PERIOPERATIVE RISK ASSESSMENT FOR THE HOSPITALIST

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Disclosures

■ None
Objectives

- Develop a framework for approaching perioperative cardiac and pulmonary risk assessment before non-cardiac surgery in hospitalized patients
Your patient

Ms. K is a 85 year-old woman who presents with hip fracture after a mechanical ground level fall.

PMH: hypertension, TIA, atrial fibrillation, hyperlipidemia, former tobacco use, and osteoporosis.

She walks short distances with a walker at her assisted living facility.

You are asked to provide a perioperative risk assessment, ie .”clearance.”
The “Art” of Perioperative Medicine

Benefits vs. risks of surgery

Shared decision making

Harms of delaying surgery vs. benefit of further testing
Goals of inpatient perioperative assessment

- Identify & optimize acute conditions that may affect perioperative course
- Recommend delay of surgery, further intervention, or specialty consultation
- Address goals of care
- Communicate with surgeons, anesthesiologists, specialists
- Practice shared decision-making; guide informed consent
PERIOPERATIVE CARDIAC RISK ASSESSMENT
Patient scheduled for surgery with known or risk factors for CAD (Step 1)

Emergency

No

ACS (Step 2)

No

Estimated risk of MACE based on clinical/surgical risk (Step 3)

Elevated risk (Step 5)

Assessment of functional status

Elevated risk

Poor (< 4 METs) or unknown (Step 6)
Will further testing change management?

> 4 METs

Proceed to surgery

Additional testing

No

Proceed to surgery or non-op management

Yes

Proposed cardiac risk assessment prior to urgent surgery

- Determine urgency of surgery
- Presence of active cardiac conditions
- Optimization
- Functional status
- Risk stratification (surgical risk + patient risk factors)
Consider periop Cardiology consult for  
1. Recent PCI (<3-6 months)  
2. Severe valve disease  
3. Acute coronary syndrome

- Emergency surgery: yes → GO!  
  no → History, physical, labs, EKG

- History, physical, labs, EKG: yes → Manage condition as appropriate  
  Risk stratification  
  Discuss with surgeons and anesthesia  
  no → Active cardiac conditions

- Active cardiac conditions: yes → GO!  
  no → Functional status > 4 METs

- Functional status > 4 METs: yes → GO!  
  no → Risk stratification

- Risk stratification: Elevated risk → Shared decision making  
  Lower risk → GO!

- Medically stable, informed consent &/or consensus risks vs. benefits: yes → GO!  
  no → Non-op
Urgency of surgery

- **Emergent**: Life or limb threat if no surgery < 6 hours
- **Urgent**: Surgery required within 6 - 24 hours
- **Time-sensitive**: Surgery required within 6 weeks
- **Elective**: Surgery could be delayed for 1 year without harm

Active Cardiac Conditions

- Acute coronary syndrome (ACS)
- Severe valvular disease
  - Severe aortic stenosis
- Decompensated heart failure
- Unstable arrhythmia
- Recent percutaneous coronary intervention (PCI)
Functional status

- Self-reported low exercise tolerance associated with higher risk of periop complications\(^1\)

- Low peak O2 consumption (VO2) on cardiopulmonary testing has been associated with risk of general periop complications\(^2\)

- Duke Activity Status Index (DASI) recently shown to help predict cardiac complications\(^2\)

**Functional Status**

<table>
<thead>
<tr>
<th>METs</th>
<th>Activity Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Watching television</td>
</tr>
<tr>
<td></td>
<td>Eating, dressing, cooking, using the toilet</td>
</tr>
<tr>
<td></td>
<td>Walking 1-2 blocks on level ground</td>
</tr>
<tr>
<td></td>
<td>Doing light housework</td>
</tr>
<tr>
<td>4</td>
<td>Climbing a flight of stairs</td>
</tr>
<tr>
<td></td>
<td>Walking on level ground at 4 miles per hour</td>
</tr>
<tr>
<td></td>
<td>Running a short distance</td>
</tr>
<tr>
<td></td>
<td>Doing heavy chores around the house</td>
</tr>
<tr>
<td></td>
<td>Playing moderately strenuous sports</td>
</tr>
<tr>
<td>&gt;10</td>
<td>Playing strenuous sports (tennis, basketball)</td>
</tr>
</tbody>
</table>

**Categories:**
- **Poor**
- **Good**
- **Excellent**
# Duke Activity Status Index (DASI)

<table>
<thead>
<tr>
<th>Item</th>
<th>Activity</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Can you take care of yourself (eating, dressing, bathing or using the toilet)?</td>
<td>2.75</td>
</tr>
<tr>
<td>2</td>
<td>Can you walk indoors, such as around your house?</td>
<td>1.75</td>
</tr>
<tr>
<td>3</td>
<td>Can you walk a block or two on level ground?</td>
<td>2.75</td>
</tr>
<tr>
<td>4</td>
<td>Can you climb a flight of stairs or walk up a hill?</td>
<td>5.50</td>
</tr>
<tr>
<td>5</td>
<td>Can you run a short distance?</td>
<td>8.00</td>
</tr>
<tr>
<td>6</td>
<td>Can you do light work around the house like dusting or washing dishes?</td>
<td>2.70</td>
</tr>
<tr>
<td>7</td>
<td>Can you do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?</td>
<td>3.50</td>
</tr>
<tr>
<td>8</td>
<td>Can you do heavy work around the house like scrubbing floors, or lifting and moving heavy furniture?</td>
<td>8.00</td>
</tr>
<tr>
<td>9</td>
<td>Can you do yardwork like raking leaves, weeding or pushing a power mower?</td>
<td>4.50</td>
</tr>
<tr>
<td>10</td>
<td>Can you have sexual relations?</td>
<td>5.25</td>
</tr>
<tr>
<td>11</td>
<td>Can you participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?</td>
<td>6.00</td>
</tr>
<tr>
<td>12</td>
<td>Can you participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?</td>
<td>7.50</td>
</tr>
</tbody>
</table>

Hlatky MA, et al.. Am J Cardiol. 1989; 64(10):651-4
Risk Stratification

Combined surgical and patient risk factors to predict major adverse cardiac events (MACE)*

- Low risk (< 1% MACE)
- Elevated risk (> 1% MACE)

* MACE = ACS, MI, HF, unstable arrhythmia, death

Surgery-related risk

- **Low risk**
  - Breast surgery
  - Dermatologic surgery
  - Ophthalmologic surgery
  - Dental/oral surgery
  - Endoscopy
  - Angiography

- **Elevated risk**
  - Vascular surgery
  - Intraperitoneal surgery
  - Thoracic surgery
  - Head & neck surgery
  - Orthopedic surgery
  - Prostate surgery

Clinical cardiac risk stratification tools

- Revised Cardiac Risk Index (RCRI) score
- MICA (Myocardial infarction and cardiac arrest) risk calculator
- ACS NSQIP Surgical Risk Calculator

# RCRI score

<table>
<thead>
<tr>
<th>Point</th>
<th>Risk factor</th>
<th>Odds Ratio (OR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>History of CHF</td>
<td>4.3</td>
</tr>
<tr>
<td>1</td>
<td>Known CAD</td>
<td>3.8</td>
</tr>
<tr>
<td>1</td>
<td>History of TIA/CVA</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>DM on insulin</td>
<td>2.6</td>
</tr>
<tr>
<td>1</td>
<td>Renal insufficiency</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>(Cr&gt;2.0)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>High risk surgery</td>
<td>0.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># of Risk Factors</th>
<th>% Major Cardiac Complications*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.4 (0.05-1.5)</td>
</tr>
<tr>
<td>1</td>
<td>0.9 (0.3-2.1)</td>
</tr>
<tr>
<td>2</td>
<td>6.6 (3.9-10.3)</td>
</tr>
<tr>
<td>&gt;3</td>
<td>11 (5.8-18.4)</td>
</tr>
</tbody>
</table>

* Major Cardiac Complications = MI, cardiac arrest, pulmonary edema, heart block

MICA Risk Calculator

Age
ASA Class (1-5)
Type of Surgery (21 options)
Functional status
(totally independent, partially dependent, totally dependent)
Creatinine (1.5)

https://qxmd.com/calculate/calculator_245/gupta-perioperative-cardiac-risk

ACS NSQIP Risk Calculator

http://www.riskcalculator.facs.org/

## ACS NSQIP Risk Calculator

**Procedure:** 27294 - Open treatment of hip dislocation, traumatic, with acetabular wall and femoral head fracture, with or without internal or external fixation

**Risk Factors:** 75-84 years, Partially dependent functional status, Mild systemic disease, HTN

### Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Your Risk</th>
<th>Average Risk</th>
<th>Chance of Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serious Complication</td>
<td>9.6%</td>
<td>11.5%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Any Complication</td>
<td>9.9%</td>
<td>11.0%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>0.9%</td>
<td>1.4%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Cardiac Complication</td>
<td>0.5%</td>
<td>1.1%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Surgical Site Infection</td>
<td>0.6%</td>
<td>0.7%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Urinary Tract Infection</td>
<td>3.8%</td>
<td>3.4%</td>
<td>Average</td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>1.9%</td>
<td>2.0%</td>
<td>Average</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>0.1%</td>
<td>0.3%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Readmission</td>
<td>8.0%</td>
<td>8.2%</td>
<td>Average</td>
</tr>
<tr>
<td>Return to OR</td>
<td>1.5%</td>
<td>1.8%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Death</td>
<td>0.5%</td>
<td>1.4%</td>
<td>Below Average</td>
</tr>
<tr>
<td>Discharge to Nursing or Rehab Facility</td>
<td>73.9%</td>
<td>80.0%</td>
<td>Average</td>
</tr>
<tr>
<td>Sepsis</td>
<td>0.7%</td>
<td>0.6%</td>
<td>Above Average</td>
</tr>
</tbody>
</table>

**Predicted Length of Hospital Stay:** 4 days

http://www.riskcalculator.facs.org/

Your patient

RCRI score 1 - 0.4% risk of major cardiac issues

MICA risk calculator – 0.81% risk of MI, cardiac arrest

ACS NSQIP – 0.5% risk of cardiac complications
The use of risk calculators

- Serve as decision aids
- Based on specific surgical populations vs. individual patient level
- Exclude clinically important issues (ie. AS, arrhythmia, acute cardiac conditions)
- Should not replace clinical evaluation or judgement
Patients who (generally) do not require more cardiac testing:

- Emergency surgery
- Low risk surgery
- No active cardiac conditions
- Good exercise tolerance
Recommendations for pre-operative echocardiogram

• Obtain when moderate to severe valvular stenosis or regurgitation is suspected or change in symptoms or exam if known valve disease

• If severe valve disease, is pre-op valve repair or replacement indicated?
  • If no, then targeted hemodynamic and fluid management and close post-op monitoring

Recommendations for pre-operative stress testing and cardiac catheterization

• Stress testing generally reserved for ACS or evaluation of angina

• Preoperative revascularization should be performed only if pre-existing indication for revascularization

Pre-op cardiac revascularization – CARP trial

Surgical delay: 54 days vs. 18 days $p<0.001$)

Perioperative Pulmonary Risk Assessment
Perioperative Pulmonary Complications

- Postoperative pulmonary complications are common
- Associated with higher readmission risk, morbidity, and mortality than cardiac complications $^{1,2}$
- There are several risk assessment tools available
- Airway assessment by Anesthesia plays a large role

Acute pulmonary conditions

- Identifying and managing acute pulmonary conditions is vital
  - Wheezing, bronchospasm
  - Large pleural effusions that may affect ventilation
  - Pulmonary edema
  - Hypercapnia
  - Pneumonia
## ARISCAT risk tool

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yrs)</strong></td>
<td></td>
</tr>
<tr>
<td>51-80</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 80</td>
<td>16</td>
</tr>
<tr>
<td><strong>Preop Spo2 (%)</strong></td>
<td></td>
</tr>
<tr>
<td>91-95%</td>
<td>8</td>
</tr>
<tr>
<td>&lt; 91</td>
<td>24</td>
</tr>
<tr>
<td><strong>Respiratory infection in past month</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>Location of surgery</strong></td>
<td></td>
</tr>
<tr>
<td>Upper abdominal</td>
<td>15</td>
</tr>
<tr>
<td>Thoracic</td>
<td>24</td>
</tr>
<tr>
<td><strong>Duration of surgery</strong></td>
<td></td>
</tr>
<tr>
<td>&gt; 2 to 3</td>
<td>16</td>
</tr>
<tr>
<td>&gt; 3</td>
<td>23</td>
</tr>
<tr>
<td><strong>Emergency Surgery</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>Preop Hgb &lt;10 g/dL</strong></td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Class</th>
<th>Risk Score</th>
<th>PPCs (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt; 26</td>
<td>1.6-3.4</td>
</tr>
<tr>
<td>Intermediate</td>
<td>26-44</td>
<td>13-13.3</td>
</tr>
<tr>
<td>High</td>
<td>&gt; 44</td>
<td>38-42.1</td>
</tr>
</tbody>
</table>

Pulmonary Hypertension (PH)

- Moderate to severe pulmonary HTN associated with 7-18% periop mortality after non-cardiac surgery

- Presence of severe pulmonary HTN requires careful assessment of risks vs. benefits of surgery

Obstructive sleep apnea (OSA)

- OSA associated with ↑ periop complications of multiple types
- Clinical screening tools (ie. STOP-BANG) can help identify high risk patients pre-op
- STOP-BANG ≥ 5 = ↑ complications

S – Snoring
T – Tiredness
O – Observed apnea
P – Hypertension (Pressure)
B – BMI>35
A – Age > 50
N – Neck >40cm
G – Male Gender
Perioperative management of patients with OSA

- Non-opiate analgesics, as able
- Head of bed > 30 immediately post-op
- Home CPAP or auto-CPAP if significant hypoxemia or obstruction
- Consider supplemental O2
  - Shown to improve hypoxemia; though may increase the duration of apnea-hypopnea events\(^1\)

Consideration of anesthesia technique

- Local, regional, or neuraxial anesthesia may be preferred if desire to avoid intubation or perioperative respiratory depression
  - Severe COPD or asthma
  - OSA, obesity hypoventilation (OHV)
  - Advanced age
  - Pulmonary hypertension
- GA preferred if patient unable to lay flat without dyspnea or with cough
Take Home Points

• Cardiac and pulmonary risk assessment prior to urgent surgery should focus on evaluation of active/acute cardiac conditions

• Functional status assessment is a vital component of cardiac evaluation

• Available risk tools may be helpful in shared decision making, but also may be of limited utility prior to urgent surgery

• Severe pulmonary hypertension and moderate-severe OSA should be identified to help address periop management
QUESTIONS?
References


- Cohn SL. Updated guidelines on cardiovascular evaluation before noncardiac surgery: A view from the trenches. CCJM 2014 Dec; 81(12):742-751


