

Perioperative Cardiac Management

Emma Sargsyan, MD, FACP

Outline

- Evaluation of cardiac risk prior to non-cardiac surgery
- Management of cardiac risk for non-cardiac surgery

Preop medical consultation

- Many patients undergoing major noncardiac surgery are at risk for cardiac morbidity and mortality not only intraoperatively but also during their recovery period.
- The risk is related to patient- and surgery-specific characteristics.
- All patients scheduled to undergo noncardiac surgery should have an assessment of the risk of perioperative cardiac event.
- Identification of increased risk provides the patient (and surgeon) with information that helps them better understand the benefit-to-risk ratio of a procedure and may lead to interventions that decrease risk.

Outline

- **STEP 1: IS THERE CLINICAL NEED FOR EMERGENCY NONCARDIAC SURGERY?**
- **STEP 2: DOES THE PLANNED SURGERY HAVE A LOW CARDIAC RISK?**
- **STEP 3: DOES THE PATIENT HAVE GOOD FUNCTIONAL CAPACITY WITHOUT SYMPTOMS?**
- **STEP 4: DOES THE PATIENT HAVE CLINICAL RISK FACTORS?**
- **STEP 5: ARE THERE ACTIVE CARDIAC CONDITIONS?**

Definition of urgency

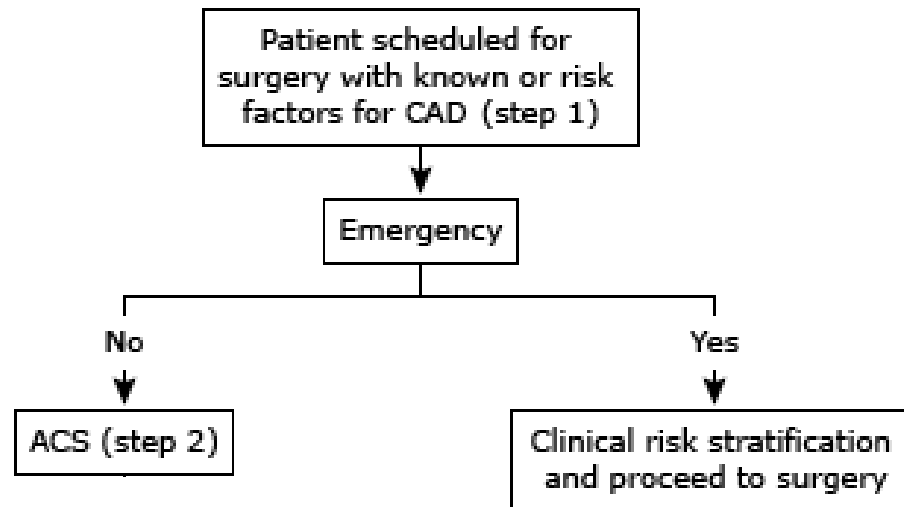
- Emergent < 6 hours
 - time for no or very limited or minimal clinical evaluation
- Urgent < 6-24 hours
 - may be time for a limited clinical evaluation
- Time sensitive – may delay for up to 6 weeks
 - most oncologic procedures would fall into this category
- Elective – may delay for up to 1 year

Outline

- **STEP 1: IS THERE CLINICAL NEED FOR EMERGENCY NONCARDIAC SURGERY?**
- STEP 2: DOES THE PLANNED SURGERY HAVE A LOW CARDIAC RISK?
- STEP 3: DOES THE PATIENT HAVE GOOD FUNCTIONAL CAPACITY WITHOUT SYMPTOMS?
- STEP 4: DOES THE PATIENT HAVE CLINICAL RISK FACTORS?
- STEP 5: ARE THERE ACTIVE CARDIAC CONDITIONS?

Emergency surgery

- In many cases, there is not sufficient time for an extensive evaluation of the severity of a patient's cardiovascular problem, and in most cases the benefit of proceeding with surgery outweighs the risk of waiting to perform additional testing.



2014 ACC/AHA ALGORITHM

Outline

- STEP 1: IS THERE CLINICAL NEED FOR EMERGENCY NONCARDIAC SURGERY?
- **STEP 2: DOES THE PLANNED SURGERY HAVE A LOW CARDIAC RISK?**
- STEP 3: DOES THE PATIENT HAVE GOOD FUNCTIONAL CAPACITY WITHOUT SYMPTOMS?
- STEP 4: DOES THE PATIENT HAVE CLINICAL RISK FACTORS?
- STEP 5: ARE THERE ACTIVE CARDIAC CONDITIONS?

Surgical procedures according to their risk for a perioperative cardiac complication

■ Low-risk (<1% MACE risk)

Endoscopic procedures

Superficial procedures

Cataract surgery

Plastic surgery

Dental procedures

Ambulatory surgery

■ High-risk (>5% MACE risk):

Aortic

Peripheral vascular

■ Intermediate-risk (1% to 5% MACE risk)

Intrathoracic

Intraperitoneal

Orthopedic surgery

Head and neck surgery

Carotid endarterectomy

Prostate surgery

Outline

- STEP 1: IS THERE CLINICAL NEED FOR EMERGENCY NONCARDIAC SURGERY?
- STEP 2: DOES THE PLANNED SURGERY HAVE A LOW CARDIAC RISK?
- **STEP 3: DOES THE PATIENT HAVE GOOD FUNCTIONAL CAPACITY WITHOUT SYMPTOMS?**
- STEP 4: DOES THE PATIENT HAVE CLINICAL RISK FACTORS?
- STEP 5: ARE THERE ACTIVE CARDIAC CONDITIONS?

Cardiac functional status

- One important indicator of poor functional status and an increased risk of postoperative cardiopulmonary complications after major noncardiac surgery is the **inability to climb two flights of stairs or walk four blocks.**

Cardiac functional status

- Functional status can be expressed in metabolic equivalents
 - (1 MET is defined as 3.5 mL O₂ uptake/kg per min, which is the resting oxygen uptake in a sitting position).
- Can take care of self, such as eat, dress, or use the toilet (1 MET)
- Can walk up a flight of steps or a hill or walk on level ground at 3 to 4 mph (4 METs)
- Can do heavy work around the house, such as scrubbing floors or lifting or moving heavy furniture, or climb two flights of stairs (between 4 and 10 METs)
- Can participate in strenuous sports such as swimming, singles tennis, football, basketball, and skiing (>10 METs)

Duke Activity Status Index

Question	Activity: Can you	Yes	No
1	Take care of yourself, that is, eating, dressing, bathing, or using the toilet?	2.75	0
2	Walk indoors, such as around your house?	1.75	0
3	Walk a block or two on level ground?	2.75	0
4	Climb a flight of stairs or walk up a hill?	5.50	0
5	Run a short distance?	8.00	0
6	Do light work around the house like dusting or washing dishes?	2.70	0
7	Do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?	3.50	0
8	Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?	8.00	0
9	Do yard work like raking leaves, weeding, or pushing a power mower?	4.50	0
10	Have sexual relations?	5.25	0
11	Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	6.00	0
12	Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?	7.50	0

From Hlatky MA, Boineau RE, Higginbotham MB, et al. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index).

Outline

- STEP 1: IS THERE CLINICAL NEED FOR EMERGENCY NONCARDIAC SURGERY?
- STEP 2: DOES THE PLANNED SURGERY HAVE A LOW CARDIAC RISK?
- STEP 3: DOES THE PATIENT HAVE GOOD FUNCTIONAL CAPACITY WITHOUT SYMPTOMS?
- **STEP 4: DOES THE PATIENT HAVE CLINICAL RISK FACTORS?**
- STEP 5: ARE THERE ACTIVE CARDIAC CONDITIONS?

History

- At the time of the initial preoperative evaluation, inquire about symptoms such as
 - Angina
 - Dyspnea
 - Syncope
 - Palpitations
 - History of heart disease (ischemic, valvular, or cardiomyopathic disease), and a history of hypertension, diabetes, chronic kidney disease, and cerebrovascular or peripheral artery disease.

Risk estimation models

- Risk models estimate the risk based on
 - History
 - Physical examination
 - EKG
 - Type of surgery
- Revised cardiac risk index (RCRI), also referred to as the Lee index American
- College of Surgeons National Surgical Quality Improvement Program (NSQIP) risk model

The RCRI is simpler and has been widely used and validated over the past 15 years.

The NSQIP calculator is more complex and has yet to be validated in other populations.

Revised cardiac risk index (RCRI)

Six independent predictors of major cardiac complications^[1]

High-risk type of surgery (examples include vascular surgery and any open intraperitoneal or intrathoracic procedures)
History of ischemic heart disease (history of myocardial infarction or a positive exercise test, current complaint of chest pain considered to be secondary to myocardial ischemia, use of nitrate therapy, or ECG with pathological Q waves; do not count prior coronary revascularization procedure unless one of the other criteria for ischemic heart disease is present)
History of heart failure
History of cerebrovascular disease
Diabetes mellitus requiring treatment with insulin
Preoperative serum creatinine >2.0 mg/dL (177 micromol/L)

Rate of cardiac death, nonfatal myocardial infarction, and nonfatal cardiac arrest according to the number of predictors^[2]

No risk factors - 0.4% (95% CI: 0.1-0.8)
One risk factor - 1.0% (95% CI: 0.5-1.4)
Two risk factors - 2.4% (95% CI: 1.3-3.5)
Three or more risk factors - 5.4% (95% CI: 2.8-7.9)

Rate of myocardial infarction, pulmonary edema, ventricular fibrillation, primary cardiac arrest, and complete heart block^[1]

No risk factors - 0.5% (95% CI: 0.2-1.1)
One risk factor - 1.3% (95% CI: 0.7-2.1)
Two risk factors - 3.6% (95% CI: 2.1-5.6)
Three or more risk factors - 9.1% (95% CI: 5.5-13.8)

Cardiac complication percent

- These models provide us with the risk of a cardiac complication in percent.
 - **Low-risk patients** — Patients whose estimated risk of death is less than 1% are labeled as being low risk and require no additional cardiovascular testing.
 - **Higher-risk patients** — Patients whose risk of death is 1% or higher may require additional cardiovascular evaluation.

Simplified five-factor RCRI

- Compared with the RCRI, a simplified five-factor model ("reconstructed RCRI") using high-risk type of surgery, history of ischemic heart disease, congestive heart failure, cerebrovascular disease, and preoperative glomerular filtration rate (GFR) <30 mL/minute (*but not including diabetes or insulin treatment*) resulted in superior prediction of major cardiac complications following elective noncardiac surgery.

Very high risk patients

Very high risk for perioperative MI, HF, VF, primary cardiac arrest, complete heart block, and cardiac death

- **Recent MI or unstable angina**
- **Decompensated HF**
 - (symptomatic > asymptomatic)
 - HFrEF > HFpEF
- **High-grade arrhythmias**
- **Hemodynamically important valvular heart disease**
 - Stenosis > regurgitation

Recent MI

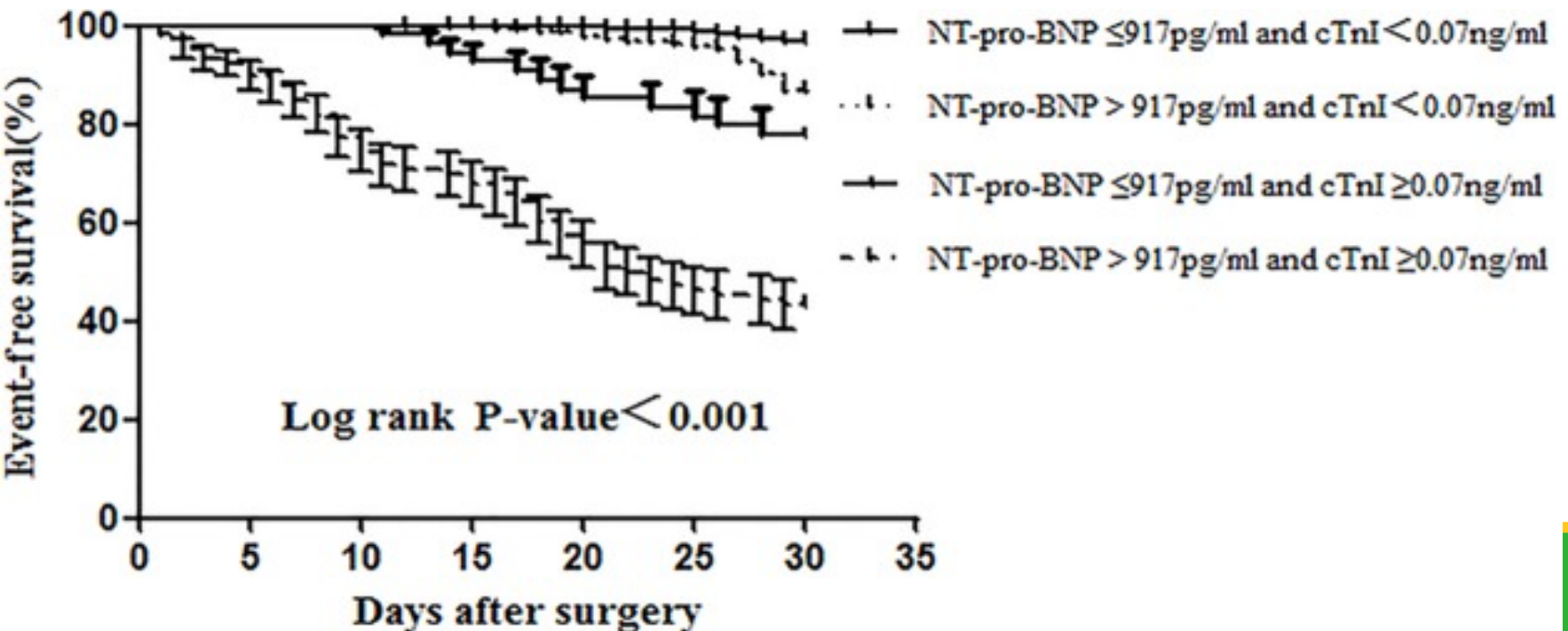
- A recent MI, defined as having occurred *within 6 months* of noncardiac surgery, was also found to be an independent risk factor for perioperative stroke, which was associated with an *8-fold increase in the perioperative mortality rate*.

Ejection fraction - an independent contributor to perioperative outcome

- In a meta-analysis using individual patient data, patients with HF and preserved LVEF had a lower all-cause mortality rate than that of those with HF and reduced LVEF (the risk of death did not increase notably until LVEF fell below 40%).
- Survival after surgery for patient with a LVEF $\leq 29\%$ is significantly worse than for those with a LVEF $>29\%$.
- However, the absolute mortality rate was still high in patients with HF and preserved LVEF as compared with patients without HF, highlighting the importance of presence of HF.
- Diastolic dysfunction with and without systolic dysfunction has been associated with a significantly higher rate of MACE, prolonged length of stay, and higher rates of postoperative HF.

Troponin and brain natriuretic peptide

- Preoperative plasma NT-proBNP and troponin are both independently associated with an increased risk of major adverse cardio-vascular events in elderly patients after emergent non-cardiac surgery.
- The combination of these biomarkers provides better prognostic information than using either biomarker separately.



Preop BNP/NT-proBNP and 30-day mortality or MI

BNP pg/mL	30-d death or MI		NT-proBNP pg/mL	30-d death or MI
0-250	6.6%		0-300	1.8%
250-400	15.7%		300-900	8.7%
>400	29.5%		900-3000	20.1%

Anesthesiology 2013; 119:270-283

Atrial fibrillation

Population-based data analysis of 4 cohorts of 38,047 patients, the 30-day postoperative mortality rate was:

- nonischemic HF (9.3%), ischemic HF (9.2%)
- atrial fibrillation (6.4%)
- CAD (2.9%)

The risk associated with atrial fibrillation is higher than that associated with a diagnosis of coronary artery disease.

Patients with active HF have a significantly higher risk of postoperative death than do patients with CAD.

The stability of a patient with HF plays a significant role.

Other arrhythmias

- *Frequent ventricular premature beats and nonsustained ventricular tachycardia are risk factors for the development of intraoperative and postoperative arrhythmias, but they are not associated with an increased risk of nonfatal MI or cardiac death in the perioperative period.*

Age

- Age >62 years is an independent risk factor for perioperative stroke.
- Older adults >70 years of age have increased length of hospitalization, and inability to return home after hospitalization.

Obesity

Obese patients are at increased risk for adverse cardiovascular events at the time of noncardiac surgery.

Additional cardiovascular evaluation

If functional capacity is < 4 METs or unknown, additional testing may be indicated if it will influence perioperative care.

- EKG
- 24-hour ambulatory monitoring
- Echocardiography
- Stress testing
- Cardiologist consultation, revascularization

EKG

- EKG abnormalities are not part of either risk estimation calculators, because of the lack of prognostic specificity associated with these findings.
- A preoperative EKG obtained in asymptomatic patients without known cardiovascular disease is rarely helpful.
- Obtain an EKG in patients with known cardiovascular disease, significant arrhythmia, or significant structural heart disease unless the patient is undergoing low-risk surgery.

EKG

- The rationale for obtaining a preoperative EKG comes from the utility of having a baseline EKG should a postoperative ECG be abnormal.
- Evaluate for the presence of Q waves or significant ST-segment elevation or depression, which raises the possibility of myocardial ischemia or infarction, left ventricular hypertrophy, QTc prolongation, bundle-branch block, or arrhythmia

24-hour ambulatory monitoring

- 24-hour ambulatory monitoring is not recommended for perioperative diagnostic or prognostic purposes if it is not otherwise indicated.
- It is primarily for patients with syncope or significant bradycardia or tachycardia if not previously evaluated.

Resting echocardiography

- Resting echocardiography is not indicated in the perioperative patient unless there is another indication, such as to evaluate valve function in patients with a murmur or left ventricular systolic function in patients with heart failure or dyspnea of unknown cause.

Resting echocardiography - Class I recommendation

- Patients with clinically suspected moderate or greater degrees of valvular stenosis or regurgitation should undergo preoperative echocardiography if there has been either
 - 1) no prior echocardiography within 1 year, or
 - 2) a significant change in clinical status or physical examination since last evaluation
- For adults who meet standard indications for valvular intervention (replacement and repair) on the basis of symptoms and severity of stenosis or regurgitation, valvular intervention before elective noncardiac surgery is effective in reducing perioperative risk.

Resting echocardiography - Class II recommendation

- It is reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function.
- It is reasonable for patients with HF with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function.
- Reassessment of LV function in clinically stable patients with previously documented LV dysfunction may be considered if there has been no assessment within a year.

Resting echocardiography - Class III recommendation

- Routine preoperative evaluation of LV function is not recommended.

Stress testing

- Stress testing is not indicated in the perioperative patient solely because of the surgery if there is no other indication.
- No study has shown that interventions performed consequent to the results of the test improves outcomes.

Stress test – recommendations

- Class IIa

It is reasonable for patients who are at an elevated risk for noncardiac surgery and have poor functional capacity (<4 METs) to undergo noninvasive pharmacological stress testing if it will change management.

- Class III

Routine screening with noninvasive stress testing is not useful for patients undergoing low-risk noncardiac surgery.

Stress test

- A normal study for perioperative MI and/or cardiac death has a very high negative predictive value.
- The presence of an old MI identified on rest imaging is of little predictive value for perioperative MI or cardiac death.
- The presence of moderate to large areas of myocardial ischemia is associated with increased risk of perioperative MI and/or death.

Revascularization

- With the exception of patients with an acute coronary syndrome, myocardial revascularization prior to noncardiac surgery to improve perioperative outcomes of noncardiac surgery is not recommended.
- Pharmacologic therapy holds more promise than coronary revascularization for the reduction of major adverse perioperative cardiac events that might complicate noncardiac surgery.

Revascularization - recommendations

- Class I
Revascularization before noncardiac surgery is recommended in circumstances in which revascularization is indicated according to existing clinical practice guidelines.
- Class III
It is not recommended that routine coronary revascularization be performed before noncardiac surgery exclusively to reduce perioperative cardiac events

The Coronary Artery Revascularization Prophylaxis trial

- Randomized comparison of *planned preoperative revascularization (with either PCI or CABG) and no plan for preoperative coronary revascularization* in patients with stable coronary disease undergoing major vascular surgery.
- Both groups received usual medical therapy with approximately 80% of both groups receiving beta blockers and aspirin and over 50% receiving statins and ACE inhibitors.
 - 5859 patients scheduled for vascular operations
 - 1190 were considered to be at increased cardiac risk (based upon clinical factors and/or stress testing) and had no other exclusions to participation (urgent vascular surgery or severe coexisting illness). These patients underwent coronary angiography;
 - *680 patients were excluded because of left main coronary disease, severe left ventricular dysfunction (left ventricular ejection fraction [LVEF] $\leq 20\%$), severe aortic stenosis, or coronary anatomy not suitable for revascularization.*
 - The remaining 510 patients (representing 9% of the original study candidates) were randomly assigned to planned preoperative revascularization or no plan for preoperative coronary revascularization.
 - Of those assigned to revascularization, 38% underwent CABG, 55% underwent PCI, and 7% received no revascularization.

The Coronary Artery Revascularization Prophylaxis trial

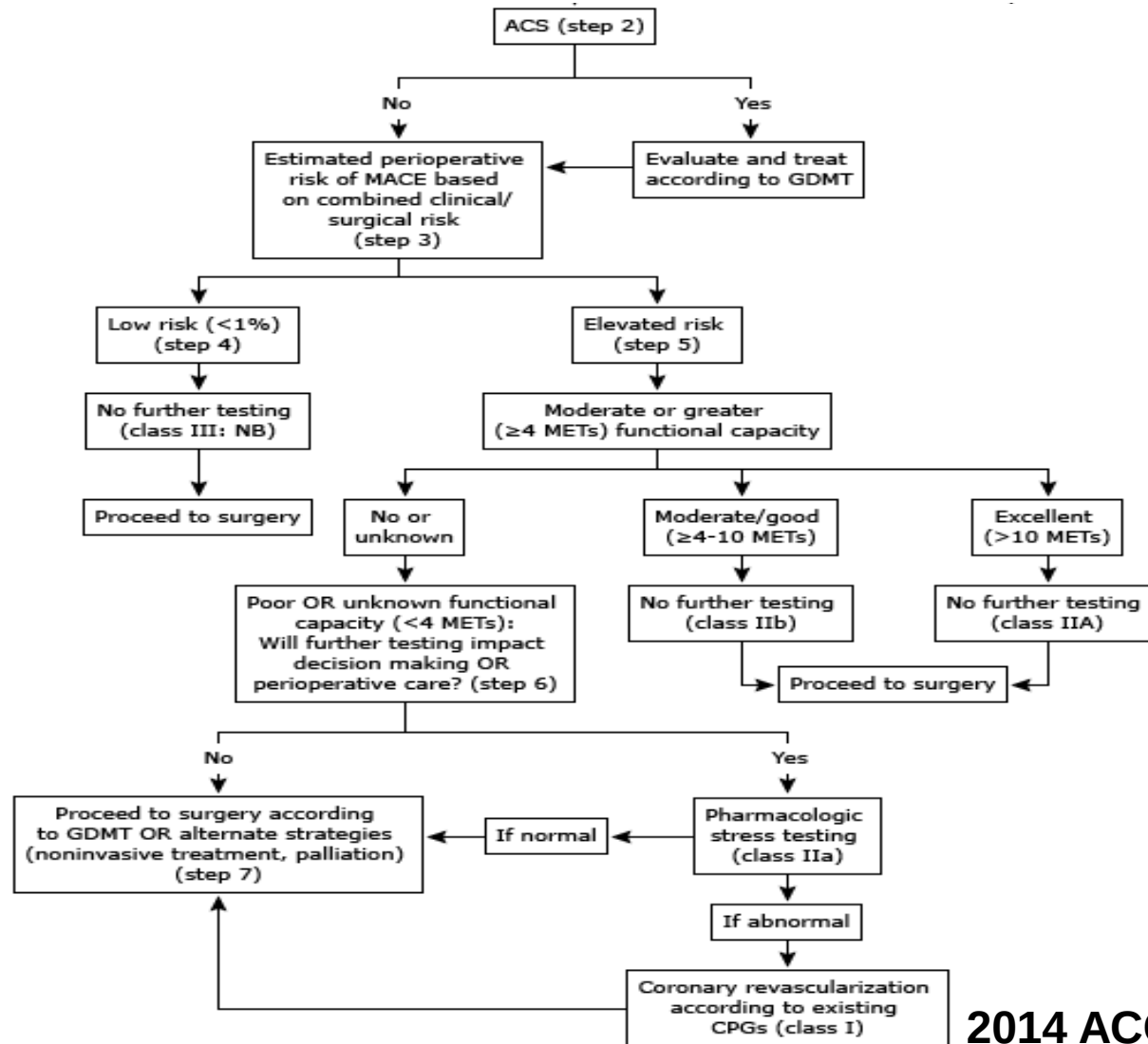
The following outcomes were observed:

- MI within the first 30 days after noncardiac surgery was 8.4 % in both groups. However, 5.8 % of the patients in the coronary revascularization group experienced an MI after their coronary revascularization but prior to their noncardiac surgery.
- There were no differences between the revascularization and medical arms in LVEF at three months (54 versus 55 %).
- **At a median of 2.7 years, the primary end point (all-cause mortality) was not significantly different in the revascularization and no revascularization groups** (22 versus 23 %, relative risk 0.98, 95% CI 0.70-1.37).
- Post-hoc subgroup analysis found that **only patients with unprotected left main coronary artery disease benefited from preoperative revascularization.**

Timing of Elective Noncardiac Surgery in Patients With Previous PCI

- Class I
 - Elective noncardiac surgery should be delayed 14 days after balloon angioplasty and 30 days after BMS implantation.
 - Elective noncardiac surgery should optimally be delayed 365 days after drug-eluting stent implantation.
- Class IIb
 - Elective noncardiac surgery after drug-eluting stent implantation may be considered after 180 days if the risk of further delay is greater than the expected risks of ischemia and stent thrombosis.

In summary: Non-emergency surgery



2014 ACC/AHA ALGORITHM

Beta blocker

- Do not start beta blockers preoperatively in patients without strong indications, as they may increase the risk of death and stroke.
- Continue beta blockers in patients taking them for indications such as hypertension, rate control for atrial fibrillation, control of angina, heart failure, or prior MI.
- For patients scheduled for noncardiac surgery who should have been started on beta blocker for an appropriate indication (eg, heart failure, angina, hypertension, after MI), avoid starting a beta blocker preoperatively, particularly if the time between initiation and surgery is less than two to four hours.

POISE trial - the largest trial to evaluate the efficacy and safety of prophylactic beta blockers

- 8351 patients with or at risk of atherosclerotic disease (most with a revised cardiac risk index [RCRI] of 1 or 2) undergoing noncardiac surgery
- Randomly assigned to either metoprolol (100 mg metoprolol succinate) or placebo started two to four hours before surgery and repeated 0 to 6 hours after surgery depending on the patients hemodynamics.
- This was followed by 200 mg of metoprolol or placebo daily for 30 days.
- Study drug administration was given if the heart rate was ≥ 50 beats per minute and the systolic blood pressure was ≥ 100 mmHg.
- The following findings were noted at 30 days:
 - **The primary end point of cardiovascular death, nonfatal MI, or nonfatal cardiac arrest occurred significantly less often in the metoprolol group** (5.8 versus 6.9%, hazard ratio [HR] 0.84, 95% CI 0.70-0.99). This benefit was driven entirely by a reduction in MI (4.2 versus 5.7%).
 - **Total mortality and stroke were significantly increased in the metoprolol group** (3.1 versus 2.3 % and 1 versus 0.5 %, respectively). Clinically important hypotension occurred significantly more often in the metoprolol group (15 versus 9.7%). The use of perioperative beta blockade was associated with a significantly increased risk of nonfatal stroke.

Interactive cases

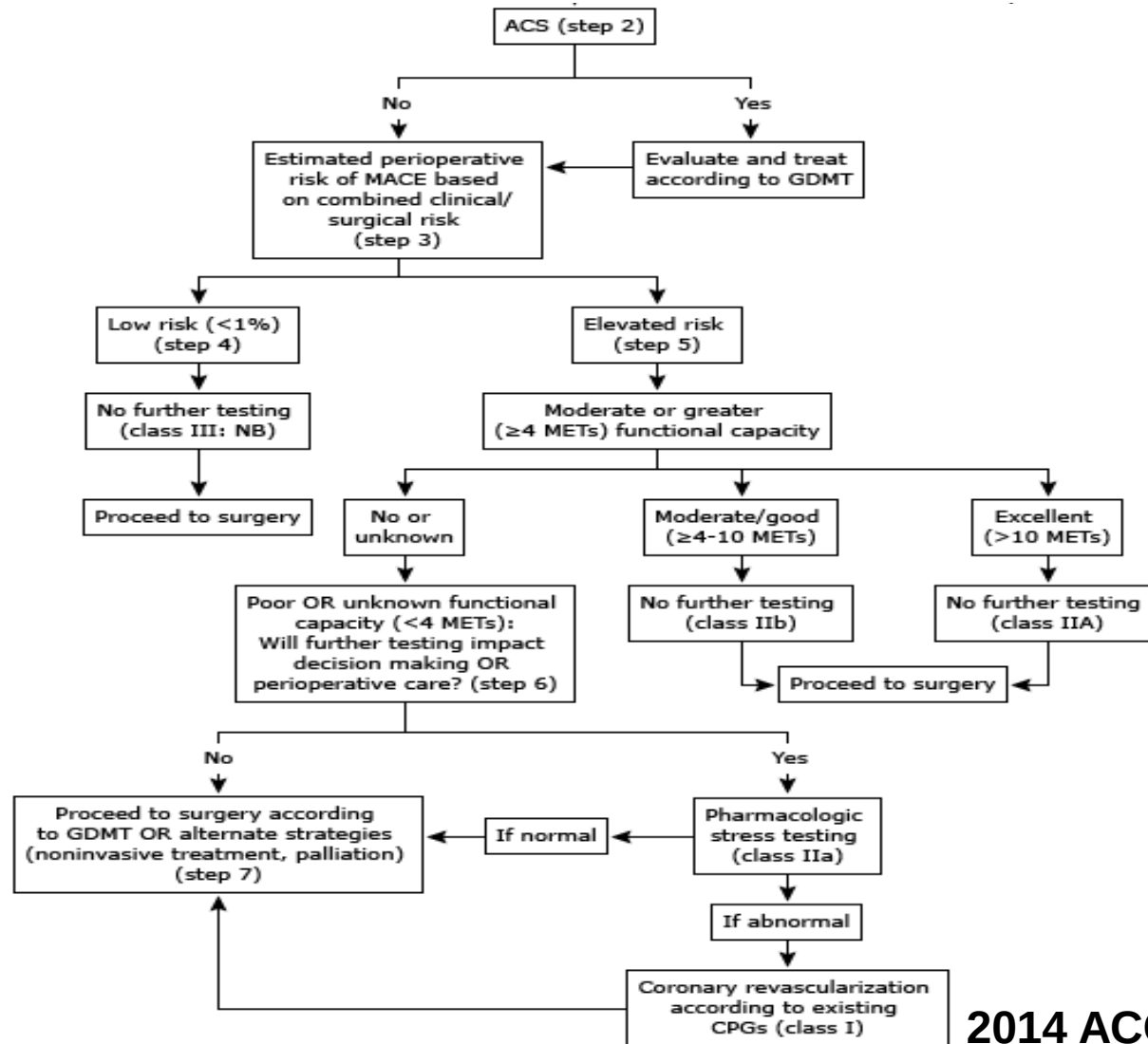
Patient #1

- Ms. Jones, a 55-year-old woman who presents to your office for a preoperative evaluation for cataract surgery. From the chart you see she has a history of congestive heart failure due to ischemic heart disease, hypertension, and diabetes. She takes aspirin, glyburide, lisinopril, metformin, and metoprolol.
- Her exam revealed no concerns
- Denies having chest pain, dyspnea, dizziness. She is not physically active.

What are your recommendations for this patient?

- Proceed to surgery without further testing
- Evaluate with cardiac stress testing
- Recommend against surgery

In summary: Non-emergency surgery



2014 ACC/AHA ALGORITHM

What are your recommendations for this patient?

- **Proceed to surgery without further testing**
- Evaluate with cardiac stress testing
- Recommend against surgery

Patient #2

- Ms. Carter, a 67-year-old woman with long-standing cervical radiculopathy who sees you in your office to discuss the cervical spine surgery she is considering. She is worried about a perioperative complication because her father had a heart attack during colon surgery many years ago.
- She has a history of diabetes, chronic obstructive pulmonary disease, and chronic kidney disease. She also had a transient ischemic attack years ago and a hysterectomy 5 years ago. She takes aspirin, formoterol, insulin 70/30, and lisinopril.
- She is very active, including gardening and walking in her neighborhood. She reports no symptoms, including chest pain, cough, and shortness of breath, even when she walks up the two flights of stairs to her apartment.

Patient #2

- Blood pressure: 118/78 mm Hg; pulse: 86 beats/min
- Heart: S1 and S2 regular; no murmurs
- Lungs: clear, but breath sounds are decreased at both bases
- Abdomen: soft, nondistended, and nontender
- Extremities: no peripheral edema
- Her hemoglobin A1c was 6.9 and her creatinine was 2.1 a month ago. These have been stable for the last year. A recent electrocardiogram was normal.

She asks you about the risk for a complication during surgery like her father had.

- You are very low risk. I think it would be safe to have the surgery
- You are low risk. I think surgery will probably be safe.
- You are at moderate risk. I am somewhat concerned you could have a complication.
- You are at high risk. I am very concerned that you could have a complication.

She asks you about the risk for a complication during surgery like her father had.

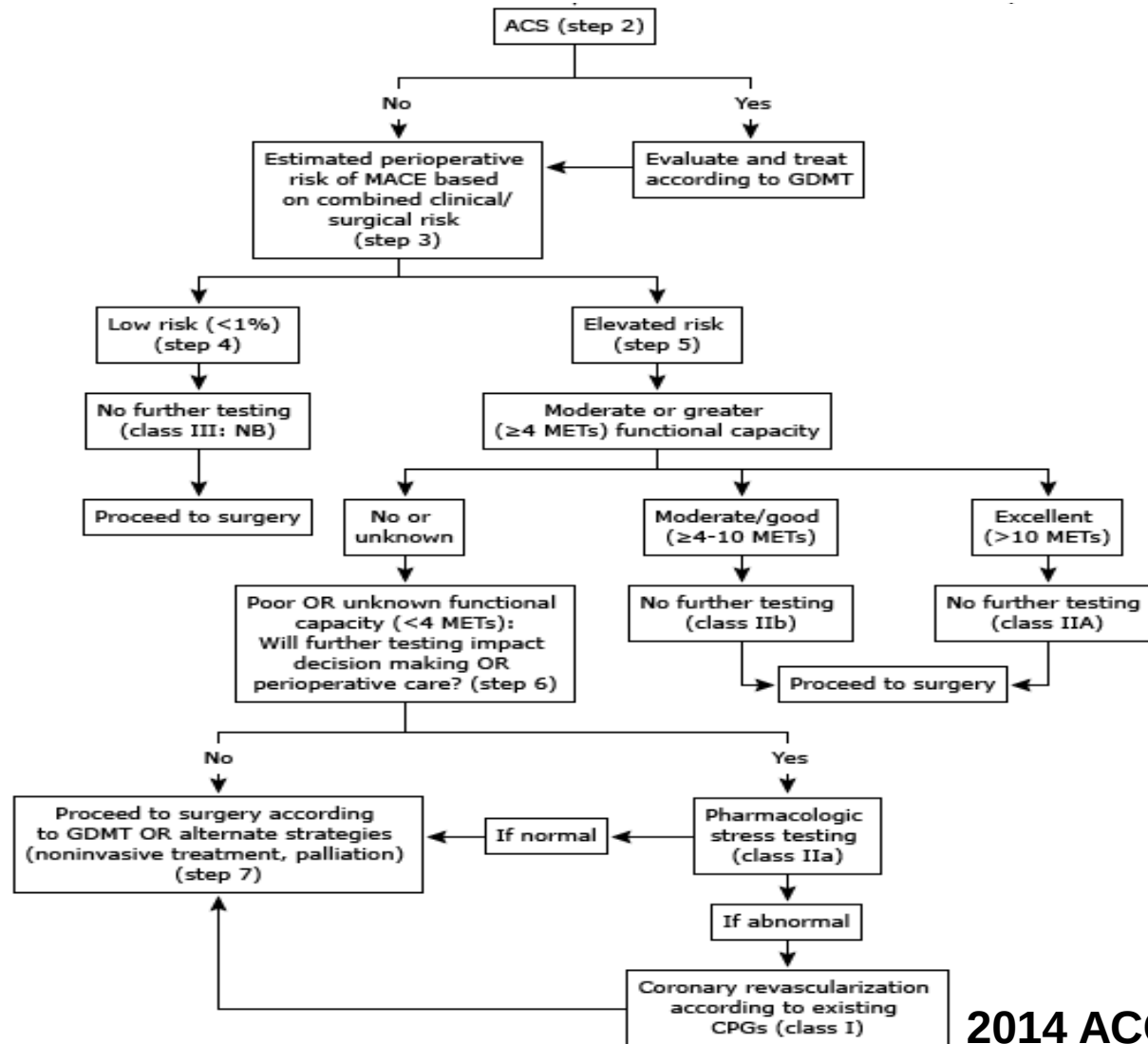
- You are very low risk. I think it would be safe to have the surgery
- You are low risk. I think surgery will probably be safe.
- You are at moderate risk. I am somewhat concerned you could have a complication.
- **You are at high risk. I am very concerned that you could have a complication.**

What would you like to do?

Ms. Carter calls your clinic to tell you that she understands the elevated risks but would like to proceed with the surgery anyway.

- Order stress test
- Do not order stress test

In summary: Non-emergency surgery



2014 ACC/AHA ALGORITHM

What would you like to do?

Ms. Carter calls your clinic to tell you that she understands the elevated risks but would like to proceed with the surgery anyway.

- Order stress test
- **Do not order stress test**

Stress testing is not indicated in asymptomatic patients with good functional capacity.

- Stress testing should be done only if it is likely to change management. In most patients with good functional status, stress testing is not likely to change management.
- If she were planning to undergo high-risk surgery rather than intermediate-risk surgery, some experts would consider ordering cardiac stress testing.

2

Don't obtain baseline diagnostic cardiac testing (trans-thoracic/esophageal echocardiography – TTE/TEE) or cardiac stress testing in asymptomatic stable patients with known cardiac disease (e.g., CAD, valvular disease) undergoing low or moderate risk non-cardiac surgery.

Advances in cardiovascular medical management, particularly the introduction of perioperative beta-blockade and improvements in surgical and anesthetic techniques, have significantly decreased operative morbidity and mortality rates in noncardiac surgery. Surgical outcomes continue to improve causing the mortality rate of major surgeries to be low and the need for revascularization minimal. Consequently, the role of preoperative cardiac stress testing has been reduced to the identification of extremely high-risk patients, for instance, those with significant left main disease for which preoperative revascularization would be beneficial regardless of the impending procedure. In other words, testing may be appropriate if the results would change management prior to surgery, could change the decision of the patient to undergo surgery, or change the type of procedure that the surgeon will perform.

Patient #3

- Mr. Green, a 62-year-old man, comes to see you in your office before a scheduled abdominal aortic aneurysm (AAA) repair. His AAA has been gradually increasing in size, and a vascular surgeon has recommended an elective open repair.
- He is having no symptoms from his AAA. He reports no other symptoms, including chest pain, cough, shortness of breath, and syncope. He is mostly sedentary, being limited by severe osteoarthritis in his knees and hips. He can walk slowly on flat ground with only moderate pain but cannot climb steps. In addition to osteoarthritis, he also has a history of diabetes, hypertension, and coronary artery disease. His medications include aspirin, carvedilol, insulin glargine, lisinopril, metformin, and naproxen.

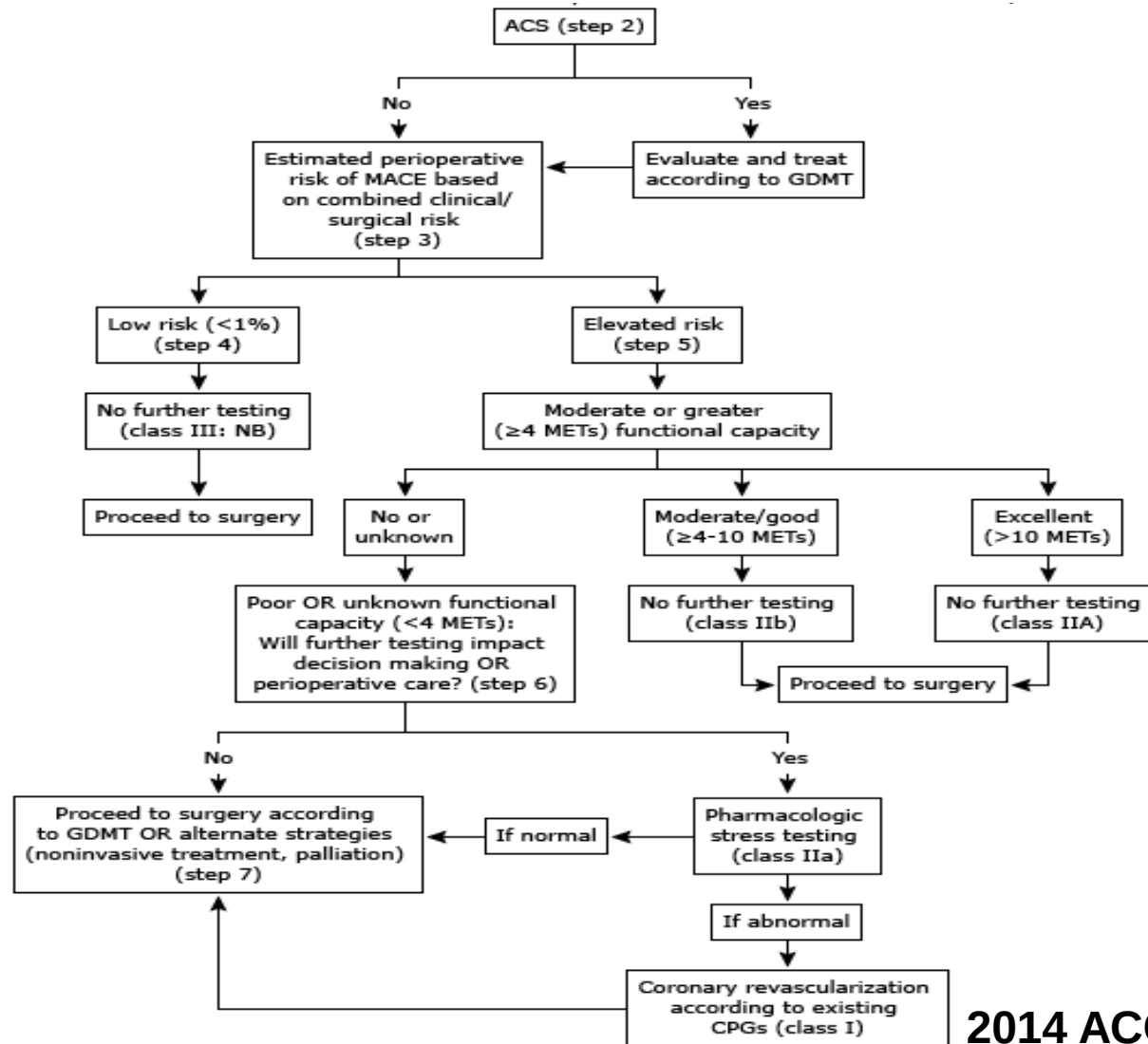
Patient #3

- His pulse is 64, and his blood pressure is 124/78.
- Heart: S1 and S2 regular; no murmurs
- Lungs: clear to auscultation b/l
- Abdomen: soft, nondistended, and nontender
- Extremities: no edema, his knees have significant crepitus and are painful with flexion and extension.
- His electrocardiogram shows old Q waves in the anterior leads with no new changes.

What do you recommend?

- Proceed with surgery without additional testing or management.
- Proceed with surgery with an increase of his beta-blocker dose.
- Perform stress test.
- Recommend against surgery.

In summary: Non-emergency surgery



2014 ACC/AHA ALGORITHM

What do you recommend?

- Proceed with surgery without additional testing or management.
- Proceed with surgery with an increase of his beta-blocker dose.
- **Perform stress test.**
- Recommend against surgery.

Low functional status => further assessing with stress test (vs patient #2 had good functional capacity)

- It reveals a large reversible defect. Mr. Green subsequently undergoes coronary angiography, which demonstrates 60% narrowing of his left main coronary artery. After a multidisciplinary team meeting and discussion with the patient, he undergoes a percutaneous coronary intervention with placement of a bare metal stent and begins receiving clopidogrel (in addition to his aspirin).
- His vascular surgeon decides to delay his surgery for 2 months until his clopidogrel can be safely withheld for the surgery. He completes the surgery at that time without any adverse events and recovers well.

Revascularization?

- Revascularization is recommended preoperatively when it would be indicated anyway, not simply to reduce perioperative risk.
- If this surgery were not elective, the same reasoning about stress testing would not apply. If he needed an AAA intervention urgently, for example, proceeding to surgery without stress testing would be recommended.

THANK YOU

Emma Sargsyan, MD, FACP