Updates and Controversies in Perioperative Medicine

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How long should we delay surgery after:
• Acute myocardial infarction?
• Drug-eluting stent implantation?
• Ischemic stroke?
Which patients need bridging anticoagulation?
Postoperative anemia:
• How much evaluation is needed?
• When should patients be transfused?

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

Question: 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

Delaying Surgery after Acute MI

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 after MI

How Long to Wait after MI?

Surgery After Drug Eluting Stent

A 75-y.o. man sustains an unstable cervical spine fracture. He had a drug-eluting stent placed 3 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; 3 months is fine
2. Wait 6 months after DES placed
3. Wait 12 months after DES placed

Effect of Stent Type & Time After Implantation

Time of surgery after PCI didn’t matter after first 6 months

**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 at least:
  - Bare metal stent: 30 days
  - Drug eluting stent: 6 months (optimal)
    - 3 months (if harm in delay)
- Continue or restart antiplatelet agents (especially ASA) as soon as hemostasis permits

**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

**Question:** How does time between stroke and surgery affect the risk of cardiovascular complications?

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): cardiovascular death, nonfatal MI, ischemic stroke
- Looked at effect of time since stroke on MACE rate

Jørgensen ME et al. JAMA 2014; 312:269-277
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

Managing Perioperative Anticoagulation

Two patients on warfarin therapy are scheduled for elective hip arthroplasty. 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 St. Jude mechanical AVR
- Neither has any other relevant comorbidity

1. Bridge for AVR only
2. Bridge for AF only
3. Bridge for both
4. Bridge for neither

Benefits & Harm of Bridging Perioperative Anticoagulation

| Benefit from thromboembolism averted by bridging | Harm from postoperative bleeding caused by bridging |

BRIDGE Trial

Patients:
- 1884 patients on warfarin for atrial fibrillation
- 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)

BRIDGE Trial

<table>
<thead>
<tr>
<th></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>

Douketis JD et al. NEJM, 2015; 373:823-33

What About Mechanical Valves?

Thromboembolic Risk (annual) vs. Anticoagulation & Warfarin

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

Cannegieter et al. Circulation, 1994

Ansell J. Chest. 2004;126:204S-233S.

<table>
<thead>
<tr>
<th>Atrial Fibrillation</th>
<th>Mechanical Valve</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; = 5-6; recent CVA; rheumatic AF</td>
<td>Any MVR; older (caged-ball or tilting disc) AVR; recent CVA</td>
<td>Bridge with heparin</td>
</tr>
<tr>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; = 3-4</td>
<td>Bileaflet AVR plus other stroke risk factor(s)</td>
<td>???</td>
</tr>
<tr>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; = 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 Trial**

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<td>Any MVR; older (caged-ball or tilting disc) AVR; recent CVA</td>
<td>Consider bridging</td>
</tr>
<tr>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; = 3-4</td>
<td>Bileaflet AVR plus other stroke risk factor(s)</td>
<td>No bridge</td>
</tr>
<tr>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; = 0-2</td>
<td>Bileaflet AVR without AF or other stroke risk factor</td>
<td></td>
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**What 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>Time Since Venous Thromboembolic Event</th>
<th>Recurrent VTE</th>
<th>No Bridge</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 month</td>
<td>0%</td>
<td>0.2%</td>
<td>ns</td>
</tr>
<tr>
<td>2nd &amp; 3rd month</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clark NP et al. *JAMA Int Med.* 2015; 175:1163
How About Venous Clots?

Conclusions:
• Recurrent VTE is rare & bridging didn’t affect risk
• Bridging increases bleeding

Caveats:
• Nonrandomized study, so selection bias
• Few patients were considered high-risk for recurrence

My practice:
• Bridge or place temporary IVC filter only in high-risk group

Venous Clots: 2012 ACCP Guideline

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

Venous Clots: My Approach

<table>
<thead>
<tr>
<th>Risk of Recurrent VTE</th>
<th>Recommendation</th>
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</thead>
<tbody>
<tr>
<td>High Risk:</td>
<td>Consider bridging or IVC filter</td>
</tr>
<tr>
<td>VTE &lt; 3 months ago; Severe thrombophilia</td>
<td></td>
</tr>
<tr>
<td>Medium Risk:</td>
<td>No bridge</td>
</tr>
<tr>
<td>VTE 3-12 months ago; recurrent VTE;</td>
<td></td>
</tr>
<tr>
<td>VTE with cancer other thrombophilia</td>
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<td>Single VTE &gt; 12 months ago</td>
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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 before surgery 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. Labs to rule out coagulopathy
2. Labs to rule out hemolysis
3. CT to rule out retroperitoneal hematoma
4. No work-up; the EBL is wrong
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
  \[
  ABL = \text{Estimated Blood Volume \times A Hct} \div (\text{Initial Hct} + \text{Final Hct})/2
  \]

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 before surgery to 8.5 g/dL today. She has no complaints other than moderate hip pain. Vital signs stable.

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

Carson JL et al. NEJM, 2011; 365
### 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><strong>10 g/dL Trigger</strong></td>
<td>2 (1,2) 1866</td>
<td></td>
</tr>
<tr>
<td><strong>Symptomatic Trigger (or 8 g/dL)</strong></td>
<td>0 (0,1) 652</td>
<td></td>
</tr>
</tbody>
</table>

Carson JL et al. NEJM, 2011; 365

### Conclusions

- Recent MI & stroke predicts postoperative cardiac events, especially within first 2 (for MI) or 3 (for stroke) months
- Wait 6 months after DES implantation before going for elective surgery (3 months if surgery is time-sensitive)
- 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 hemoglobin < 8 g/dL

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**AABB Transfusion Guidelines**

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

“For patients undergoing orthopedic surgery or cardiac surgery and those with preexisting cardiovascular disease, the AABB recommends RBC transfusion threshold of 8 g/dL hemoglobin.”

Strong recommendation, moderate evidence

**JAMA. doi:10.1001/jama.2016.9185**
Thank You

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