PERIOPERATIVE MEDICINE FOR NONCARDIAC SURGERY:

Goal: identify & optimize conditions that increase perioperative morbidity/mortality

* **myocardial infarction within 30 days may occur in 5% of patients having noncardiac surgery:** cohort study [Ann Intern Med 2011 Apr 19;154(8):523](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list%5Fuids=21502650&" \t "%5Fblank)
  + 8,351 patients from [POISE](https://rap.northshorelij.com/dynamed/,DanaInfo=web.ebscohost.com+detail?vid=3&sid=1f91e0f0-7efd-4753-82d1-6d75ca938528%40sessionmgr10&hid=19&bdata=JnNpdGU9ZHluYW1lZC1saXZlJnNjb3BlPXNpdGU%3d#highdose) trial reviewed
  + 415 patients (5%) had perioperative myocardial infarction, defined by: autopsy finding, elevated level of cardiac biomarker or enzyme plus ≥ 1 (ischemic symptoms, pathological Q waves, ischemic changes on electrocardiogram (ECG), coronary artery intervention, evidence of myocardial infarction on cardiac imaging)
  + comparing patients with perioperative myocardial infarction vs. without, 30-day mortality 11.6% vs. 2.2% (p < 0.001)

RISK STRATIFICATION:

#### Revised cardiac risk index (RCRI): 1 procedural risk factor, 5 clinical risk factors

#### high-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular)

#### history of ischemic heart disease

#### history of heart failure

#### history of cerebrovascular disease

#### insulin therapy

#### serum creatinine > 2 mg/dL (176.8 mol/L)

| **Risk of major cardiac event by # of points from RCRI** | |
| --- | --- |
| **Points** | **Risk % for Major Cardiac Complications (MI/pulm edema/cardiac arrest/complete heart block)** |
| 0 | 0.4 |
| 1 | 0.9 |
| 2 | 6.6 |
| ≥ 3 | ≥11 |

0:Low Risk

1-2:Moderate Risk

>=3:High Risk

#### In considering revascularization: Are there indications for revascularization (3-v or L main disease) regardless of surgery?

#### CARP Trial: Coronary Artery Revascularization Prophylaxis (CARP) trial: randomized patients undergoing elective vascular surgery who had at least 70% stenosis in 1 or more vessels to revascularization (PCI or CABG) vs usual care🡪no diff in post op mortality, MI, or stroke

Dobutamine stress echo: CI with unstable angina, recent MI, ventricular arrhythmias, & severe hypertension

Vasodilator Myocardial Perfusion Imaging: CI with severe AS or bronchospasm

1. EMERGENCY SURGERY?
   1. YES🡪Proceed with surgery & optimize medical management
   2. NO
      1. ACTIVE CARDIAC CONDITIONS?
         1. YES: Treat conditions PRIOR to surgery, including:
            1. Unstable/severe angina
            2. Recent MI (within 30 days)
            3. Decompensated HF
            4. Significant arrhythmias (high grade, 3rd degree, Mobitz II AV block, symptomatic ventricular arrhythmia, SVT>100 at rest, symptomatic brady, new VT
            5. Severe valvular disease (AS mean gradient >40, valve area<1cm2, SEM right 2nd intercostal space, mid-late peak, soft S2, carotid pulse delayed upstroke; symptomatic MS). Symptomatic AS should be evaluated for valve replacement!
         2. NO
            1. LOW RISK SURGERY? *\*duration>8 hrs is higher risk*

|  |  |
| --- | --- |
| Low  <1% | Endoscopic  Breast  Cataract  Ambulatory |
| Intermediate  1-5% | CEA  Intraperitoneal  Intrathoracic  Head/Neck  Orthopedic  Prostate |
| High  >5% | Major vascular |

YES🡪proceed with surgery

NO

FUNCTIONAL CAPACITY >=4 METS?

|  |  |
| --- | --- |
| METs | Activity |
| 1-3 | Self care: eat/dress/toilet |
| 4 | Flight of stairs, walk up hill, walk on level ground at 4mph |
| 6 | Moderate recreational activity: dance, doubles tennis, cycle |

YES🡪proceed with surgery

NO🡪Assess # of Clinical Risk Factors (DM, Ischemic heart disease, CHF, CVA, CKD)

0🡪proceed with surgery

1-2🡪Consider BB/stress test if it will change manage

3+🡪consider periop BB/stress

MEDICATIONS:

Beta Blockers: abrupt withdrawal🡪tachy, HTN, angina

-already on a BB? 🡪 continue it!

-consider starting BB >1 week prior to surgery & titrate to HR 60-70 while avoiding hypotension for (AHA guidelines):

1. vascular surgery in patients with CAD (probably recommended)

2. vascular surgery in patients with multiple risk factors (reasonable)

3. Intermediate-high risk procedures in patients with CAD or multiple RF’s.

* **perioperative beta blocker use associated with reduced in-hospital mortality in high-risk but not low-risk patients:** based on retrospective cohort study
  + 663,635 adults who had no contraindications to beta blockers and had major noncardiac surgery at 329 United States hospitals, 18% had beta blockers during first 2 hospital days
  + comparing beta blocker use vs. no use
    - beta blockers associated with reduced in-hospital mortality in patients with
      * RCRI score 4 or 5 (odds ratio [OR] 0.58, 95% CI 0.6-0.67)
      * RCRI score 3 (OR 0.71, 95% CI 0.63-0.8)
      * RCRI score 2 (OR 0.88, 95% CI 0.8-0.98)
    - in-hospital mortality not significantly different among patients with RCRI score 0 or 1
  + Reference - [N Engl J Med 2005 Jul 28;353(4):349](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list%5Fuids=16049209&" \t "%5Fblank) [full-text](https://rap.northshorelij.com/doi/full/10.1056/,DanaInfo=www.nejm.org+NEJMoa041895" \t "%5Fblank)
* **POISE trail** ([Lancet 2008 May 31;371(9627):1839](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?db=pubmed&cmd=Retrieve&dopt=Abstract&list%5Fuids=18479744&" \t "%5Fblank)): >8000 patients (mean age 69 years) with cardiac risk factors having noncardiac surgery were randomized to perioperative metoprolol vs. placebo. Aggressive regimen of extended-release metoprolol succinate 100 mg orally 2-4 hours preoperatively & 12 hours after first postoperative dose, patients started extended-release metoprolol succinate 200 mg orally once daily for 30 days. Death occurred in 3.1% vs. 2.3% (p = 0.0317, **NNH 125**). Stroke occurred in 1% vs. 0.5% (p = 0.0053, **NNH 200**). Clinically significant hypotension occurred in 15% vs. 9.7% (p < 0.0001, **NNH 18**). Clinically significant bradycardia occurred in 6.6% vs. 2.4% (p < 0.0001**, NNH 23**). Post hoc multivariate analyses suggest hypotension, bradycardia, and stroke may explain increased risk of death in this trial

*Conclusion: high risk benefit most from BB, and should be titrated over weeks*

Statins:

1.for patients currently taking statins and scheduled for noncardiac surgery, continue statins

2. reasonable if having vascular surgery

3.may be considered for patients with ≥ 1 clinical risk factors having [intermediate-risk procedures](https://rap.northshorelij.com/dynamed/,DanaInfo=web.ebscohost.com+detail?vid=3&sid=1f91e0f0-7efd-4753-82d1-6d75ca938528%40sessionmgr10&hid=19&bdata=JnNpdGU9ZHluYW1lZC1saXZlJnNjb3BlPXNpdGU%3d#anc-89090642)

##### Evidence for statins:

* perioperative statins reduce perioperative cardiovascular risk in patients having noncardiac vascular surgery
  + **perioperative statins may reduce perioperative myocardial infarction in statin-naive patients having noncardiac surgery**
    - systematic review of 15 randomized trials comparing perioperative statin treatment vs. placebo or active control in 2,292 statin-naive patients undergoing cardiac or noncardiac surgery
    - trials evaluated a variety of statins, doses, and regimens
    - total duration of treatment ranged from 3-67 days (preoperative 2-37 days, postoperative 0-30 days)
    - in patients having noncardiac surgery (4 trials with 1,236 patients), perioperative statins associated with reduced perioperative myocardial infarction
      * + **NNT 18-43** with myocardial infarction in 9% in control group
    - Reference - [Arch Surg 2012 Feb;147(2):181](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list%5Fuids=22351917&" \t "%5Fblank), editorial can be found in [Arch Surg 2012 Feb;147(2):189](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list%5Fuids=22351918&" \t "%5Fblank)

Antiplatelets:

* + BMS:
    - 162-325mg asa x 1 month, then 75-162mg indefinitely
    - 75mg Plavix x 1 month, extend to 1 year if no bleed

Sirolimus/Paclitaxel:

162-325mg asa x 3 months, then 75-162 indefinitely

75mg Plavix for at least 12 months

* deferring surgery recommended (instead of undertaking surgery within these time periods) for:
* at least 6 weeks after placement of bare-metal stent
* at least 6 months after placement of drug-eluting stent
* if surgery required within these time periods, continuing dual antiplatelet therapy around time of surgery suggested (instead of stopping dual antiplatelet therapy 7-10 days before surgery)

\*case fatality rate for in-stent thrombosis of a DES=45%!!!!!!!!!!

Anticoagulation:

Coumadin: hold 5 doses

Dabigatran: hold 4 doses (2 days)

\*~2000 patients on Coumadin over 11 years were followed for 3 months. Those who restarted heparin within 24 hours had most major bleeding. Therefore err on the side of decreased bleed risk. Therapeutic bridging started at 48 hours.

Clonidine: can’t abruptly withdrawal because of HTN/tachycardia. Transition to patch takes 2-3 days. Take full oral dose day 1 of patch, ½ dose day 2, ¼ dose day 3, then stop oral and change patch q 7 days.

ACE/ARBs: hold morning of surgery unless persistently hypertensive with SBP>180 due to risk of excessive intraoperative hypotension & hold if there is risk of compromised renal blood flow (AAA repair)

Carbidopa-levodopa: consider taper pre-op as acute discontinuation🡪NMS & resume ASAP post op; discuss with neurologist

Insulin:

* usefulness of strict control of blood glucose levels during perioperative period is uncertain in patients with diabetes mellitus or acute hyperglycemia who are having noncardiac surgical procedures without planned intensive care unit (ICU) admission
* continuous insulin infusion may reduce perioperative cardiovascular events after vascular surgery
* NPH: 75% usual evening dose night before surgery, 50% usual AM dose on morning of surgery
* Lantus: 50-75% usual evening dose; if Type 1, take 80%

Stress dose steroids:

* all patients with Addison’s disease or ACTH deficiency
* not suppressed if <3 weeks, qod dosing, <5mg prednisone daily
* may be suppressed: 5-20mg pred daily
* is suppressed:>20mg pred daily for >3 weeks; clinically cushingoid appearance
* Dosing:
  + Minor surgery: take usual AM steroid dose
  + Moderate surgery: take usual AM dose, 25-50mg IV hydrocort prior to surgery & 25q8 x 24 hours
  + Major surgery: take usual AM dose, 25-100mg IV hydrocort prior to surg then 50 q8 x 48 hours, taper dose by ½ per day until maintenance dose reached

ATRIAL FIBRILLATION:

* Think about:
  + rate/rhythm control
  + valvular disease/heart failure
  + prior thromboembolic events
  + prior management plans re: AC
* Hold asa 7 days prior to surgery. Discuss with cardiologist if for stents
* Hold Coumadin for 5 days/doses
* Hold dabigatran for 24 hours if CrCl>50, 48 hours if CrCl 30-50 for standard bleed procedures; hold for 2/4 days in higher risk procedures.
* Don’t bridge if low risk, CHADS2 0-2

OSA:

* high risk for complications including post extubation hypoxemia, hypercarbia, unplanned reintubation, PNA, resp failure, cardiac complications, ICU, LOS, sudden death.
* Screen with: STOP-BANG
  + Snoring, Tired, Observed apnea, Pressure (HTN), BMI>35, Age>50, Neck circumference>40cm, Gender male

High risk:>=3

Low risk: <3

93% sensitivity, 47% specificity for OSA

REUMATOID ARTHRITIS:

* increased cardiac risk
* pulmonary: fibrosis, bronchiolitis, pleuritis
* cricoarytenoid arthritis: 75% of RA patients; 🡪irritation from ET tube causes postop airway obstruction; h/o hoarseness, sore throat, trouble with inspiration
* cervical spine disease: cervical spine flex/extension films, especially if has had dz>5 years
* preop assessment: cbc for leukopenia/anemia; cmp bec of drug side effects, walking O2 sat, cervical spine films
* methotrexate: usually continue; stop if surgery for infection, post op infection, AKI, prolonged NPO, over age 70
* leflunomide: ½ life = 2 weeks; consider holding if large wound expected
* sulfasalazine, azathioprine, plaquenil: generally continue
* TNF alpha inhibitors: hold at least 2 ½ lives

CIRRHOSIS:

* Child-Pugh Score (INR, albumin, bilirubin, encephalopathy, ascites)
  + A: 5-6 points: 10% mortality undergoing abdominal surgery
  + B: 7-9 points: 30%
  + C: 10-15 points: 75-80% mortality

#### POST OP TESTS:

* **immediate postoperative electrocardiogram changes associated with postoperative major cardiac complications**
  + based on prospective cohort study
  + 3,570 patients who had major noncardiac procedures and had electrocardiogram (ECG) in recovery room were evaluated
  + new postoperative ECG abnormalities evaluated
    - ST-T elevation or depression
    - T-wave abnormalities compatible with ischemia
  + major cardiac complications considered
    - acute myocardial infarction
    - pulmonary edema
    - ventricular fibrillation
    - primary cardiac arrest
    - complete heart block
  + comparing patients with vs. without new postoperative ECG abnormalities
    - major cardiac complications in 6.7% vs. 1.9% (p < 0.001)
    - increased risk of major cardiac complications (odds ratio 2.2, 95% CI 1.2-3.9)
  + Reference - [Am J Cardiol 2004 Oct 15;94(8):1017](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list%5Fuids=15476615&" \t "%5Fblank)
* **Are post op troponin levels associated with 30 day mortality?**
  + **peak troponin T levels ≥ 0.02 ng/mL within 3 days after noncardiac surgery associated with increased 30-day mortality**
  + based on prospective cohort study
  + 15,133 patients ≥ 45 years old, with 24% over age 75, having noncardiac surgery and requiring ≥ 1 overnight hospital admission had peak troponin T levels measured postoperatively at 6-12 hours and on days 1-3
  + 1.9% overall 30-day mortality
  + limits: didn’t measure pre-op trop or assess interventions
  + peak troponin T levels ≥ 0.02 ng/mL associated with increased 30-day mortality (comparisons vs. levels ≤ 0.01 ng/mL)
    - 1% 30-day mortality with levels ≤ 0.01 ng/mL
    - 4% 30-day mortality with levels of 0.02 ng/mL (adjusted hazard ratio [HR] 2.41, 95% CI 1.33-3.77)
    - 9.3% 30-day mortality with levels of 0.03-0.29 ng/mL (adjusted HR 5, 95% CI 3.72-6.76)
    - 16.9% 30-day mortality with levels ≥ 0.3 ng/mL (adjusted HR 10.48, 95% CI 6.25-16.62)
  + Reference - [JAMA 2012 Jun 6;307(21):2295](https://rap.northshorelij.com/entrez/,DanaInfo=www.ncbi.nlm.nih.gov+query.fcgi?cmd=Retrieve&db=pubmed&dopt=Abstract&list%5Fuids=22706835&" \t "%5Fblank) [full-text](https://rap.northshorelij.com/,DanaInfo=jama.jamanetwork.com+article.aspx?articleid=1172044" \t "%5Fblank), correction can be found in JAMA 2012 Jun 27;307(24):2590

##### *-Monitoring troponin levels: consider for all patients at high risk for cardiac complications; high-risk surgery + RCRI I*

##### *-not recommended in asymptomatic stable patients with history of* [*low-risk*](https://rap.northshorelij.com/dynamed/,DanaInfo=web.ebscohost.com+detail?vid=3&sid=1f91e0f0-7efd-4753-82d1-6d75ca938528%40sessionmgr10&hid=19&bdata=JnNpdGU9ZHluYW1lZC1saXZlJnNjb3BlPXNpdGU%3d#anc-89090642) *surgery*

POST OP FEVERS:

1. Immediate (within hours): trauma/cytokine, meds (malignant hyperthermia), transfusion, necrotizing fasciitis, infection, thrombosis
2. Acute (within 1st week): surgical site, PNA, UTI, IV catheter, MI, DVT/PE, CVA/SAH, thrombophlebitis, hematoma, pancreatitis, ETOH withdrawal, gout, bowel ischemia, TTP, hyperthyroid, adrenal insufficiency, transfusion/med rxn
3. Subacute (1-4 weeks): surgical site infection, thrombophlebitis, dvt/pe, c diff, drug rxn, nosocomial pna/uti/iv catheter, intraabdominal abscess, sinusitis, otitis media, osteomyelitis, endocarditis, choly (acalculous)