UPDATE IN PERIOPERATIVE MEDICINE

Noncardiac elective or semi-elective surgery

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October 2019
Disclosures

- No conflicts of interest
- Liberally used web-based images
- Great material from CCA/ACC

“Now, I can say that I’ve officially seen everything”
Key Updates (4 cases)

1. Anticoagulation
2. Cardiac Risk Stratification
3. Hypertension Meds
4. PCI and Stents
Goals of Perioperative Evaluation

Optimize Perioperative Risk
Identify highest risk periop patients

- 230 Million surgeries worldwide/year
- 3 Million post-op deaths worldwide
- 10 Million Major Adverse Cardiac Events
- 4% surgical death rate @ 7 days (Based on UK data)

- 53 Million US ambulatory procedures
  - Patients driving most complications
  - Serious complication rate unchanged
  - ERAS (enhanced recovery after surgery) has 33% fewer post-op complications (15K, Kaiser)

Perioperative anticoagulation
Perioperative anticoagulation: DOAC?

Factor Xa inhibitors

Factor IIa inhibitors

Vitamin K antagonist
Peri-procedural Major Bleeding Risk

Peri-procedural Thrombotic Risk
Major Bleeding

- Fatal bleed
- Hb ≥ 2g drop or ≥ 2UPRBC
- Needs surgical correction

Perioperative anticoagulation

88yo woman with afib on Xarelto (no prior strokes) has mild bloody stools. CT shows colonic mass, colonoscopy planned in 1 week. VSS. Periop: What shall we do with her rivaroxaban (Xarelto)?

a. Continue rivaroxiban through colonoscopy
b. Stop rivaroxiban 2 days before; bridge with heparin/Imwh
c. Stop rivaroxiban 2 days before; restart after hemostasis
Perioperative anticoagulation

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August 2019

- Prospective Clinical Trial of DOAC cessation
- 23 centers, US/Canada/Europe
- n = 3007, mean age 72yo
- procedures: 1000 ↑ bleeding risk, 2000 ↓ risk
PAUSE: elective surgery, nonvalvular afib

- Interruption and resumption strategy: hold NOACS for 1-4 days
- No bridging

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**Figure. Perioperative Direct Oral Anticoagulant (DOAC) Management Protocol**

<table>
<thead>
<tr>
<th>DOAC</th>
<th>Surgical Procedure-Associated Bleeding Risk</th>
<th>Preoperative DOAC Interruption Schedule</th>
<th>Postoperative DOAC Resumption Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day-5</td>
<td>Day-4</td>
<td>Day-3</td>
</tr>
<tr>
<td>Apixaban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>esonatasae</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CrCl ≥ 50)</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ml/min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>esonatasae</td>
<td>Low</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CrCl &lt; 50)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ml/min²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Duoketis, JAMA Intern Med, August 2019
### PAUSE: 30 day outcomes

<table>
<thead>
<tr>
<th></th>
<th>Bleeding</th>
<th>CVA/MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apixiban</td>
<td>1.4%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Rivaroxiban</td>
<td>1.9%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Dabigitran</td>
<td>0.5%</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

* Bleeding risks almost doubled with high risk procedures

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**Duoketis, JAMA Intern Med 2019**

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PAUSE Study: non-valvular afib

Generally safe to stop NOAC for elective procedures, especially lower risk surgeries.
Perioperative cardiac risk assessment (prevent MACE)
Perioperative cardiac risk assessment

78yo woman with CAD, TIA and OA right hip. Perioperative evaluation for total hip arthroplasty in 2 weeks. VSS, exam consistent with OA.

What is the patient’s perioperative cardiac event risk?

a. <1%
b. 1-5%
c. 5-10%
d. >10%
Perioperative cardiac risk assessment

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d. >10%
3 most common cardiac risk stratification indices

**RCRI**
Developed by Goldman 1977
Updated by Lee 1999, then with more data Duceppe 2017
Most studied!

**NSQIP**
Developed in 2013 with 1.4M patients by Bilimoria, now updated: 4.3M pts

**Gupta/MICA**
Derived from NSQIP database by Gupta in 2011: with 200K patients
Revised Cardiac Risk Index

RCRI doesn’t discriminate well between outcomes in high vs low risk surgical risk

• Sens 65%
• Spec 76%
# Revised Cardiac Risk Index

<table>
<thead>
<tr>
<th>Patient has...</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD</td>
<td>1</td>
</tr>
<tr>
<td>CHF</td>
<td>1</td>
</tr>
<tr>
<td>CVA</td>
<td>1</td>
</tr>
<tr>
<td>DM on Insulin</td>
<td>1</td>
</tr>
<tr>
<td>Has CKD (Cr &gt;2)</td>
<td>1</td>
</tr>
<tr>
<td>High-risk surgery</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RCRI score</th>
<th>MI, cardiac arrest, death within 30 days</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.9%</td>
<td>2.8%-5.4%</td>
</tr>
<tr>
<td>1</td>
<td>6%</td>
<td>4.9%-7.4%</td>
</tr>
<tr>
<td>2</td>
<td>10%</td>
<td>8.1%-12.6%</td>
</tr>
<tr>
<td>≥3</td>
<td>15%</td>
<td>11.1%-20.0%</td>
</tr>
</tbody>
</table>

Our patient  
RCRI = 2  
10% MACE event rate at 30 days

For additional risk stratification, order...

a. EKG  
b. NT Pro-BNP  
c. Echocardiogram  
d. Exercise Stress Test  
e. CT Coronary Angiogram
Our patient
\text{RCRI} = 2 
10\% \text{ MACE event rate at 30 days}

For additional risk stratification, order...

a. EKG
b. \text{NT Pro-BNP}
c. Echocardiogram
d. Exercise Stress Test
e. CT Coronary Angiogram

Rodseth, JACC 2014: (63):2, 170-180
JACC 2014 Meta-analysis

- 2179 patients, 18 studies
- 30d outcomes
  - Cardiac events: 10.8% (Troponin > 0.04)
  - Death: 3% died
RCRI $\geq 1$

NT-proBNP $\geq$

$$300 = 22\% \text{ MACE}$$

death or nonfatal MI at 30 days
aOR 3.4 (2.6-4.5)

Rodseth, JACC 2014: (63):2, 170-180
NT-proBNP ≥

300 = 22% MACE

depth or nonfatal MI at 30 days

If < 300 (or BNP < 92) = 4.7% risk
Order NT-proBNP or BNP if

- RCRI ≥ 1
- Patient > 65yo
- 18-64yo with significant CV dx
Canadian Cardiovascular Society 2017

NT-proBNP ≥ 300

Then, recommend:

- Troponin daily for 48-72hrs
- EKG in PACU
- Consider ERAS/care team management

Blood Pressure Medications
Blood Pressure Medications

74yo woman with HTN, for evaluation of semi-elective leiomyoma resection with bleeding.

Meds: HCTZ, lisinopril, amlodipine.
You recommend...

a. Start metoprolol morning of surgery
b. Hold lisinopril morning of surgery
c. Hold amlodipine morning of surgery
d. Give HCTZ morning of surgery.
Blood Pressure Medications

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- a. Start metoprolol morning of surgery
- b. **Hold lisinopril morning of surgery**
- c. Hold amlodipine morning of surgery
- d. Give HCTZ morning of surgery.
A Systematic Review of Outcomes Associated With Withholding or Continuing Angiotensin-Converting Enzyme Inhibitors and Angiotensin Receptor Blockers Before Noncardiac Surgery

Caryl Hollmann, MBChB, DA(SA), Nicole L. Fernandes, MBChB, DA(SA), and Bruce M. Biccard, MBChB, FCA, PhD

Sept 2018: Systematic Review
• 9 studies: 5 RCT, 4 cohort, n= 6022 patients
• Continued (n=1816) vs stopped ACEI/ARB (n=4206)
Hold ACEI/ARBs to prevent hypotension

Stop ACE/ARB:
- Mortality unchanged OR 0.97 (0.6 - 1.52)
- MACE unchanged OR 1.1 (0.8 -1.52)
- Less hypotension OR 0.6 (0.5 – 0.85)

Recommendation
- Generally hold ACE on day of surgery, but individualize
- Hypotension risk worst on POD1 (may restart afterwards)
Don’t initiate β-blocker (POISE and Bouri)

- increases stroke (1.0% vs 0.5%)
- Increases all cause mortality (3.1% vs 2.3%)
- decreases MI slightly (4.2% vs 5.7%)

Bouri 2014, systematic review (secure trials only shown)

Nonfatal Stroke
N = 5090

Post-op MI
N = 5093

Hypotension
N = 5146
If taking a β-blockers, continue, don’t withdraw

- Retrospective cohort @ SFVA
- 1996-2008, n=12,105

All cause 30-day mortality
continuation:  \( \text{aOR 0.74 (95\% CI, 0.51-1.05)} \)
withdrawal:   \( \text{aOR 3.57 (95\% CI, 2.31-5.52)} \)

1 year mortality
continuation:  \( \text{aOR 0.82 (95\% CI, 0.67 to 1.0)} \)
withdrawal:   \( \text{aOR 1.96 (95\% CI, 1.49 to 2.58)} \)
PCI and Cardiac Stents
PCI and Cardiac Stents

68yo man with CAD s/p DES 6 months ago presents for perioperative evaluation of elective rotator cuff repair next week. Meds: dual antiplatelet therapy (ASA and Plavix) to prevent in-stent rethrombosis. You recommend:

a. Proceed with surgery
b. Delay surgery for 3 months
c. Delay surgery for 6 months
PCI and Cardiac Stents

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a. **Proceed with surgery**

b. Delay surgery for 3 months

c. Delay surgery for 6 months
# Waiting after cardiac arterial intervention

New shorter duration from ACC/AHA

## TABLE 1

<table>
<thead>
<tr>
<th>Type of coronary intervention</th>
<th>Delay for nonurgent surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angioplasty without stenting</td>
<td>14 days$^2$</td>
</tr>
<tr>
<td>Bare-metal stent</td>
<td>30 days$^{16}$</td>
</tr>
<tr>
<td>Drug-eluting stent</td>
<td>Optimal: 6 months$^{16}$</td>
</tr>
<tr>
<td></td>
<td>3–6 months if benefits of surgery outweigh risks of stent thrombosis$^{16}$</td>
</tr>
</tbody>
</table>

From references 2 and 16.
2016 ACC/AHA DAPT recs: PCI and stable ischemic heart disease (SIDH)

Based on:

11 new studies DES + shorter duration DES

1 large RCT patients with MI, one year after ASA or DAPT.
Bottom line

• Wait for at least 6 months for DES if you can – don’t want to thrombose the stent

• If you can’t wait, ortho can operate on antiplatelet therapy (they don’t like it, but they usually can!)

• Neurosurgery or major bleeding may require reversal (with platelet transfusion or ddAVP)
summary
Summary: for elective noncardiac surgeries

1. Generally safe to stop DOACs 1-3 days before surgery
2. If RCRI $\geq 1$, get NT-pro-BNP or BNP
3. If NT-proBNP $\geq 300$: PACU EKG & troponins x 48-72hrs
4. Hold ACE/ARB day of surgery and POD1
5. Don’t stop or newly start beta-blockers before surgery
6. Don’t have to wait as long for DAPT for PCI/stents
Thank you!