

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:
 - 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%

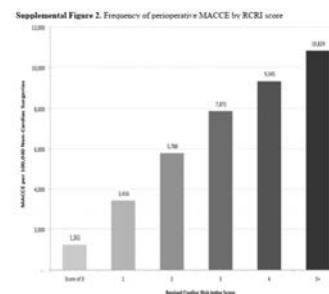
RCRI = Revised Cardiac Risk Index

MACCE: Major Adverse Cardiovascular and Cerebrovascular Event

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Importance of Preoperative Evaluation



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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

Duke Activity Status Index (DASI) 

Estimate functional capacity.

INSTRUCTIONS
Answers are self-reported. Provide an estimate of functional capacity, and may not be as accurate as objective measurements such as exercise stress testing.

When to Use:

Is the patient able to:	
Take care of self e.g. eating, dressing, bathing, using the toilet	No: 0 Yes: +2.75
Walk indoors	No: 0 Yes: +2.75
Walk 1-2 blocks on level ground	No: 0 Yes: +2.75
Climb a flight of stairs or walk up a hill	No: 0 Yes: +5.5
Run a short distance	No: 0 Yes: +10
Do light work around the house e.g. dusting, washing dishes	No: 0 Yes: +2.7
Do moderate work around the house e.g. vacuuming, sweeping floors, carrying groceries	No: 0 Yes: +5

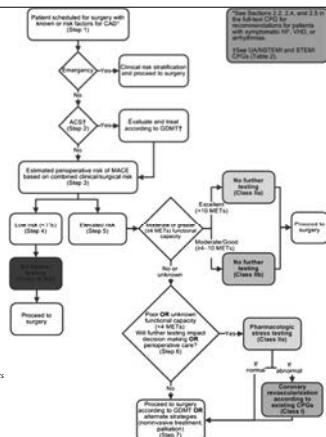
0 points 2.74 METs

The higher the score (maximum 18-21), the higher the functional status.

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† (%)
Low intrinsic cardiac risk		
Partial mastectomy (lumpectomy)	0.22 (0.15-0.31)	0.05
Arthroscopic rotator cuff repair	0.32 (0.19-0.54)	0.07
Simple mastectomy (complete breast)	0.37 (0.26-0.54)	0.08
Laparoscopic appendectomy	0.45 (0.33-0.62)	0.10
Laparoscopic cholecystectomy	0.62 (0.53-0.72)	0.14
Intermediate intrinsic cardiac risk		
Transurethral resection of bladder tumor, large	0.85 (0.61-1.20)	0.19
Laparoscopic prostatectomy	0.88 (0.69-1.22)	0.19
Open appendectomy	0.95 (0.51-1.75)	0.21
Total hip arthroplasty	0.95 (0.83-1.08)	0.21
Laparoscopic radial hysterectomy w/bilateral salpingo-oophorectomy	1.05 (0.57-1.94)	0.23
High intrinsic cardiac risk		
Laparoscopic total abdominal colectomy w/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 (1.25-1.82)	0.34
Open ventral hernia repair, incarcerated or strangulated, recurrent	1.78 (1.29-2.44)	0.39
Whipple procedure, pylorus-sparing	4.70 (4.00-5.53)	1.02



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/Ishemia
 - 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.

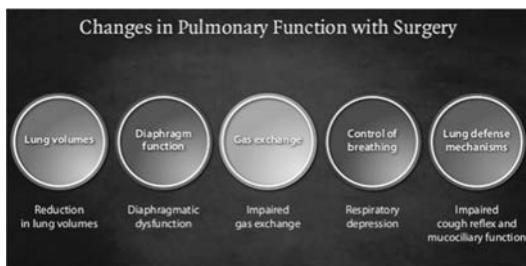
Pre-operative Evaluation: Medications

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, P. 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">• Asthma / COPD• Recent respiratory infection• Smoking (> 20 pk/yr)• Obstructive sleep apnea• General poor state of health• > 70 year old• Poor nutritional status	<ul style="list-style-type: none">• Upper abdominal / thoracic surgery• General anesthesia• Duration of anesthesia > 3 hour• Use of pancuronium	<ul style="list-style-type: none">• Immobilization• Poor pain control

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 / μ L.
- 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 incident 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



Revised Cardiac Risk Index for Pre-Operative Risk

Estimates risk of cardiac complications after noncardiac surgery.

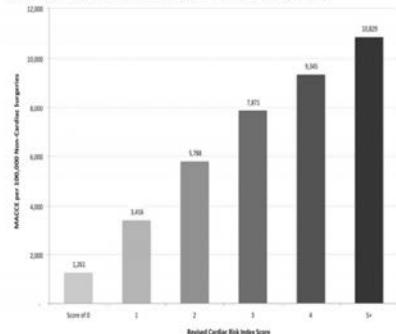
INSTRUCTIONS:
Note: This calculator was updated January 2013 to reflect the substantial body of evidence, namely external validation studies, suggesting that the original RCRI had significantly underestimated the risk [see Evidence for more].

Below the line	Painful/itchy	Wifey/Chewy
Intermediate-risk surgery (orthopedic, urologic, gastrointestinal, vascular)	No: 0	Yes: >1
History of ischemic heart disease	No: 0	Yes: >1
History of asymptomatic hypertension (HTN) history of preexisting HTN or systolic blood pressure of 160 mm Hg or greater with participation in exercise	No: 0	Yes: >1
History of congestive heart failure	No: 0	Yes: >1
Previous history of stroke or transient ischemic attack (TIA) history of stroke, TIA, or transient ischemic attack (TIA) during preoperative cardiovascular evaluation	No: 0	Yes: >1

0 points
3.9 %
30-day risk of death, MI, or cardiac arrest
From Devereux PB, Larson MG, et al. Prediction of perioperative major adverse cardiovascular events from the Framingham cohort study. Circulation. 2000;102:1800-1805. See Evidence for details.

Copy Results **Next Stage 2**

Supplemental Figure 2. Frequency of perioperative MACCE by RCRI score



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

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

ACS NSQIP® Surgical Risk Calculator

Enter Patient and Surgical Information

Procedure: Start by entering the procedure name or CPT code. One or more procedures will appear below the procedure box. You will need to click on the procedure you would like to use. You can also search using the words or text field located to the right of the term box, for example, "cholesterol-lowering cholesterol".

Are there other potential appropriate treatment options? Other Surgical Options Other Non-operative options None

Please enter as much of the following information as you can to receive the best risk estimates. This will help us to determine the best surgical approach for your patient.

Age Group: 18-40 years	Dialysis: <input checked="" type="checkbox"/>
Sex: Female	Hypertension requiring medication: <input type="checkbox"/>
Functional Status: Independent	Congestive Heart Failure in 30 days prior to surgery: <input type="checkbox"/>
Emergency Care: No	Diabetes: <input type="checkbox"/>
ASA Class: Healthy patient	Obesity: <input type="checkbox"/>
Smoker: No	Current Smoker within 30 days: <input type="checkbox"/>
Use of tobacco for chronic condition: No	History of severe COPD: <input type="checkbox"/>
Asches within 30 days prior to surgery: No	Arterial Disease: <input type="checkbox"/>
Systemic BP ^a within 48 hours prior to surgery: Normal	Arterial Occlusive Disease: <input type="checkbox"/>
Vascular Dependence: No	Acute Renal Failure: <input type="checkbox"/>
Disseminated Cancer: No	IMC Classification: <input type="checkbox"/>

Height: cm **Weight:** kg

Results: Copy Results Reset All Selections Compute Results

Procedure: 44140 - Colorectal partial with enucleation

Risk Factors: 75-84 years, Partial resected functional status: Healthy (Normal), COPD: No

Change Patient Risk Factors

Outcomes:

Outcomes	Your Risk	Average Risk	Chance of Outcomes
Serious Complication	24.0%	16.0%	Above Average
Any Complication	34.3%	24.0%	Above Average
Pneumonia	4.2%	2.0%	Above Average
Catheter Complications	1.1%	1.1%	Average
Surgical Site Infection	10.0%	10.0%	Average
Urinary Tract Infection	0.5%	2.0%	Above Average
Venous Thromboembolism	1.8%	2.0%	Below Average
Renal Failure	0.6%	1.2%	Below Average
Death	17.0%	10.0%	Above Average
Anastomotic Leak	2.0%	4.0%	Below Average
Readmission	15.1%	10.0%	Above Average
Return to OR	6.1%	6.0%	Average
Discharge to Nursing or Rehab Facility	38.0%	8.1%	Above Average

Predicted Length of Hospital Stay: 9.5 days

How to Interpret the Graph Above:

Your Risk: Average Patient Risk: % X%

Surgeon Adjustment of Risks: This will need to be used infrequently, but surgeons may adjust the estimated risks if they feel the calculated risks are unrealistically high. This should only be done if the reason for the discrepancy was NOT already accounted for in the calculator.

1 - No adjustment necessary

Back **Continue** **Step 3 of 4**

RISK CALCULATORS

• Bariatric Surgery Calculator

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

MBS QIP® Bariatric Surgical Risk Benefit Calculator

Enter Patient and Surgical Information

Please enter as much of the following information as you can to receive the best risk/benefit estimates. A rough estimate will still be generated if you cannot provide all of the information below.

Procedure Type: End Lap Sleeve Lap Bariat SPBD

Bariatric Surgery: Current Smoker within 30 days Smoking Apnea History of PE Diabetes Hypertension Obesity ASA Class: 1 ASA Class: 2 ASA Class: 3 ASA Class: 4 ASA Class: 5 ASA Class: 6 ASA Class: 7 ASA Class: 8 ASA Class: 9 ASA Class: 10 ASA Class: 11 ASA Class: 12 ASA Class: 13 ASA Class: 14 ASA Class: 15 ASA Class: 16 ASA Class: 17 ASA Class: 18 ASA Class: 19 ASA Class: 20 ASA Class: 21 ASA Class: 22 ASA Class: 23 ASA Class: 24 ASA Class: 25 ASA Class: 26 ASA Class: 27 ASA Class: 28 ASA Class: 29 ASA Class: 30 ASA Class: 31 ASA Class: 32 ASA Class: 33 ASA Class: 34 ASA Class: 35 ASA Class: 36 ASA Class: 37 ASA Class: 38 ASA Class: 39 ASA Class: 40 ASA Class: 41 ASA Class: 42 ASA Class: 43 ASA Class: 44 ASA Class: 45 ASA Class: 46 ASA Class: 47 ASA Class: 48 ASA Class: 49 ASA Class: 50 ASA Class: 51 ASA Class: 52 ASA Class: 53 ASA Class: 54 ASA Class: 55 ASA Class: 56 ASA Class: 57 ASA Class: 58 ASA Class: 59 ASA Class: 60 ASA Class: 61 ASA Class: 62 ASA Class: 63 ASA Class: 64 ASA 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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://posjournal.biomedcentral.com/articles/10.1186/s13037-019-0221-5>

Questions?