Preoperative Evaluation of Patients Undergoing Elective Non-cardiac Surgery

Renée Gabree, MSN, RN, FNP-BC
Elliot Hospital Pre-Surgical Testing
Clinical Lead
RGabree@Elliot-hs.org
Disclosures

I have nothing to disclose.
Objectives

- Introduce ACC/AHA guidelines for assessment of perioperative cardiac risk
- Discuss and compare cardiac risk screening tools (RCRI, Gupta, ACS Surgical Risk Calculator)
- Discuss step wise approach to determining if a patient is optimized for noncardiac surgery
- Preop testing
  - Labs, EKG, U/A & CXR
- Considerations for patients with cardiac stents undergoing surgery
- Perioperative anticoagulant/antiplatelet therapy management
  - ASRA guidelines
- Perioperative medication management
Why have a preop evaluation?

• Serves as an opportunity to review medical, surgical and anesthesia history in order to identify any area’s that can be optimized prior to surgery in order to make the operation as safe as possible for the patient and avoid last minute cancellations or delays on DOS.

• Identify untreated conditions (new diabetes, HTN) that can be addressed prior to surgery

• Identify issues that could require surgery to be postponed until evaluated/treated (PNA, uncontrolled DM or new arrhythmia)

• Assess functional capacity which is one of the most predictive tools for perioperative and postop complications

• Communication with surgeon, anesthesia, nursing team
## Surgical Risk by Procedure

<table>
<thead>
<tr>
<th>Low Risk &lt;1%</th>
<th>Intermediate Risk 1-5%</th>
<th>High Risk &gt;5%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Superficial surgeries</strong>&lt;br&gt;Minor GYN</td>
<td>CEA&lt;br&gt;Endovascular aneurysm repair</td>
<td>Aortic, major vascular or peripheral vascular surgery</td>
</tr>
<tr>
<td><strong>Cataract</strong>&lt;br&gt;Dental&lt;br&gt;Breast</td>
<td>Major orthopedic surgery&lt;br&gt;Urologic/ GYN&lt;br&gt;Head/Neck</td>
<td>Major abd surgery, prolonged procedures w/ large fluid shifts/blood loss</td>
</tr>
<tr>
<td><strong>Endoscopic or minor urologic</strong>&lt;br&gt;(TURP)</td>
<td>Intraperitoneal</td>
<td>Esophagectomy</td>
</tr>
</tbody>
</table>

Cohn, S. 2016
# ASA Classification

<table>
<thead>
<tr>
<th>ASA Classification</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA I</td>
<td>Healthy patient</td>
</tr>
<tr>
<td>ASA II</td>
<td>Mild systemic disease</td>
</tr>
<tr>
<td>ASA III</td>
<td>Severe systemic disease</td>
</tr>
<tr>
<td>ASA IV</td>
<td>Severe systemic disease that is a constant threat to life</td>
</tr>
<tr>
<td>ASA V</td>
<td>Moribund patient not expected to survive without surgery</td>
</tr>
</tbody>
</table>
ACC/AHA Guidelines

• 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

• A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

ACC/AHA Stepwise Approach to Perioperative Cardiac Assessment
ACC/AHA Guidelines

• ACC/AHA has released clinical practice guidelines addressing management of:
  • valvular heart disease • 2014
  • Afib • 2014
  • Heart failure • 2013
• A statement for perioperative management of patients with implantable defibrillators, pacemakers and arrhythmia monitors
  • 2011 Heart Rhythm Society (HRS)/ASA
• Focused update on duration of dual antiplatelet therapy in patients with CAD
  • 2016 ACC/AHA

Fleisher LA et al. JACC 2014, 64(22) e77-137.
Risk Calculators

• Clinical practice guidelines recommend the use of one of the following calculators:
  • RCRI
  • Gupta MICA (Myocardial Infarction or Cardiac Arrest)
  • ACS NSQIP (American College of Surgeons National Surgical Quality Improvement Program)
Revised Cardiac Risk Index (RCRI)

• Widely regarded useful tool for assessing patient risk of MACE (major adverse cardiac event).

• Developed in 1977 by Goldman et al, who identified 9 variables associated with increased risk of cardiac complications. Later known as the Original Cardiac Risk Index or Goldman Index.

• 1999 Lee et al. published a cardiac risk index identifying 6 variables that predicted increased risk of cardiac complications.

• This is the tool that remains in use today.
Revised Cardiac Risk Index

**SIX independent predictors, 1999**

<table>
<thead>
<tr>
<th>Clinical variable</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-risk surgery</td>
<td>1</td>
</tr>
<tr>
<td>H/o Ischemic heart disease</td>
<td>1</td>
</tr>
<tr>
<td>H/o Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>H/o cerebrovascular disease</td>
<td>1</td>
</tr>
<tr>
<td>Insulin treatment for diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td>Pre-operative serum creatinine level &gt;2.0 mg/dl (180 mcg/mol/L)</td>
<td>1</td>
</tr>
</tbody>
</table>

**Interpretation of risk score**

<table>
<thead>
<tr>
<th>Risk class</th>
<th>Points</th>
<th>Risks of complications (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Very low</td>
<td>0</td>
<td>0.4 %</td>
</tr>
<tr>
<td>II. Low</td>
<td>1</td>
<td>0.9 %</td>
</tr>
<tr>
<td>III. Moderate</td>
<td>2</td>
<td>7.0 %</td>
</tr>
<tr>
<td>IV. High</td>
<td>3+</td>
<td>11.0 %</td>
</tr>
</tbody>
</table>
RCRI Breakdown

- High risk surgical procedures
  - Intraperitoneal, intrathoracic and major vascular
- History of ischemic heart disease
  - History of MI, positive stress test, current complaints of chest pain considered secondary to ischemia, use of nitrates or ECG with pathological Q waves
- History of heart failure
  - Pulmonary edema, PND, rales on exam or chest x-ray showing pulmonary vascular redistribution
- History of cerebrovascular disease (TIA/CVA)
- Diabetes that requires treatment with insulin
- Preoperative serum creatinine greater than 2.0 mg/dL
RCRI Pro’s & Con’s

• Validated
• Easy to use
• Separates high vs low risk patients

• Intended for use on intermediate/high risk surgical procedures with LOS expected >2 days
• If used on patient’s having ambulatory surgery or low risk surgery the risk is overstated
• Underestimates risk in vascular surgery (AAA)
• Does not take functional capacity into account

Gupta MICA Perioperative Cardiac Risk

- Risk model developed based on 5 factors:
- Variables entered into an online calculator – (QxMD)
  - Type of surgery
  - Dependent functional status
    - Independent, partially dependent or totally dependent
  - Abnormal creatinine
    - ≥ 1.5 mg/dL
    - < 1.5 mg/dL
    - Creatinine unknown
  - ASA class
    - 1-5
  - Increased age

ACS NSQIP Surgical Risk Calculator

Patient characteristics are input into an online calculator and at the end results are broken down into categories with the patient risk, average risk and chance of outcome as well as predicted length of hospital stay.
ACS NSQIP risk calculator results

The result shows the patient’s risk of having any of 14 different complications with the first 30 days postoperatively.
ACS NSQIP Pro’s & Con’s

• Includes operations across multiple specialties
• Includes surgeon adjustment scores to modify risk estimates
• Visual aides to help patient/families understand

• Need a computer or smartphone to use
• Lengthy data entry
• Underestimated risk for moderate risk patients (but recalibrated recently)
• Limited by narrow definition of adverse major cardiac events


Statistical Comparison of tools

- RCRI
  - C-stat = 0.747
- Gupta MICA
  - C-stat = 0.874
- ACS Surgical Risk Calculator
  - C-stat = 0.895

C-stat: gives a general idea about how good a model is
- Value < .5 = very poor model
- Value .5 = no better predicting outcome than random chance
- Value > .7 = good
- Value > .8 = very strong model
- Value of 1 means that the model perfectly predicts who will experience a particular outcome.

Is the Patient Optimized?

• Look at chronic conditions systematically and how well they are managed
  • HTN

• Lung disease
  • ? Recent exacerbations/steroid use.
  • PFT’s before high risk or thoracic surgery
  • If severe disease consider pulm preop eval

• Diabetes
  • Should be controlled
  • Studies have shown A1c >7.0 carries increased mortality

• CAD
  • ? Recent/past interventions
  • ? New sx
  • Have they seen cardiology recently
    • May need preop cardiology eval
Cardiac Risk Assessment

• Patients with risk of MACE <1% (RCRI score of 0-1) further testing is unlikely to change management and they can proceed with surgery.

• Patients with risk of MACE >1%
  • Assess functional capacity.
  • If they can achieve at least 4 METs (walk 4 blocks, climb 2 flights of stairs at any speed) they can proceed with surgery with acceptable risk.
  • Cardiac stress from anesthesia is the equivalent of 4 METs.
  • Ability to achieve 4 METs has been associated with low MACE risk.
Determining Functional Capacity

• METs (metabolic equivalents)
  • >10 = excellent functional capacity
    • Racquetball singles, fast running or swimming
  • 7-10 = good capacity
    • Jogging or skiing
  • 4-6 = moderate
    • Bicycling, tennis singles, climbing stairs
  • <4 = poor
    • Walking or yard work
Poor Functional Capacity

• If the patient is unable to achieve 4 METs or you are unable to calculate METs then you may need to consider additional testing.
• This depends on the surgical risk: low, intermediate or high.
• Will further testing change the management?
  • The most updated literature reveals that coronary revascularization in an asymptomatic patient prior to surgery does not necessarily improve outcomes.
Pulmonary Risk Assessment

• 3 things to consider:
  • General risk
  • Airway
  • OSA risk

• ARISCAT Index
  • Breaks down risk into low, intermediate and high
  • Easy to use/score
  • Outcomes only measured out 7 days post-op

ARISCAT Index

ARISCAT – Using the Model

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Multivariate Analysis OR</th>
<th>Risk score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 51-80</td>
<td>1.4</td>
<td>3</td>
</tr>
<tr>
<td>Age &gt;80</td>
<td>5.1</td>
<td>16</td>
</tr>
<tr>
<td>Preop SpO2 91-95</td>
<td>2.2</td>
<td>8</td>
</tr>
<tr>
<td>Preop SpO2 &lt;= 90</td>
<td>10.7</td>
<td>24</td>
</tr>
<tr>
<td>Resp infection w/in 1mo</td>
<td>5.5</td>
<td>17</td>
</tr>
<tr>
<td>Preop hemoglobin &lt;=10</td>
<td>3.0</td>
<td>11</td>
</tr>
<tr>
<td>Upper abdominal incision</td>
<td>4.4</td>
<td>15</td>
</tr>
<tr>
<td>Intrathoracic incision</td>
<td>11.4</td>
<td>24</td>
</tr>
<tr>
<td>Surgery &gt;2-3 hrs</td>
<td>4.9</td>
<td>16</td>
</tr>
<tr>
<td>Surgery &gt;3 hrs</td>
<td>9.7</td>
<td>23</td>
</tr>
<tr>
<td>Emergency procedure</td>
<td>2.2</td>
<td>8</td>
</tr>
</tbody>
</table>

Risk category | PPC rate
--- | ---
Low risk <26 points | 1.0%
Intermediate risk 26-44 points | 13.3%
High risk 45 points | 42.1%
Pulmonary Risk Assessment

- Airway assessment
  - Predictors of difficult ventilation
    - Beard, BMI >26, age>55, edentulous and snoring
  - OSA
    - STOP-Bang score ≥5 patient at increased risk of moderate/severe sleep apnea
    - Further evaluation is indicated before surgery if patient has a STOP-Bang score ≥5 WITH uncontrolled systemic condition OR ≥3 with hypercarbia

Pfeifer, K. 2019 Perioperative Pulmonary Risk Assessment and Management. Perioperative Medicine Summit. Lecture conducted from Orlando, FL
STOP-Bang Questionnaire

Please answer the following questions by checking "yes" or "no" for each one:

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snoring (Do you snore loudly?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tiredness (Do you often feel tired, fatigued, or sleepy during the daytime?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obstructed Apnea (Has anyone observed that you stop breathing, or choke or gasp during your sleep?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Blood Pressure (Do you have or are you being treated for high blood pressure?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI (Is your body mass index more than 35 kg per m²?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (Are you older than 50 years?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck Circumference (Is your neck circumference greater than 40 cm [15.75 inches]?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender (Are you male?)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Score 1 point for each positive response.

Scoring interpretation: 0 to 2 = low risk, 3 or 4 = intermediate risk, ≥ 5 = high risk.
Case Study 1

Patient Presentation

- 75-year-old female with history of CVA/TIA, IDDM and hyperlipidemia seen for preoperative evaluation prior to elective right TKA.
- Limited by pain and is unable to walk any long distance other than around her home. Reports she’s able to climb “a few stairs” without chest pain, pressure. Mildly SOB.
- EKG revealed new T-wave abnormalities in lateral leads.
- RCRI score is 2 = 6.6% or intermediate risk
- She was referred for stress test & cardiology risk stratification.
- Stress test came back abnormal.
- Cath revealed multi-vessel disease and she ultimately required a CABG.
- She did well and once fully recovered was rescheduled for her knee surgery.

2014 ACC/AHA Step Wise Approach to Perioperative Cardiac Assessment for CAD
"Off hand, I'd say you're suffering from an arrow through your head, but just to play it safe, I'm ordering a bunch of tests."
Preop Testing

• Test with purpose
• No testing recommended for low risk procedures (eg, cataract)
• EKG
  • Recommended for patients having high risk procedures or intermediate risk procedures WITH additional risk factors. Not recommended for low risk procedures
  • Reasonable for patients with known CAD, structural heart disease
    • ACC/AHA guideline
  • Normal ECG adds little to the preop evaluation and does not usually change anesthetic management
• Urine culture
  • Recent literature discourages treatment of asymptomatic bacteriuria for patients having total joint replacements
  • No recommendation to obtain urine cultures preoperatively in asymptomatic patients unless undergoing urologic procedure (with instrumentation or TURP d/t high rate of postop sepsis/bacteremia)
  • Infectious Disease Society of America (IDSA) recommends screening urine cultures only in pregnant women or patients having urologic procedures

Lamb MJ et al. Clinical Infectious Disease 2017; 64(6) 806-9
Zhang, Q et al. Medicine 2018; 97:7 (e9810)
Preop Testing

• CXR
  • Recommended for patients with new/active symptoms or having cardiothoracic or thoracic surgery (upper abdominal, thoracic or AAA surgery) and over age 50.

• HgbA1c
  • Within 3 months if diabetic

• H&H
  • Anemia/recent bleeding

• WBC
  • Infection
  • History of myeloproliferative/suppressive disease

Pfeifer, K. 2018
Testing Continued

- Platelet count
  - Bleeding history, liver disease (cirrhosis), cardiac or neurosurgery
- BMP
  - Medications affecting electrolytes (ACE-I, diuretics), diabetics, hx of kidney or cardiovascular disease
- Coags
  - Bleeding history, liver disease, neuro or cardiac surgery, warfarin use

Test results obtained within 6 months of surgery are generally acceptable if no significant change in patients clinical status.
Case study 2

- 75 y/o female preop for THA
- PMH: CAD/MI, OA and glaucoma
- HH and Plt ct noted to be elevated in 2014 – no repeat labs since
- CBC at preop visit
  - HH 18.7/56.3
  - Plt ct 819
- Referred to Heme
  - Diagnosed with polycythemia vera
  - Began therapeutic phlebotomy and hydroxyurea
- Surgery postponed until blood counts improved
Antiplatelet therapy

• Patients with history of previous coronary intervention continue ASA perioperatively (Unless having surgery were bleeding would be catastrophic).
• Patients on aspirin for primary prophylaxis should hold 7 days prior to surgery.
• Plavix
  • 5-7 day hold depending on type of surgery & anesthesia (GA vs spinal)
  • 2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with CAD
    • SIHD on DAPT after BMS: P2y12 inhibitor (clopidogrel) minimum of 30 days
    • SIHD on DAPT after DES: clopidogrel optimally 6 months. Can be considered after 3 months if further delay of surgery>than risk of stent thrombosis
• Involve the cardiologist & surgeon to weigh benefit/risk if needs to be interrupted

Figure 6. Treatment Algorithm for the Timing of Elective Noncardiac Surgery in Patients With Coronary Stents
Anticoagulation Risk Stratification

- **High Risk:**
  - Any mitral valve prosthesis, caged ball/titling disc aortic valve prosthesis
  - CHADS 5-6, CVA/TIA w/in 3 months or Rheumatic heart disease
  - Recent VTE (w/in 3 months), severe thrombophilia
    - Bridge w/ heparin or LMWH

- **Moderate Risk:**
  - Bileaflet aortic valve prosthesis + hx afib, CVA/TIA, HTN, DM, HF, age >75
  - CHADS 3-4
  - VTE w/in 3-12 months, non severe thrombophilia, recurrent VTE, active cancer
    - Bridging on case by case basis

- **Low Risk:**
  - Bileaflet aortic valve prosthesis without other risk factors, CHADS 0-2, VTE >12 months ago
  - No bridge

Rechenmacher SJ & Fang, JC JACC 2015; 66(12): 1392-1403
Perioperative Medication Management

- **Statins:**
  - Class I recommendation to continue in patients currently taking them.
  - Class IIa recommendation to initiate in patients undergoing vascular surgery.

- **ACE/ARB:**
  - Continuing perioperatively is reasonable (Class IIa, Level B).
  - Holding before surgery is reasonable and restart when clinically feasible postoperatively (Class IIa, Level C).

- **Beta Blockers:**
  - Class I: should be continued in patients undergoing surgery are already taking them.

Fleisher LA, et al. *Journal of the American College of Cardiology* 2014; 64e77.
Considerations for the Anesthesiologist

- **Hx of OSA:** Bring CPAP/Bipap
- **Insulin pumps:** Periop management plan from patients endocrinologist
- **Copy of PFT (if available)** in patients with hx of lung disease
- **Recent or long term steroid use**
  - These patients often require stress dose steroids
- **Hx of difficult intubation or other anesthesia complications**
  - malignant hyperthermia, pseudocholinesterase deficiency
Take Home Points

• Do not perform testing that you would not normally do solely because the patient is having surgery
  • Have a plan for what you will do with the results
• Communicate with surgeon/specialists/anesthesiologists to ensure solid perioperative plan of care
• Involve the patient and explain why testing/labs are being ordered
Helpful Sources & Sites

• ACC/AHA guidelines and focused updates found online at www.acc.org/guidelines
• Guide to Preoperative Evaluation https://www.preopevalguide.com
• Choosing Wisely http://www.choosingwisely.org
• ASRA (online or mobile app)
  • Useful for anticoagulation/antiplatelet therapy interruption prior to spinal anesthesia/blocks
References

• Cohn, S. (2019, Feb). Preoperative cardiac risk calculators. Perioperative Medicine Summit. Lecture conducted from Orlando, FL.
References Con’t