to operate, but putting him in a halo vest is a less desirable alternative approach.

**What do you recommend?**
1. Operate now; 6 months is fine
2. Wait 9 months after DES placed
3. Wait 12 months after DES placed

**ACC/AHA Guidelines for PCI**

- Indications for PCI are same as for nonsurgical patients
- Avoid PCI if antiplatelet drugs will need to be held prematurely
- Delay elective surgery after elective PCI:
  - Bare metal stent: 30 days
  - Drug eluting stent: 6 months (optimal)
  - 3 months (if harm in delay)

- Continue or restart antplatelet agents (especially ASA) as soon as possible, unless bleeding risk precludes

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**How Long to Wait after MI?**

- Surgery within one year of acute MI associated with high risk of postoperative MI
- Risk falls over time, most of the reduction within 2 months
- Trend is similar when only elective surgery considered

**Caveats:**
- Nonrandomized, observational study

**ACC/AHA Guidelines:**
- Delay elective surgery for at least 2 months
Managing Perioperative Anticoagulation

Two patients on warfarin therapy are scheduled for elective hip arthropasty. You’re asked whether they should receive perioperative bridging anticoagulation (with enoxaparin):

- One patient has atrial fibrillation due to hypertension
- The other patient has a mechanical AVR
- Neither has any other relevant comorbidity

1. Heparin bridge for AVR only
2. Heparin bridge for AF only
3. Heparin bridge for both
4. Heparin bridge for neither

Benefits & Harm of Bridging Perioperative Anticoagulation

<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>Bridged</th>
<th>No Bridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embolic Event</td>
<td>0.3%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Major Bleeding</td>
<td>3.2%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Minor Bleeding</td>
<td>21%</td>
<td>12%</td>
</tr>
</tbody>
</table>

BRIDGE Trial

Patients:
- 1884 patients on warfarin for atrial fib or flutter
- CHADS-2 score ≥ 1
- Excluded patients with mechanical valve or stroke within 12 weeks and cardiac & neurologic surgery

Intervention:
- Randomized to bridging with LMWH or placebo

Outcome:
- 30-day risk of arterial thromboembolism & bleeding

Douketis JD et al. NEJM, 2015; 373:823-33
BRIDGE Trial for Atrial Fibrillation

Conclusions:
- Bridging did not reduce risk of embolism
- Bridging increases bleeding risk

Caveats:
- Few patients with high CHADS-2 score (mean = 2.3)

My take-away:
- Don’t bridge majority of atrial fibrillation
- Carefully consider bridging if stroke risk is very high (CHADS-2 score 5 or 6, rheumatic atrial fibrillation)

Effect of Mechanical Valve Location & Design on Thromboembolic Risk

Valve Location:
- Aortic: RR = 1.0
- Mitral: RR = 1.8

Valve Design:
- Caged Ball: RR = 1.0
- Tilting Disk: RR = 0.7
- Bi-leaflet: RR = 0.6

What About Mechanical Valves?


Perioperative Anticoagulation:
2012 ACCP Guidelines (9th Edition)

<table>
<thead>
<tr>
<th>CHADS2</th>
<th>Mechanical Valve</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-6</td>
<td>Any MVR; older (caged-ball or tilting disc) AVR; recent CVA</td>
<td>Bridge with heparin</td>
</tr>
<tr>
<td>3-4</td>
<td>Bileaflet AVR plus other stroke risk factor(s)</td>
<td>???</td>
</tr>
<tr>
<td>0-2</td>
<td>Bileaflet AVR without AF or other stroke risk factor</td>
<td>No heparin bridge</td>
</tr>
</tbody>
</table>
**Perioperative Anticoagulation: My Approach after BRIDGE**

<table>
<thead>
<tr>
<th>Atrial Fib.</th>
<th>Mechanical Valve</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHADS2 = 5-6; recent CVA; rheumatic AF</td>
<td>Any MVR; older (caged-ball or tilting disc) AVR; recent CVA</td>
<td><strong>Consider bridging</strong></td>
</tr>
<tr>
<td>CHADS2 = 3-4</td>
<td>Bileaflet AVR plus other stroke risk factor(s)</td>
<td>No bridge</td>
</tr>
<tr>
<td>CHADS2 = 0-2</td>
<td>Bileaflet AVR without AF or other stroke risk factor</td>
<td>No bridge</td>
</tr>
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**How About Venous Clots?**

Retrospective cohort study
- 1178 patients on warfarin for DVT or PE
- Outcome: 30-day recurrent clotting & significant bleeding

<table>
<thead>
<tr>
<th></th>
<th>Bridged</th>
<th>No Bridge</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurrent VTE</td>
<td>0%</td>
<td>0.2%</td>
<td>ns</td>
</tr>
<tr>
<td>Bleeding</td>
<td>2.7%</td>
<td>0.2%</td>
<td>17 (4-75)</td>
</tr>
</tbody>
</table>

Clark NP et al. *JAMA Int Med.* 2015; 175:1163

**What About Venous Clots?**

**Venous Clots: 2012 ACCP Guideline**

<table>
<thead>
<tr>
<th>Risk of Recurrent VTE</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Risk:</strong> VTE &lt; 3 months ago; Severe thrombophilia</td>
<td>Bridge</td>
</tr>
<tr>
<td><strong>Medium Risk:</strong> VTE 3-12 months ago; recurrent VTE; VTE with cancer other thrombophilia</td>
<td>Case-by-case decision</td>
</tr>
<tr>
<td><strong>Low:</strong> Single VTE &gt; 12 months ago</td>
<td>No bridge</td>
</tr>
</tbody>
</table>
Venous Clots: My Approach

<table>
<thead>
<tr>
<th>Risk of Recurrent VTE</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Risk: VTE &lt; 3 months ago; Severe thrombophilia</td>
<td>Consider bridging or IVC filter</td>
</tr>
<tr>
<td>Medium Risk: VTE 3-12 months ago; recurrent VTE; VTE with cancer other thrombophilia</td>
<td>No bridge</td>
</tr>
<tr>
<td>Low: Single VTE &gt; 12 months ago</td>
<td></td>
</tr>
</tbody>
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Estimated & Actual Blood Loss

Estimated Blood Loss (EBL):
- Based on suctioned blood and weight of sponges
- Poor repeatability and inter-observer variability

Actual Blood Loss (ABL):
- Calculated value based on patient’s estimated blood volume and change in hemoglobin level
  \[ ABL = \text{Estimated Blood Volume} \times \Delta \text{Hct} \]
  \[ = \frac{\text{Initial Hct} + \text{Final Hct}}{2} \]

Postoperative Anemia

You visit a 79-year-old woman on postoperative day #1 after hip fracture repair. You notice her hemoglobin dropped from 11.6 g/dL on admission to 8.5 g/dL today. The operative note reports an EBL (estimated blood loss) of 300 mL.

Which of the following actions is most likely to be useful?
1. Order labs to rule out coagulopathy
2. Order labs to rule out hemolysis
3. Recheck CBC; the results are wrong
4. No work-up; the EBL is wrong

EBL versus ABL

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Estimated Blood Loss</th>
<th>Actual Blood Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hip Arthroplasty</td>
<td>362 mL</td>
<td>1383 mL</td>
</tr>
<tr>
<td>Total Knee Arthroplasty</td>
<td>159</td>
<td>1067</td>
</tr>
<tr>
<td>Posterior Spinal Fusion</td>
<td>975</td>
<td>1606</td>
</tr>
<tr>
<td>Retropubic Prostatectomy</td>
<td>1300</td>
<td>1794</td>
</tr>
</tbody>
</table>

Table courtesy Barbara Slawski, MD (Medical College of Wisconsin)
Postoperative Anemia

You visit a 79-year-old woman on postoperative day #1 after hip fracture repair. You notice her hemoglobin dropped from 11.6 g/dL on admission to 8.5 g/dL today. She has no complaints other than moderate hip pain.

When should she receive red blood cell transfusion?

1. Now
2. Now, if she has CV disease
3. Wait until hemoglobin < 8 g/dL
4. Wait until hemoglobin < 7 g/dL

FOCUS* Trial

(*Functional Outcomes in Cardiovascular Patients Undergoing Surgical Hip Fracture Repair)

Patients: 2016 patients undergoing hip fracture repair.
- Mean age = 82
- 63% with CV disease (CAD (40%); CVA (24%); CHF(17%))

Treatment: Randomized to 2 transfusion triggers:
1. Hemoglobin < 10 g/dL
2. Symptoms of anemia (chest pain, CHF, hypotension or tachycardia unresponsive to fluids) or at physician discretion for Hgb < 8 g/dL

FOCUS Trial Results

<table>
<thead>
<tr>
<th></th>
<th>Median PRBC Units Transfused (IQR)</th>
<th>Total Units Transfused</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 g/dL Trigger</td>
<td>2 (1,2)</td>
<td>1866</td>
</tr>
<tr>
<td>Symptomatic Trigger (or 8 g/dL)</td>
<td>0 (0,1)</td>
<td>652</td>
</tr>
</tbody>
</table>

Carson JL et al. NEJM, 2011; 365

FOCUS Trial Results

<table>
<thead>
<tr>
<th></th>
<th>In-hospital mortality</th>
<th>60-day mortality</th>
<th>60-day mortality or disability</th>
<th>3-year mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 g/dL Trigger</td>
<td>2.0%</td>
<td>7.6%</td>
<td>35%</td>
<td>46%</td>
</tr>
<tr>
<td>Symptom Triggered</td>
<td>1.4%</td>
<td>6.5%</td>
<td>35%</td>
<td>45%</td>
</tr>
</tbody>
</table>

Carson JL et al. NEJM, 2011; 365
Carson JL et al. Lancet, 2015; 386
AABB Transfusion Guidelines

The society formerly known as the American Association of Blood Banks:

- “In postoperative surgical patients, transfusion should be considered at a hemoglobin concentration of 8 g/dL or less or for symptoms (chest pain, orthostatic hypotension or tachycardia unresponsive to fluid resuscitation, or congestive heart failure).”  
  Strong recommendation

- Same recommendation if patient has pre-existing CV disease  
  Weak recommendation


Conclusions

- Recent MI & stroke predicts postoperative cardiac events, especially within first 2 (for MI) or 3 (for stroke) months
- While waiting 12 months to go to OR after DES is standard, 6 months may be adequate
- Bridging anticoagulation not indicated for most patients with atrial fibrillation, mechanical valves, or VTE
- Possible exceptions CHADS2 = 5-6, MVR, acute VTE
- They call it an “estimated” blood loss for a reason
- Transfuse after surgery for symptoms (or maybe if hgb > 8)

Thank You

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