Reasons to perform a preoperative evaluation

❶ Assessment of perioperative risk
- Can impact decision to proceed or choice of surgery
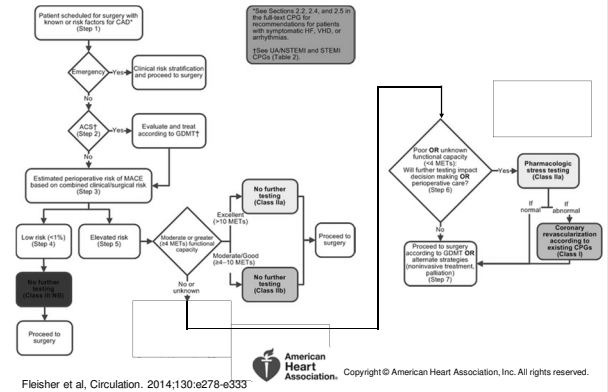
❷ Determination of need for changes in management
- Medical therapies, perform interventions or postoperative monitoring

❸ Identification of cardiovascular conditions or risk factors requiring longer-term management

Fleisher et al, Circulation. 2014;130:e278-e333

Perioperative Cardiac Assessment Algorithm

Fleisher et al, Circulation. 2014;130:e278-e333

Perioperative Cardiac Assessment Algorithm

Definitions of Urgency and Risk:

Emergency	Life or limb is threatened if not in the operating room, time for no or very limited clinical evaluation, within <6 hours
Urgent	May be time for limited clinical evaluation, life or limb is threatened if not in the operating room, within 6-24 hours
Time Sensitive	A delay of >1 to 6 weeks to allow for an evaluation and significant changes in management is not possible due to negative affected outcome
Elective	Procedure could be delayed by for up to 1 year

Fleisher et al, Circulation. 2014;130:e278-e333

Perioperative Cardiac Assessment Algorithm

Definitions of Urgency and Risk:

- Determination of Risk:
  - Combined surgical _and_ patient characteristics predict a risk of a major adverse cardiac event (MACE) of death or myocardial infarction
- Low risk procedures:
  - Lowest-risk operations are without significant fluid shifts and stress
  - cataract and plastic surgery
- Elevated risk procedures:
  - Vascular procedures, can be lowered by performing endovascularly

*prior risk-stratification step looked at surgical risk alone
*prior risk-stratification included intermediate and high risk classes but recommendations are similar so now simplified with two categories

Fleisher et al, Circulation. 2014;130:e278-e333

Perioperative Cardiac Assessment Algorithm

Determination of risk by multivariate risk indices:

RCRI 1999	ACS NSQIP MICA 2011	ACS NSQIP Surgical Risk Calculator 2013
▪ Simple, validated ▪ Used in prior guidelines ▪ Predicts major cardiac complications: MI, pulmonary edema, VFib or primary cardiac arrest, and complete heart block ▪ ≥ 2 RCRI would have elevated risk	▪ Single study, large and multicenter ▪ Target complications: cardiac arrest or MI ▪ Outperformed RCRI especially in vascular surgery	▪ Uses CPT codes to enable procedure-specific risk in addition to 21 patient-specific variables ▪ Calculates risk of MACE, death and 8 other outcomes ▪ Limitations: hasn't been validated externally, definition of MI (ST segment or large troponin bumps in symptomatic patients), uses ASA

Fleisher et al. Circulation. 2014;130:e278-e333
Lee et al. Circulation. 1999;100:1043-1049
Gupta et al. Circulation. 2011 Jul 26;124(4):381-7
Bilimoria et al. J Am Coll Surg. 2013 Nov;217(5):833-42.e1-3

Comparison of multivariate risk indices

	RCRI 1999	ACS NSQIP MICA 2011	ACS NSQIP Surgical Risk Calculator 2013
1	Creatinine ≥2 mg/dL	Creatinine >1.5 mg/dL	Acute renal failure
2	HF	...	HF
3	Intrathoracic, intra-abdominal, or suprainguinal vascular surgery	Surgery type: Anorectal, Aortic, Bariatric, Brain, Breast, Cardiac, ENT, Foregut / hepatopancreatobiliary, Gallbladder / adrenal / appendix / spleen, Intestinal, Neck, Obstetric / gynecological, Orthopedic, Other abdomen, Peripheral vascular, Skin, Spine, Thoracic, Vein, Urologic	Procedure (CPT Code)
4	Insulin-dependent diabetes mellitus	...	Diabetes mellitus
5	History of cerebrovascular accident or TIA	...	...
6	Ischemic heart disease	...	Previous cardiac event
7	...	Increasing age	Age
8	...	Partially or completely dependent functional status	Functional status
9	...	...	American Society of Anesthesiologists Physical Status Class
10	...	...	Wound class
11	...	...	Ascites
12	...	...	Systemic sepsis
13	...	...	Ventilator dependent
14	...	...	Disseminated cancer
15	...	...	Steroid use
16	...	...	Hypertension
17	...	...	Sex
18	...	...	Dyspnea
19	...	...	Smoker
20	...	...	COPD
21	...	...	Dialysis
22	...	...	Acute kidney injury
23	...	...	BMI
24	...	...	Emergency case

Fleisher et al. Circulation. 2014;130:e278-e333
Lee et al. Circulation. 1999;100:1043-1049
Gupta et al. Circulation. 2011 Jul 26;124(4):381-7
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Comparison of multivariate risk indices

	RCRI 1999	ACS NSQIP MICA 2011	ACS NSQIP Surgical Risk Calculator 2013
Use outside original cohort	Yes	No	No
Sites	Most often single-site studies, but findings consistent in multicenter studies	Multicenter	Multicenter
Outcome and risk factor ascertainment	Original: research staff, multiple subsequent studies using variety of data collection strategies	Trained nurses, no prospective cardiac outcome ascertainment	Trained nurses, no prospective cardiac outcome ascertainment
Calculation method	Single point per risk factor	Web-based or open-source spreadsheet for calculation http://www.surgicalriskcalculator.com/miorcardiacarrest	Web-based calculator www.riskcalculator.facs.org

Fleisher et al. Circulation. 2014;130:e278-e333
Lee et al. Circulation. 1999;100:1043-1049
Gupta et al. Circulation. 2011 Jul 26;124(4):381-7
Bilimoria et al. J Am Coll Surg. 2013 Nov;217(5):833-42.e1-3

Perioperative Cardiac Assessment Algorithm

Low risk of perioperative MACE (<1%):

- Example: ophthalmologic procedures despite the clinical risk factors
- Go straight to surgery without further testing

Elevated risk of perioperative MACE:

- Example: major vascular procedure despite minimal risk factors
- Proceed to step 5 in algorithm, functional determination
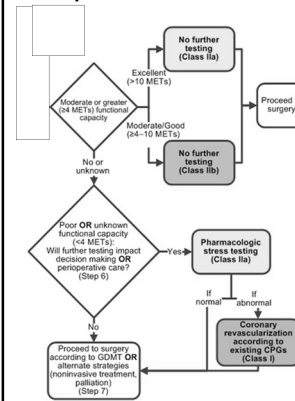
Fleisher et al, Circulation. 2014;130:e278-e333

Perioperative Cardiac Assessment Algorithm

Determine functional status (METS vs Dependent function):

- >4-10METS "moderate to good" or >10 METS "excellent"= proceed straight to surgery (Class IIb or Ia)
  – Key: golfing with a cart, walking at <4mph is NOT >4 METS
  – Perioperative cardiac and long term risks are increased when patients unable to perform 4 METS of work

- ACS NSQIP dataset has shown dependent functional status (based on need for assistance with ADLs and not METS), associated with significantly increased risk of perioperative morbidity and mortality

Fleisher et al, Circulation. 2014;130:e278-e333

Perioperative Cardiac Assessment Algorithm

Fleisher et al. Circulation. 2014;130:2215-2245

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Perioperative Cardiac Assessment Algorithm

Will further testing impact care or change medical management?

- Change surgical plan

- Cancel surgery

- Change perioperative management

"…the value of additional testing and treatment is often limited except for identifying and stabilizing patients with unstable cardiac disease. Such [urgent surgical] patients are usually not candidates for CABG and the need for prolonged dual antiplatelet therapy markedly limits the use of PCI…and recommendations are often made on the basis of initial risk indices. If the surgical approach would be altered on the basis of additional risk stratification (eg, surgery would be delayed, canceled, or performed on dual antiplatelet therapy), additional testing and treatment may be warranted."

Up-To-Date Preoperative Evaluations

Clinical risk factors and disease processes

Cardiovascular/Cerebrovascular disease:

- Prior coronary events are risk factors for MACE
  – Wait >60 days after an MI before non-cardiac surgery in the absence of coronary intervention

- Recent MI (<6 months) independent risk factor for perioperative stroke

- Age over 65 reported higher incidence of acute ischemic stroke

- History of CVA shown to predict perioperative MACE

Fleisher et al, Circulation. 2014;130:e278-e333

Clinical risk factors and disease processes

Risk of congestive heart failure

- Active or history of clinical heart failure (HF) increases risk significantly
- Despite changes in definition, treatment, demographics, perioperative care
- Risk models focus on CAD however active HF has significantly higher risk of postop death
- Higher rates of readmission and operative death in elderly HF patients (50-100% higher)
- Longer length of stay, increased readmission and longterm mortality rates even in stable HF

Clinical risk factors and disease processes

Risk of heart failure: reduced EF and diastolic dysfunction

- Decreased LV function (EF <30%) alone (compensated HF) is independent contributor to periop outcome and long-term risk factor for death in pts undergoing elevated risk noncardiac surgery
  - HFpEF higher rates of all-cause mortality but not like reduced EF HF

- Diastolic dysfunction risks limited data but associated with higher rate of MACE, prolonged LOS and postoperative HF

Clinical risk factors and disease processes

Valvular disease:

- **Class I/LOE C:**
  - Moderate or greater stenosis or regurgitation have preoperative echo if not done in year or if change in status or exam
  - If meet indications for valve intervention regardless, should do before elective surgery to reduce perioperative risk

Aortic Stenosis:

- **Class IIa/LOE B:**
  - Asymptomatic severe AS reasonable to proceed to elevated risk non-cardiac surgery with appropriate monitoring

- Postoperative MI more frequent in AS patients than non-AS patients

- Predictors of 30-day death and postop MI with moderate or severe AS include: high risk surgery, symptomatic severe AS, coexisting mod/severe MR and pre-existing CAD

Clinical risk factors and disease processes

**Pulmonary Hypertension (pHTN):**

Class IIa/LOE C:

- Preoperative evaluation by pHTN specialist can be beneficial, particularly for those with features of increased risk* (unless risk of delay outweighs this benefit)

  *diagnosis of PAH; other pHTN associated with high pulmonary artery pressures (PAP >70) and/or moderate or greater RV dilatation and/or dysfunction and/or pulmonary vascular resistance; WHO/NYHA class III or IV symptoms due to pHTN

- All based on observational data and predominantly related to Group I PAH

- In patients with other causes for PAH, preoperative eval should assess functional capacity, hemodynamics, echo for RV function, +/- RHC

Why care about pulmonary pressures perioperatively?
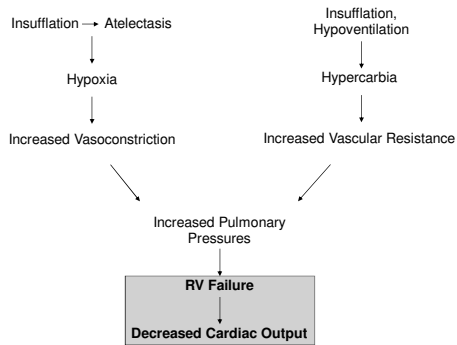
Supplemental testing and strategies

Preoperative EKG:

- **Class IIa/LOE B:**
  - Preoperative resting 12 lead ECG is reasonable for patients with known CAD, significant arrhythmia, peripheral arterial disease, cerebrovascular disease or other significant structural heart disease, except for those undergoing low risk surgery

- **Class III/LOE B:**
  - Routine preoperative resting 12 lead ECG is not useful for asymptomatic patients undergoing low risk surgical procedures

- 1-3 month interval preoperatively is adequate for stable patients

Supplemental testing and strategies

Preoperative echocardiogram:

- **Class IIa/LOE C:**
  - Reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function
  - Reasonable for patients with HF with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function

- **Class III/LOE B:**
  - Routine preoperative evaluation of LV function is not recommended

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Revascularization

Preoperative revascularization:

- **Class I/LOE C:**
  - In circumstances when revascularization is indicated according to existing clinical guidelines

- **Class III/LOE B:**
  - It is not recommended that routine coronary revascularization be performed before non cardiac surgery exclusively to reduce perioperative cardiac events

- Performing PCI before noncardiac surgery should be limited to:
  - LM disease whose comorbidities preclude bypass surgery without undue risk
  - Patients with unstable CAD who would be appropriate candidates for emergency or urgent revascularization (STEMI or non-STEMI)

2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with CAD

Introduction and Definitions:

- DAPT = combination antiplatelet therapy with aspirin and a $P2Y_{12}$ receptor inhibitor (clopidogrel, prasugrel, or ticagrelor)

- Recommendations apply to newer-generation stents (e.g., everolimus- or zotarolimus-eluting) and in general only to those not treated with oral anticoagulant therapy

General Overriding Concepts (section 3.1):

- Lower ischemic risk + High bleeding risk = Shorter-duration DAPT

- Higher ischemic risk + Lower bleeding risk = Longer-duration DAPT

2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with CAD

Timing of noncardiac surgery after PCI:

- **Class I:**
  - Elective noncardiac surgery should be delayed 30 days after BMS implantation and optimally 6 months after DES implantation
  - If procedure mandates stopping DAPT preop, is recommended that aspirin be continued if possible and the $P2Y_{12}$ platelet receptor inhibitor be restarted as soon as possible after surgery

- **Class IIb/LOE C:**
  - Elective noncardiac surgery after DES implantation in patients for whom DAPT will need to be discontinued may be considered after 3 months if the risk of further delay is greater than the expected risks of stent thrombosis

- **Class III/LOE B:**
  - Elective noncardiac surgery should not be performed within 30 days after BMS implantation or within 3 months after DES implantation in patients in whom dual antiplatelet therapy will need to be discontinued perioperatively

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2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with CAD

Timing of noncardiac surgery after PCI:

- DES treated with DAPT
  - Class I: > 6 months since DES implantation, discontinue DAPT
  - Class IIb (may be considered): 3-6 months since DES implantation, discontinue DPAT; delayed surgery risk is greater than stent thrombosis risk
  - Class III (harm): <3 months since DES implantation, so delay surgery

- BMS treated with DAPT
  - Class I: > 30 days since DES implantation, ok to proceed with surgery
  - Class III (harm): <30 days since BMS implantation, so delay surgery

---

2016 ACC/AHA Guideline Focused Update on Duration of Dual Antiplatelet Therapy in Patients with CAD

Timing of *noncardiac surgery* after recent ACS:

- Recent ACS treated with any modality

- Class IIb: After 6 months may be reasonable to discontinue DAPT, if high bleeding risk (risk of bleeding or risk of severe bleeding complications such as major intracranial surgery)

Preoperative beta blocker therapy

- **Class IIb/LOE C:**
  - In patients with intermediate- or high-risk myocardial ischemia on preoperative risk testing, it may be reasonable to begin BB

- **Class IIb/LOE B:**
  - In patients with 3 or more RCRI risk factors, it may be reasonable to begin BB

- **Class III/LOE B:**
  - Should not be started on the day of surgery

Fleisher et al, Circulation. 2014;130:e278-e333

Chief complaint: "I have a spot on my kidney"

Patient H&P

- Ms. X is a 58yo F w/ PMH of CAD, OSA
- Workup of microscopic hematuria led to finding of right renal mass suspicious for renal cell carcinoma

PMH:	• CAD s/p RCA stent, OSA
Functional Capacity:	• >4 METS
Surgical Procedure:	• Robotic laparoscopic nephrectomy
Home Meds:	• Atenolol 50mg QD; Rosuvastatin 20mg; • ASA 325mg; Clopidogrel 75mg; Lisinopril-HCTZ 20-12.5mg
Vitals:	• 136/72 64 14 ht: 5'2" wt: 280# BMI 51
Exam:	• Gen: NAD • CV: RRR no M; no JVD • Lungs: CTAB • Ext: 1+ bilateral pitting edema
Labs/Data:	• Hgb 12, Creatinine 1.0 • Cardiac cath 8 months ago: DES prox RCA • Echo with EF 60%, PASP ~65, RV normal • PSG 2013 severe OSA

What should we NOT do for our patient in preparing her for surgery?

Treatment Options

A. Discontinue the DAPT preoperatively, ask surgeon to operate on aspirin therapy

B. Tell the surgeon to operate once it has been 12 months from time of stent insertion and then stop all antiplatelets for surgery

C. Consult with a pulmonary HTN specialist if available

D. Speak with surgeon and anesthesia about whether a robotic approach is truly feasible

---

Always ask the surgeon and anesthesiologist:

- Urgency of the case or indication for surgery

- Expected length of case

- Expected blood loss

- Preferred route of anesthesia

- Positioning

- Other surgical options, non-surgical options, do they want to do it

- Other nuances (intranasal cocaine, adenosine in neurovascular)

The key points from our discussion today:

- Determine if patient is at low risk or elevated risk of MACE and then decide further testing

- Do not ignore other cardiopulmonary disease outside of CAD (valve disease, pulmonary HTN, etc)

- Class III recommendation for EKGs in low risk procedures, Class I recommendation for an updated echocardiogram if moderate or greater valvular disease

- Shorter duration of DAPT is reasonable when bleeding risk is higher and vice versa

- **Always remember, more about preop'ing than just CAD and/or predicting MACE… don't have tunnel vision**