

# Preoperative Evaluation

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## Objectives

- Importance of Pre-operative Evaluation
- Approach to Pre-operative Assessment
- Accurate assessment of functional status
- Risk Factor Optimization
- Smoking Cessation
- Medication Optimization
- Risk calculators

## Objective of Preoperative Evaluation

Main objective of a preoperative evaluation is to lower the risks for any perioperative major adverse cardiovascular and cerebrovascular events (MACCE).

## Importance of Preoperative Evaluation

- Large scale study reviewed patients undergoing major *noncardiac* surgery from Jan-2004 to Dec-2013 across the nation.
- 10,581,621 patients
  - Mean age 65.74 years
  - 56.6% females
- Over 1.5 million perioperative events (major + minor)
- MACCE occurred in: 3000 events per 100,000 (3.0%)
- Nonfatal AMI: 0.76%
- Nonfatal stroke: 0.54%
- Death: 1.67%

MACCE: Major Adverse Cardiovascular and Cerebrovascular Event

Perioperative Major Adverse Cardiovascular and Cerebrovascular Events Associated With Noncardiac Surgery. *JAMA Cardiol.* 2017;2(2):181-187. doi:10.1001/jamacardio.2016.4792

## Importance of Preoperative Evaluation

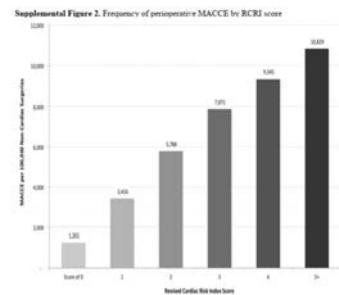
- Patients who had a MACCE were *older*
- More likely to be *male*
- More likely to have *cardiovascular risk factors*
- Patients with *higher RCRI scores* were more likely to have perioperative MACCE

Between 2004 - 2013, frequency of MACCE declined from 3.1% to 2.6%

RCRI = Revised Cardiac Risk Index  
MACCE: Major Adverse Cardiovascular and Cerebrovascular Event

Perioperative Major Adverse Cardiovascular and Cerebrovascular Events Associated With Noncardiac Surgery. *JAMA Cardiol.* 2017;2(2):181-187. doi:10.1001/jamacardio.2016.4792

## Importance of Preoperative Evaluation



Perioperative Major Adverse Cardiovascular and Cerebrovascular Events Associated With Noncardiac Surgery. *JAMA Cardiol.* 2017;2(2):181-187. doi:10.1001/jamacardio.2016.4792

## Approach to Preoperative Evaluation

Does the patient need a cardiac stress test and/or Cardiologist evaluation?

## Approach to Preoperative Evaluation

Does patient need a stress test?

As per 2014/ACC/AHA Guidelines:

- Functional status is reliable predictor of perioperative MACE.
- Can be estimated from activities of daily living (ADLs).
  - Excellent: >10 METs
  - Good: 7 METs to 10 METs
  - Moderate: 4 METs to 6 METs
  - Poor: <4 METs

# Approach to Preoperative Evaluation

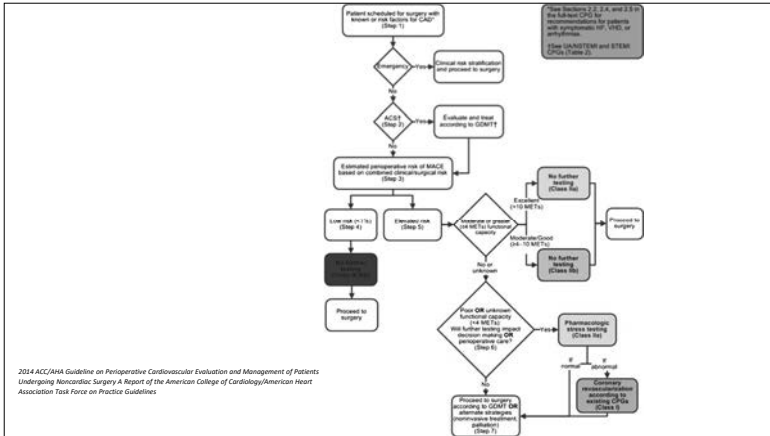
How to determine functional status accurately?

- Duke Activity Status Index
  - Available on MDCALC

# Approach to Preoperative Evaluation

Selected examples of low, intermediate, and high intrinsic cardiac risk operations

Description	Odds ratio* (95% CI)	Estimated cardiac risk of hypothetical patient† (%)
<b>Low intrinsic cardiac risk</b>		
Partial mastectomy (lumpectomy)	0.22 (0.13-0.31)	0.05
Arterioscrotic rotator cuff repair	0.32 (0.19-0.54)	0.07
Simple mastectomy (complete breast)	0.37 (0.26-0.50)	0.08
Laparoscopic appendectomy	0.45 (0.33-0.62)	0.10
Laparoscopic cholecystectomy	0.62 (0.53-0.72)	0.14
<b>Intermediate intrinsic cardiac risk</b>		
Transurethral resection of bladder tumor, large	0.85 (0.61-1.20)	0.19
Laparoscopic prostatectomy	0.88 (0.69-1.12)	0.19
Open appendectomy	0.95 (0.81-1.13)	0.21
Total hip arthroplasty	0.95 (0.83-1.08)	0.21
Laparoscopic radical hysterectomy with bilateral salpingo-oophorectomy	1.05 (0.87-1.24)	0.23
<b>High intrinsic cardiac risk</b>		
Laparoscopic total abdominal colectomy with ileostomy	1.50 (0.92-2.44)	0.33
Breast reconstruction with free flap	1.52 (0.81-2.86)	0.33
Open cholecystectomy	1.55 (1.25-1.92)	0.34
Open ventral hernia repair, incarcerated or strangulated, recurrent	1.78 (1.29-2.44)	0.39
Whipple procedure, pancreas-sparing	4.70 (4.00-5.53)	1.02



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

# Approach to Preoperative Evaluation

- CBC:
  - Preoperative Anemia (very common: up to 30% in a cohort study)
- CMP, LFTs:
  - Commonly ordered, but not indicated.
  - Severe liver disease a/w high morbidity & mortality
  - Screen for electrolyte imbalances
- PT/PTT/INR:
  - Test for hemostasis
- Urinalysis:
  - Detection of unsuspected UTIs.
  - UTIs can result in bacteremia & postsurgical wound infections.

# Risk Factors Assessment

- Cardiovascular
- Pulmonary
- Endocrinology
- Hematology

# Risk Factor Assessment: Cardiovascular

- Despite METs >4, recommended to optimize risk factors, such as:
  - Heart Failure (higher risk of MACE w/ LVEF <30%)
  - Hypertension (HTN)
  - Pulmonary HTN
  - Hyperlipidemia

# Risk Factor Assessment: Cardiovascular

## Arrhythmias:

- Sinus Bradycardia
  - May proceed with surgery in asymptomatic patients w/ HR ≥ 45 bpm
  - Bradycardia very common in post-op:
    - Medications
    - Hypoxemia/Ischemia
    - Pain increases vagal tone
    - Sleep apnea may manifest as nocturnal bradycardia
- First Degree AV Block
  - PR interval > 200 ms
  - Proceed w/ surgery if asymptomatic

# Medication Optimization - Cardiovascular

## Initiating Beta Blockers

- Limited data suggesting mortality benefit
- Consistent data suggesting:
  - Pre-operative BB administration **increase** adverse outcomes (bradycardia + stroke)
- Reasonable to initiate BBs:
  - In patients with intermediate, or high-risk of MI on pre-operative testing
  - In patients with 3 or more risk factors (example: DM, CAD, HF, CKD, CVA, etc)
  - Initiate a few weeks before surgery to obtain optimal BP & HR

## ACC/AHA Perioperative Clinical Practice Guideline:

"Beta blockers should be continued in patients undergoing surgery who have been on beta blockers chronically"

## Medication Optimization - Cardiovascular

### Initiating Statins:

- Statins reduce vascular inflammation, stabilize atherosclerotic plaques
- Statins highly effective in primary & secondary prevention of cardiac events.
- Multiple observational studies, RCTs have shown decrease MACE with statin use.
  - Statin therapy had a 5-fold reduction of risk of 30-day all-cause-death.
  - 57% lower chance of perioperative MI or death of 2-year follow-up in patients undergoing noncardiac vascular surgery.

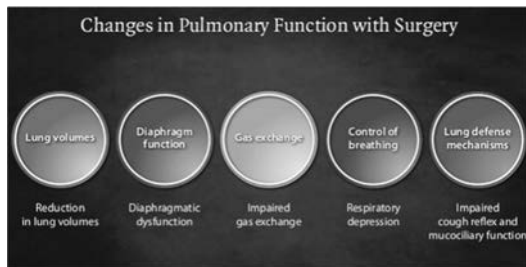
## Pre-operative Evaluation: Medications

### Initiating Statins:

- For maximal anti-inflammatory and plaque-stabilizing benefits, statin should be initiated a few weeks before surgery
- Statin initiation immediately during preprocedural period (especially in vascular surgeries) show also been proven to be beneficial
- No evidence that perioperative statin use is a/w increase in adverse events, including rhabdomyolysis or liver dysfunction

NNT 13 to prevent one occurrence of MI  
 NNT 36 to prevent one nonfatal MI  
 NNT 42 to prevent one cardiac death.

## Risk Factor Assessment: Pulmonary



## Risk Factors: Pulmonary

### Intraoperative risk factors for Pulmonary Complications:

- Anesthesia drugs diminish respiratory drive
- Alter response to hypoxia and hypercapnia, which causes hypoventilation.
- General anesthesia in combination with supine positioning, opiates results in atelectasis
- Anesthesia, bed rest, and opioids inhibit the cough reflex
  - Impairment of respiratory tract ciliary activity
  - Dry gases result in mucus plugging.
- Aspiration risk

Fernandes, A., Rodrigues, J., Lages, F. et al. Root causes and outcomes of postoperative pulmonary complications after abdominal surgery: a retrospective observational cohort study. *Patient Saf Surg* 13, 40 (2019). <https://doi.org/10.1186/s13037-019-0221-5>

## Risk Factor Assessment: Pulmonary

### Surgical risk factors for Pulmonary Complications:

- Surgical site, length of surgery (>3 hours) carry higher risk
- Prolonged surgery and exposure to anesthesia:
  - Alters immune defense and gas exchange
  - Alter surfactant production
  - Slowing mucociliary clearance
- Abdominal, thoracic, and head and neck surgeries are the most likely to interfere with respiratory function
- Vascular and emergency surgeries are also associated, perhaps because of the higher risk patient cohort.
- Orthopedic surgeries are considered to be lower risk for PPCs.

## Risk Factor Assessment: Pulmonary

### Factors Associated With Postoperative Pulmonary Complications

Preoperative	Intraoperative	Postoperative
<ul style="list-style-type: none"> <li>• Asthma / COPD</li> <li>• Recent respiratory infection</li> <li>• Smoking (&gt; 20 pkyr)</li> <li>• Obstructive sleep apnea</li> <li>• General poor state of health</li> <li>• &gt; 70 year old</li> <li>• Poor nutritional status</li> </ul>	<ul style="list-style-type: none"> <li>• Upper abdominal / thoracic surgery</li> <li>• General anesthesia</li> <li>• Duration of anesthesia &gt; 3 hour</li> <li>• Use of pancuronium</li> </ul>	<ul style="list-style-type: none"> <li>• Immobilization</li> <li>• Poor pain control</li> </ul>

Harris, M. (2019, September 22). Risk factors associated with post-operative

## Pulmonary Complications

- Atelectasis (CXR, CT)
- Pneumonia
- Acute respiratory distress syndrome (ARDS)
- Pulmonary aspiration (clinical history and imaging evidence)
- Unplanned need for supplemental oxygen or noninvasive or invasive mechanical ventilation
- Exacerbation of underlying chronic lung disease
- Bronchoconstriction

## Strategies to Reduce Pulmonary Complications

- COPD Optimization
- Asthma Optimization
- OSA optimization
- Smoking Cessation
- Oral Care

## Strategies to Reduce Pulmonary Complications

- COPD, Asthma:
  - SABA, LABA and anticholinergics should be continued
  - Symptomatic patients: preoperative inhaled bronchodilators may improve pulmonary function and maintain the postoperative respiratory function
  - Short-term systemic or inhaled corticosteroids can improve lung function preoperatively
  - Antibiotics: only when an infection is present
    - New or changed sputum
    - New or changed lung opacities
    - Fever, WBC count >12,000 /uL.
  - Asthmatics should continue treatment

## Strategies to Reduce Pulmonary Complications

### Obstructive Sleep Apnea (OSA)

- Majority of patients with known or suspected OSA may proceed to surgery without additional testing or treatment for OSA
- Patients with known OSA:
  - Document in pre-op note:
  - Severity of OSA: current symptoms, signs, sleep study results
  - Current treatment: BIPAP, CPAP: settings
  - Bring PAP equipment or oral appliances (used post-operatively)
  - May be impacted by COVID-19 guidelines
- Counseling regarding risks and adherence to therapy
- In severe OSA, preoperative continuous positive airway pressure (CPAP) may be beneficial, as may a mandibular advancement device and weight loss.

## Strategies to Reduce Pulmonary Complications

### Smoking Cessation:

- Patients who quit smoking >4 weeks prior to surgery have slight reduced in post-operative complications (RR 0.77, CI 0.61–0.96)
- After 8 weeks smoking cessation incidence of pulmonary complications is comparable to non-smokers
- Pre-rehabilitation exercise programs - Inspiratory muscle training (IMT)
- Meta-analysis including 25 studies of 21,381 patients:
  - Smokers who quit > 4 and > 8 weeks before surgery had lower risks of respiratory complications than current smokers
  - Wound-healing complications lower in smokers who quit > 3-4 weeks before surgery than in current smokers

## Strategies to Reduce Pulmonary Complications

### Smoking Cessation:

- Evidence that preoperative smoking interventions providing behavioral support and offering NRT increase short-term smoking cessation and may reduce postoperative morbidity
- Preoperative intensive behavioral therapy, typically with concomitant NRT, can reduce smoking and complications of surgery.
- Meta-analysis found intensive preoperative behavioral interventions (typically with NRT) led to:
  - Greater rate of smoking cessation at the time of surgery [RR] 10.76, 95% CI 4.55-25.46a
  - Reduced postoperative complications [RR 0.42] 95% CI 0.27-0.65
- Brief interventions (eg, 15 to 90 mins of counselling) were a/w a smaller reduction in smoking cessation and were not a/w significant reduction in complications.

## Strategies to Reduce Pulmonary Complications

- Duration of pharmacotherapy — In general, pharmacotherapy for smoking cessation is recommended for at least three months
- Both varenicline and bupropion use may be extended up to one year if the patient has quit smoking at risk for relapse
- Consider depressive symptoms if Bupropion also being used for to treat mood disorders.

## Strategies to Reduce Pulmonary Complications

### Oral Care:

- Perioperative dental care along with oral chlorhexidine rinse has reduced postoperative pneumonia in cardiac surgery patients
- No evidence on risk reduction in non-cardiac surgeries.

## Risk Factors: Endocrinology

- Diabetes Mellitus:
  - A1c goal surgeon dependent (consensus <8.5%)
  - Holding medication on day of surgery:
    - Insulin: Risk of hypoglycemia
    - Metformin: Due to renal function, risk for lactic acidosis
    - Pioglitazone, Rosiglitazone: Post-op fluid retention
    - Sulfonylureas: Risk of hypoglycemia
    - GLP-1 Agonists: Delays return of GI function
    - DPPV-4: May be continued if needed
- Hyper- or Hypothyroidism: TSH at goal
  - Treat hyperthyroidism prior to surgery (unless thyroidectomy)

## Risk Factors: Hematology

- Previous DVT/PE
- Bleeding/platelet disorders
- Anticoagulation use

## Pre-operative Evaluation: Nephrology

- CKD-3: Stable
  - Proceed with surgery
  - Avoid nephrotoxic medications
- CKD-4, ESRD (HD/PD):
  - Nephrology clearance required

## RISK CALCULATORS: REVISED CARDIAC RISK INDEX

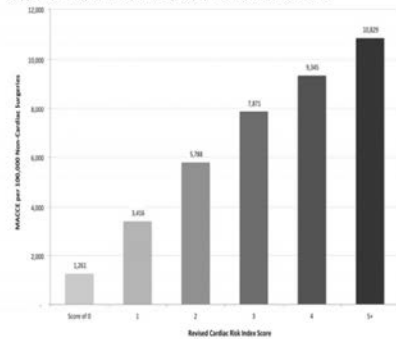
- RCRI
  - 6 parameters
  - Also known as “Revised Goldman”
  - Simple, widely used
  - Proven validity by multiple studies

The screenshot shows the 'Revised Cardiac Risk Index for Pre-Operative Risk' calculator. It includes a 'Patient Information' section with fields for Name, Sex, Age, and Height. Below that are several 'Medical History' checkboxes: Intermediate risk surgery, History of ischemic heart disease, History of congestive heart failure, and History of long-term heart failure. A 'Class Risk' section shows a score of 0 points, resulting in a 3.9% 30-day risk of death, MI, or cardiac arrest.

## Revised Cardiac Risk Index for Pre-Operative Risk

This screenshot is similar to the one above, showing the calculator interface with the same patient information and medical history checkboxes. The 'Class Risk' section displays a score of 0 points and a 3.9% 30-day risk of death, MI, or cardiac arrest.

Supplemental Figure 2. Frequency of perioperative MACCE by RCRI score



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## RISK CALCULATORS

- NSQIP
  - Developed by American College of Surgeons
  - Based on data collected from over 1 million patients (1,414,006)
  - 20 patient parameters
  - More comprehensive
  - External validation pending

The screenshot shows the 'NSQIP Surgical Risk Calculator' interface. It includes a 'Procedure' dropdown, a 'Patient Information' section with fields for Age, Sex, Race, Functional Status, Emergency Case, ASA Class, and Anesthesia. Below that are several 'Medical History' checkboxes: Hypertension requiring medication, Competitive heart failure in 30 days prior to surgery, History of severe COPD, Systemic therapy within 60 hours prior to surgery, Acute renal failure, Hemodynamic instability, and Uncontrolled diabetes. A 'Class Risk' section shows a score of 0 points, resulting in a 3.9% 30-day risk of death, MI, or cardiac arrest.

## RISK CALCULATORS

- Bariatric Surgery Calculator
  - Also developed by American College of Surgeons
  - Based on data from bariatric surgeries
  - Outcome specific to surgery type

The screenshot shows the 'Bariatric Surgical Risk Benefit Calculator' interface. It includes a 'Procedure' dropdown, a 'Patient Information' section with fields for BMI Calculation, Height, Weight, Age, Sex, Insurance Directly, Diabetes, Functional Status, and ASA Class. Below that are several 'Medical History' checkboxes: Hypertension requiring medication, Hypertension, IHD, Diabetes, Previous Foreign Surgery, and Disposed Use for Chronic Condition. A 'Class Risk' section shows a score of 0 points, resulting in a 3.9% 30-day risk of death, MI, or cardiac arrest.

## Final Remarks

- No patient can be “cleared” for surgery
  - Risk stratify patient (low risk <1%, intermediate risk ...)
- Accurately assess for functional status
- METs <4 → additional cardiac testing
- Medically optimize: HTN, HF, Asthma, COPD, OSA
- Smoking Cessation
- Initiating Statin

## Resources

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery  
<https://www.jacc.org/doi/pdf/10.1016/j.jacc.2014.07.944>

BMI  
<https://tobaccocontrol.bmi.com/>

Evaluation of Cardiac Risk Prior to Noncardiac Surgery  
<https://www.uptodate.com/contents/evaluation-of-cardiac-risk-prior-to-noncardiacsurgery?search=preoperative+evaluation>

Guidelines for Perioperative Management of the Diabetic Patient. Surg Res Pract. 2015;2015:284063. doi:10.1155/2015/284063  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4452499/>

## Resources

Perioperative Major Adverse Cardiovascular and Cerebrovascular Events Associated With Noncardiac Surgery  
<https://jamanetwork.com/journals/jamacardiology/fullarticle/2594261>

Preoperative Cardiac Risk Assessment, 2020-July  
<https://www.aafp.org/afp/2002/1115/p1889.html>

Preoperative medical evaluation of the healthy adult patient  
<https://www.uptodate.com/contents/preoperative-medical-evaluation-of-the-healthy-adult-patient?>

Root causes and outcomes of postoperative pulmonary complications after abdominal surgery: a retrospective observational cohort study  
<https://pssjournal.biomedcentral.com/articles/10.1186/s13037-019-0221-5>

# Questions?