Preoperative Evaluation and Perioperative Medical Management in the Surgical Patient

JEREMIAH S. RUTHERFORD, MD, FACP
Disclosures

I have no actual or potential conflicts of interest in relation to this program/presentation.
Objectives
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- Understand how to conduct a preoperative medical assessment (medical clearance) on the non-cardiac surgical patient.
- Understand the appropriate utilization of preoperative testing.
- Know how to advise surgeons and patients on perioperative medical needs (i.e. who needs beta blockers, antibiotics, etc.).
- Recognize common postoperative complications.
Mr. Kneeoutawack is a 68 year-old man with a past medical history of hypertension, dyslipidemia, type 2 diabetes mellitus, and osteoarthritis of the right knee who presents to your office at the request of his orthopedist. The patient is scheduled to undergo right total knee arthroplasty by Dr. Bones in 2 weeks, and Dr. Bones has asked that you “clear” the patient for surgery. The patient will be receiving general anesthesia during the procedure.
Purpose of the Preoperative Medical Assessment
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- Determine overall risk of surgery.
  - First, do no harm?
  - Are there other options to solve the patient’s problem other than surgery?
- Determine if additional testing will be needed to establish risk.
- Make recommendations to both the patient and surgeon on how to mitigate surgical risk.
- Medically *optimize* the patient for the planned procedure.
- Provide the surgeon with pre and post-operative medical recommendations to ensure the patient will do well.
“The key to optimal management is communication among all the relevant parties (i.e. surgeon, anesthesiologist, primary caregiver, and consultants) and the patient.”
Emergency Procedure
- Life or limb is threatened if not in the operating room, typically in less than 6 hours.

Urgent Procedure
- Life or limb is threatened if not in the operating room, typically between 6-24 hours.

Time-sensitive Procedure
- A delay of 1-6 weeks can be allowed.

Elective Procedure
- May be delayed up to one year.
Definitions

- Low Risk Procedure
  - Combined surgical and patient characteristics predict a risk of major adverse cardiac event (MACE) of death or myocardial infarction (MI) of less than 1%.

- Elevated Risk Procedure
  - Combined surgical and patient characteristics predict a risk of MACE of death or MI of greater than 1%.
American Society of Anesthesiologist (ASA) Physical Status Classification

- **ASA Class 1:** Normal healthy
  - No organic, physiologic, or psychiatric disturbance
  - Excludes the very young and very old

- **ASA Class 2:** Patient with mild systemic disease
  - No functional limitations
  - Well controlled disease of one body system
    - Controlled HTN or DM without systemic affects
    - Cigarette smoking without COPD
    - Mild obesity
    - Pregnancy
American Society of Anesthesiologist (ASA) Physical Status Classification

- ASA Class 3: Patient with severe systemic disease
  - Some functional limitation
  - Controlled disease of more than one body system or one major system
  - No immediate danger of death
    - Controlled CHF
    - Stable angina
    - Old MI
    - Poorly controlled HTN
    - Morbid Obesity
    - Chronic renal failure
    - COPD with intermittent symptoms
American Society of Anesthesiologist (ASA) Physical Status Classification

- ASA Class 4: patients with severe systemic disease that is constant threat to life
  - At least one severe disease that is poorly controlled or end stage
  - Possible risk of death
    - Unstable angina
    - Symptomatic COPD
    - Symptomatic CHF
    - Hepatorenal failure

- ASA Class 5: Moribund patients not expected to survive more than 24 hours without the surgery

- ASA Class 6: Brain-dead patient whose organs are being removed for donor purposes
Clinical Risk Factors for Perioperative Cardiac Complications
Coronary Artery Disease

- Major adverse cardiac events (MACE) after non-cardiac surgery is often associated with prior CAD events.

- Postoperative MI and mortality rate decreased as the length of time between MI and operation increases:
  - 0-30 days: 32.8% 14.2%
  - 31-60 days: 18.7% 11.5%
  - 61-90 days: 8.4% 10.5%
  - 91-180 days: 5.9% 9.9%

- Recent MI (less than 6 months prior to operation) is an independent risk factor for perioperative stroke.
  - Associated with 8-fold increase in perioperative mortality
Heart Failure

- Heart failure (HF) is an independent risk factor for perioperative complications.
  - In one study the mortality and readmission rate in patients undergoing 1 of 13 predefined major non-cardiac surgeries was 50%-100% higher in patients with HF compared to a control group of patients without CAD or HF.
- Many perioperative risk calculators place greater emphasis on CAD than on HF but studies have shown that patients with active HF have a higher risk of postoperative death than do patients with CAD alone.
- Studies have shown that there are improved outcomes in patients with stable heart failure who are on treatment.
Heart Failure

- Left ventricular ejection fraction (LVEF) is an independent risk factor for perioperative complications and a long-term risk of death in patients with HF undergoing elevated-risk non-cardiac surgery.
  - Survival is much worse for patients with LVEF ≤ 29% than patients with LVEF > 29%.
- The effect of asymptomatic left ventricular dysfunction on perioperative outcomes is unknown.
Non-ischemic Cardiomyopathies

- There is little information regarding the preoperative evaluation of patients with non-ischemic cardiomyopathies.
  - Restrictive
  - Hypertrophic obstructive
  - Arrhythmogenic right ventricular
  - Peripartum
- Preoperative recommendations should be based on thorough knowledge of the pathophysiology of the cardiomyopathy, assessment and management of the underlying process, and overall management of the heart failure.
- It is recommended to utilize a multidisciplinary approach on these patients.
Patients with suspected significant valvular heart disease should undergo echocardiography to quantify the degree of stenosis or regurgitation, ejection fraction, and estimation of right heart pressures.

Emergency non-cardiac surgery may proceed in the presence of uncorrected valvular heart disease and risk can be minimized if:

- Accurate diagnosis of the type and severity of valvular disease that is present.
- Choosing an anesthetic approach appropriate to the valvular heart disease.
- Higher level of perioperative and postoperative monitoring.
Valvular Heart Disease

- Aortic Stenosis
  - Elevated-risk non-cardiac surgery with appropriate intraoperative and postoperative hemodynamic monitoring is reasonable to perform in patients with asymptomatic severe aortic stenosis (AS). Class IIa
  - With newer anesthetic and surgical approaches the perioperative mortality rate of these patients has dropped from 13% to 2.1%.
  - Avoid tachycardia and hypotension.
  - If a patient meets criteria for surgical aortic valve replacement (AVR) but not a candidate, options include:
    - Invasive hemodynamic monitoring and optimization of loading conditions
    - Percutaneous aortic balloon dilation
    - Transcatheter aortic valve replacement (TVAR)
Mitral Stenosis

Elevated risk elective non-cardiac surgery using appropriate intraoperative and postoperative hemodynamic monitoring may be reasonable in asymptomatic patients with severe mitral stenosis if valve morphology is not favorable for percutaneous mitral balloon commissurotomy. Class IIb

Avoid Tachycardia and hypotension.

Maintain adequate intravascular volume to ensure forward cardiac output but without excessive rises in left atrial pressure and pulmonary capillary wedge pressure \( \rightarrow \) pulmonary edema.

If possible valvular intervention is possible then the patient should undergo intervention prior to elective non-cardiac surgery.
Valvular Heart Disease

- Aortic and Mitral Regurgitation
  - Elevated-risk elective non-cardiac surgery with appropriate intraoperative monitoring and postoperative hemodynamic monitoring is reasonable with asymptomatic severe MR or asymptomatic severe AR and normal LVEF. Class IIb
  - Associated with LV volume overload
    - Preload needs to be maintained
    - Excessive systemic afterload should be avoided
Arrhythmias and Conduction Disorders

- Common findings in the perioperative setting.
- Paucity of studies that address the surgical risk conferred by arrhythmias.
- Presence of arrhythmia in the preoperative setting should prompt investigation into underlying cardiopulmonary disease, drug toxicity, or metabolic derangements.
- PVCs or non-sustained VT do not usually require intervention.
- Atrial fibrillation carries the risk for perioperative formation of left atrial thrombus formation.
- High grade conduction abnormalities, if unanticipated may increase operative risk.
- Sinus node dysfunction and atrioventricular block requires caution if perioperative beta-blockers are being considered.
Cardiovascular Implantable Electronic Devices (CIED)

- Before elective surgery in a patient with a CIED, the surgical team and clinician following the CIED should communicate in advance to plan on perioperative management. Class I
Age

- Increased prevalence of CAD, cerebrovascular disease, and diabetes.
- Higher incidence of perioperative ischemic stroke in adults over 65 than in those under 65.
  - Age >62 is an independent risk factor for perioperative stroke
- Among frail adults over the age of 70 there is an increase in length of stay, inability to return home, and complication rate.
Clinical Vignette

- Past Medical History
  - Hypertension
  - Type 2 Diabetes Mellitus (A1c was 6.9)
  - Osteoarthritis of the knee
  - Dyslipidemia
  - Obesity (BMI 33)

- Past Surgical History
  - Tonsillectomy and Adenoidectomy
  - Cholecystectomy
  - B/L cataract surgery
Clinical Vignette

- Allergies
  - NKDA
- Home Medications
  - Metformin 1000 mg BID
  - Bydureon 2mL SC weekly
  - Atorvastatin 40 mg at bedtime
  - Losartan 50 mg BID
  - Gabapentin 300 mg TID
  - Meloxicam 15 mg daily
Clinical Vignette

- **Social History**
  - Smokes 1PPD for last 20 years
  - Does not drink
  - No illicit drug use
  - Married
  - Used to play golf until knee bothered him
  - Tries to follow a diabetic diet, but not strictly

- **Family History**
  - CAD and MI in Father
  - Breast Cancer in Mother
  - Breast Cancer in Sister
Clinical Vignette

- **Functional Status**
  - Walks 20 minutes on treadmill 3 times a week without chest pain or shortness of breath.
  - Works in his garden on weekends.
  - Assists with house work.
  - Gets short of breath after walking 2 flights of stairs but never experiences chest pain.

- **Cardiac Issues**
  - Never been diagnosed with CAD, MI, CHF, Congenital Heart Disease, Valvular Heart Disease, Arrhythmia, and does not have a pace maker.

- **Pulmonary Issues**
  - Never been diagnosed with COPD or sleep apnea.

- **Previous Testing**
  - Never had stress test, echo, PFT
  - Chest XR one week ago was normal.
  - EKG showed NSR at 85 BPM, normal.
Clinical Vignette

- Physical Examination
  - Gen: NAD, AAOX3
  - HEENT: NCAT, PERRL
  - CVS: RRR, Normal S1 and S2, 1/VI systolic murmur, No JVD, Pulses palpable in all extremities
  - Lungs: CTA B/L
  - Abd: Soft NT, ND, BS+ in all quadrants, no organomegaly
  - Ext: No edema
2014 ACC/AHA Stepwise Approach to the Perioperative Cardiac Assessment for CAD

FLEISHER LA, ET AL. 2014 ACC/AHA PERIOPERATIVE GUIDELINE: EXECUTIVE SUMMARY
MET: Metabolic Equivalent

- Useful unit for describing the energy expenditure for a particular activity.
- It is a measure of "fitness".
- Light intensity activity: 1.1-2.9 METS
  - Vacuuming, ADLS, walking at 2 MPH, writing
- Moderate intensity activity: 3-5.9 METS
  - Cycling, climbing a flight of stairs, golf (no cart), walking 4 MPH, yardwork (raking, weeding, pushing a power mower)
- Vigorous intensity activity: 6-10 METS
  - Squash, jogging (10 min/mile), scrubbing floors, singles tennis
Does Our Patient Need Further Cardiac Work-up?
Post-Operative Pulmonary Complications
Post-op pulmonary complications are equally prevalent and contribute similarly to morbidity, mortality, and length of stay as cardiac complications.

- Atelectasis
- Pneumonia
- Respiratory failure
- Exacerbation of chronic lung disease
Predictors to Post-Op Pulmonary Complications

- Advanced age
- ASA class II or greater
- Functional dependence
- Chronic obstructive pulmonary disease
- Congestive heart failure
- Impaired sensorium
- Abnormal finding on chest physical examination
- Cigarette smoking
- Alcohol use
- Weight loss
Predictors to Post-Op Pulmonary Complications

- Obesity and well controlled asthma WERE NOT independent risk factors for post-operative pulmonary complications.
- Surgical site is an important risk factor.
  - Open aortic
  - Thoracic
  - Upper abdominal
Unclear on how useful spirometry is when compared to history alone and the evidence does not support the use of routine spirometry prior to non-cardiothoracic surgery.

- Serum albumin of less than 35 g/L
- BUN greater than or equal to 21
- CXR rarely provides any value prior to surgery is not routinely recommended.
Pre-Operative Risk Calculators

- Gupta perioperative risk calculator
- Revised cardiac risk index for pre-operative risk
- ACS NSQIP surgical risk calculator
ACS NSQIP Surgical Risk Calculator
ACS NSQIP Surgical Risk Calculator

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Your Risk</th>
<th>Average Risk</th>
<th>Chance of Outcome</th>
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</thead>
<tbody>
<tr>
<td>Suture Complication</td>
<td>12 20 38 40 50 60 70 80 90 100</td>
<td>12 20 38 40 50 60 70 80 90 100</td>
<td>10%</td>
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<td>Any Complication</td>
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<td>Pneumonia</td>
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<tr>
<td>Cardiac Complication</td>
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<tr>
<td>Surgical Site Infection</td>
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<td>Urinary Tract Infection</td>
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<td>Venous Thromboembolism</td>
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<td>0%</td>
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<td>12 20 38 40 50 60 70 80 90 100</td>
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<td>Return to OR</td>
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<td>12 20 38 40 50 60 70 80 90 100</td>
<td>0%</td>
</tr>
<tr>
<td>Death</td>
<td>12 20 38 40 50 60 70 80 90 100</td>
<td>12 20 38 40 50 60 70 80 90 100</td>
<td>0%</td>
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</tbody>
</table>

Discharge to Nursing or Rehab Facility: 35.6% (compared to Average of 17.6%)

Predicted Length of Hospital Stay: 4 days

How to Interpret the Graph Above:

- Your Risk
- Average Patient Risk

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Should the Patient Proceed with Surgery?
Pre-Surgical Medical Recommendations
Beta-Blockers

- If the patient is currently taking a beta-blocker it should be continued and given prior to surgery.
- If the patient is not currently taking a beta-blocker there is no indication to start beta-blocker therapy.
- If preoperative testing indicates that a patient should be on a beta-blocker it should be initiated prior to the operation.
Prophylactic Antibiotics

- Antibiotic prophylaxis is recommended for all clean-contaminated, contaminated, and dirty procedures.
- Antibiotic prophylaxis is optional for clean procedures.
  - Consider risk factors for infection
Prophylactic Antibiotics

- Skin and Superficial Soft Tissues
  - Prophylaxis is not indicated*

- Head and Neck Procedures
  - Coverage for aerobic cocci
    - Cefazolin

- Neurosurgical Procedures
  - Coverage for *S. aureus* and *S. epidermidis*
    - Cefazolin or Vancomycin

- General Thoracic Procedures
  - Cefazolin recommended

- Cardiac Procedures
  - Coverage for *S. aureus* and *S. epidermidis*
    - Cefazolin

- Gastrointestinal Tract Procedures
  - Gastroduodenal (high risk)
    - Cefazolin

  - Colorectal
    - Oral Neomycin and erythromycin base or IV cefotetan or cefoxitin

* Consider risk factors
Prophylactic Antibiotics

- **Gastrointestinal Tract Procedures**
  - Appendectomy
    - Cefotetan or cefoxitin
  - Biliary
    - Optional*  
    - Cefazolin
  - OB/GYN Procedures
    - Cefazolin
  - Urologic Procedures
    - Variable depending on location
    - Same as GI
    - Cefazolin

- **Vascular Procedures**
  - Recommended if using synthetic material, groin incision, or involves the aorta.
  - Cefazolin

- **Orthopedic Procedures**
  - Recommended for certain procedures such as prosthetic joint.
  - Cefazolin
  - Aminoglycosides are often used in conjunction but little evidence to support.

- **Laparoscopic Procedures**
  - Utilize the same prophylaxis as would be used for an open procedure.
Anticoagulation Bridging

- Interruption of anticoagulation transiently increase thromboembolic risk while continuing anticoagulation increases the risk of bleeding.
  - Estimate the thromboembolic risk
  - Estimate the bleeding risk
  - Determine timing to stop anticoagulation
  - Determine the need to bridge
- Reserve bridging for those with recent stroke, mechanical heart valve or CHA2DS2-VASc score of 7-8.
Post-Operative Complications
Common Post-Operative Complications

- Fever
- Ileus
- Post-op nausea and vomiting
- Deep venous thrombosis
- Hypotension
- Acute renal failure
Post-Operative Fever

The 5 W’s of post-op fever

- **Wind:** Atelectasis/Pneumonia
- **Water:** Urinary tract infection
- **Walking:** Deep venous thrombosis
- **Wound:** Surgical site infection
- **Wonder drugs:** Adverse drug reaction
How to Prevent Post-Operative Fevers

- Atelectasis
  - Incentive spirometry
  - Early ambulation
- Urinary tract infection
  - Early catheter removal
- Deep venous thrombosis
  - Early ambulation
  - Sequential compression devices
  - Prophylactic anticoagulation
- Wound infection
  - Pre-op antibiotics
  - Aseptic technique
  - Excellent wound care
- Adverse drug reaction
  - Stop offending drug
Ileus

- Disruption of the normal propulsive ability of the GI tract.
- Common after surgery.
  - Anesthesia
  - Pain medication
  - Direct trauma to the bowels
- If patient is predisposed to constipation recommend normalizing bowel function prior to surgery.
- Early ambulation.
Post-Operative Nausea and Vomiting

- Common side effect of anesthesia and pain medication.
- Obtain good pre-op history to determine what drugs have caused this problem in the past and avoid if possible.
- Pre-mEDIATE with anti-emetics.
- Avoid carbonated beverages immediately post operatively.
Deep Venous Thrombosis

- Evaluate risk in every patient.
- Determine the need for mechanical vs medical prophylaxis.
- Determine the risk of bleeding.
- Orthopedic procedures have strict protocols for DVT prophylaxis after surgery.
Post-Operative Hypotension

- Determine Cause
  - Anesthesia
  - Pain medications
  - Hypovolemia
  - Blood loss

- Treat Accordingly
  - Judicious use of pain medication and reverse if needed
  - Hold antihypertensive medication
  - IV fluids
  - Blood transfusion
Acute Renal Failure

- Often a result of volume depletion after surgery.
- May be due to drug-induced hypotension.
- ATN/AIN from antibiotics.
- Treat by correcting volume status and blood pressure.
- Remove offending medication.
- Avoid ACE/ARBs immediately after surgery if hypotensive.
The preoperative medical assessment should be used to improve perioperative outcomes.

You work for the patient not the surgeon

Use common sense, if a test is not going to change your recommendation to proceed or withhold surgery then don’t order the test. Most testing is not necessary.

Do what you can to prevent perioperative complications before they occur.
Questions