



W

Perioperative Medicine

2022 ACP Washington Chapter Board
Review Course

Paul B. Cornia, MD



Disclosures

Today's talk is updated/adapted from Dr. Elizabeth Kaplan (2019 WA ACP Board Review)

I receive honoraria from UpToDate for authoring topics on pertussis infection in adolescents and adults.



Objectives

- General preop medical evaluation
- Cardiac and pulmonary preop risk stratification prior to non-cardiac surgery
- Utilize appropriate preoperative testing, avoid unnecessary testing
- Perioperative medication management



Case 1

75 yo male presents for preop medical eval prior to elective TKA scheduled 1 week from today. He is functionally limited by knee pain and but also notes recent onset progressive dyspnea on exertion; he has no angina.

PMHx: HTN, DM2, tobacco use.

BP 152/76 mmHg, HR 82/min, JVP 14, bibasilar rales, RRR S1 S2 1-2/6 systolic murmur but no S3/S4, 1+ pre-tibial edema



Case 1

Which of the following is the most appropriate next step?

- A. Order dobutamine stress echocardiography
- B. Begin diuretic therapy and proceed with surgery
- C. Refer to cardiology for preoperative evaluation
- D. Cancel surgery and initiate appropriate evaluation and treatment
- E. Order cardiac MRI



Case 1

Which of the following is the most appropriate next step?

- A. Order dobutamine stress echocardiography
- B. Begin diuretic therapy and proceed with surgery
- C. Refer to cardiology for preoperative evaluation
- D. Cancel surgery and initiate appropriate evaluation and treatment**
- E. Order cardiac MRI



Case 1

Cardiac Conditions Considered Contraindications to Surgery [1]

- Acute coronary syndrome
 - Recent MI [2]
- Acute decompensated heart failure
- High-grade arrhythmias
- Severe, symptomatic valvular disease (particularly aortic stenosis [3])

1. JAMA. 2020;324(3):279-290.
2. Ann Surg. 2011;253(5):857.
3. Eur Heart J. 2014;35(35):2372.



Case 2

82 yo female presents to primary care clinic prior to scheduled for cataract repair. She feels well and has moderate exercise tolerance (4-7 METs).

PMHx: HTN, hyperlipidemia, GERD, OA.

BP 152/84, HR 80. Exam unremarkable, lab testing 3 months ago normal.

Prior to upcoming surgery, you recommend:

- A. No additional testing or change in mgmt. is needed;
- B. ECG;
- C. CBC, BMP + PT/PTT;
- D. Increase lisinopril dosage for better BP control;
- E. B and C



Case 2

Prior to upcoming surgery, you recommend:

- A. **No additional testing or change in mgmt. is needed;**
- B. ECG;
- C. CBC, BMP + PT/PTT;
- D. Increase lisinopril dosage for better BP control;
- E. B and C



Avoid unnecessary testing before low-risk surgery

History and exam are cornerstones for preop risk assessment and direct additional testing

For low-risk surgery, testing is unlikely to change risk assessment but incurs cost and may unnecessarily delay the surgery

- Low risk surgeries include cataract, breast surgery, endoscopy, superficial skin procedures

<https://www.choosingwisely.org/clinician-lists/society-general-internal-medicine-routine-preoperative-testing-before-low-risk-surgery/>



Case 3

63 yo female with CAD (MI 10 years ago), HTN, and depression referred for preop medical eval prior to partial colectomy. She walks ½-1 mile most days for exercise and is able to climb 2 flights of stairs at the community center without angina or dyspnea.

Exam is unremarkable. ECG shows NSR with Q waves 2/3/aVF.

Regarding additional preoperative cardiac testing, which is most appropriate?

- A. Exercise (treadmill) electrocardiography
- B. Transthoracic echocardiography
- C. Dobutamine stress echocardiography
- D. No additional cardiac testing is indicated

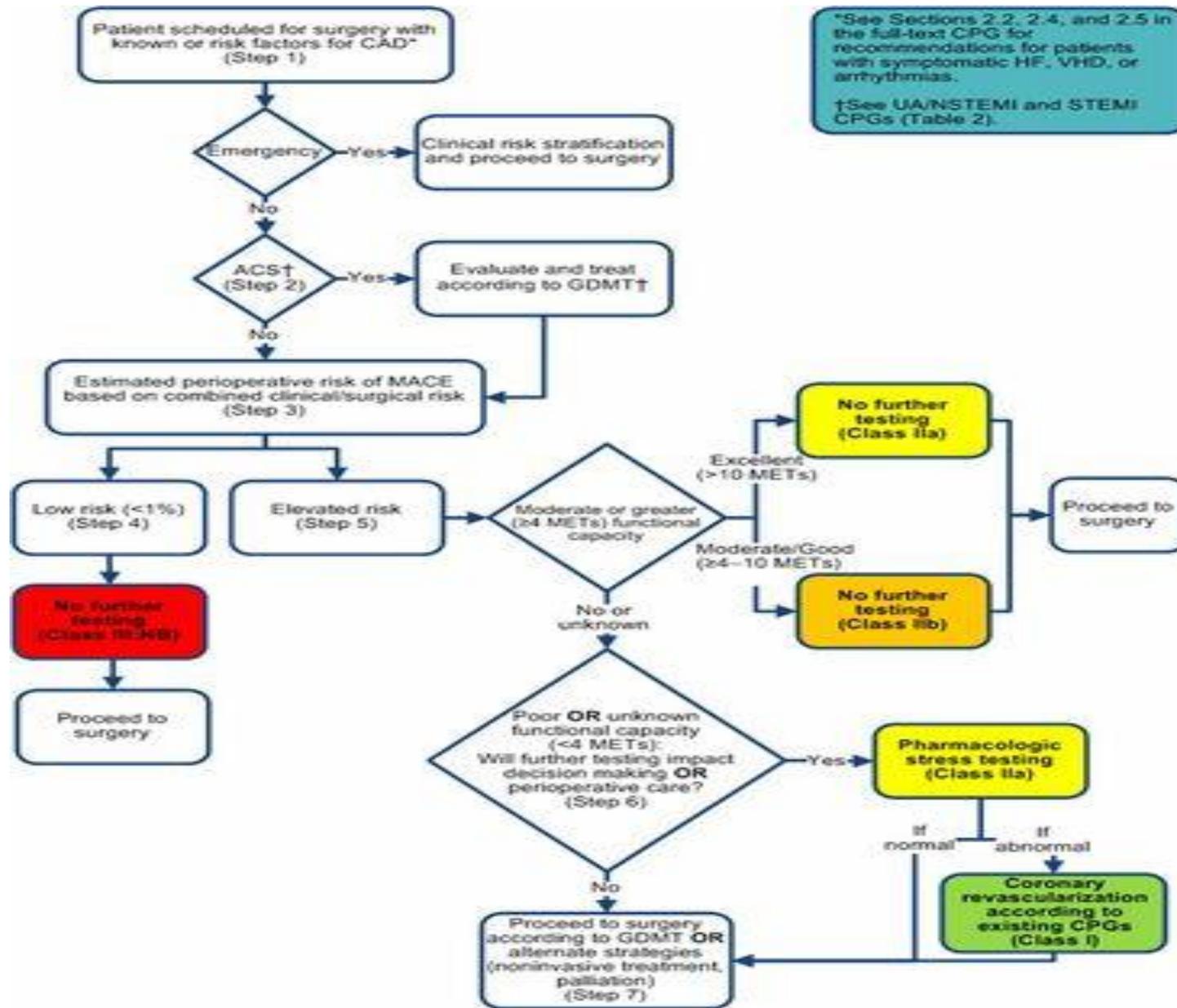


Case 3

Regarding additional preoperative cardiac testing, which is most appropriate?

- A. Exercise (treadmill) electrocardiography
- B. Transthoracic echocardiography
- C. Dobutamine stress echocardiography
- D. **No additional cardiac testing is indicated**





How do I assess functional status?

Table 1. Common activities and corresponding metabolic equivalents (METs)

Activity	METS
Walking slowly, less than 2 mph	2
Gardening, light effort, using containers	2.3
Cleaning, general house, moderate effort	3.3
Walking briskly, 3 mph	3.3
Bicycling, leisure, 5.5 mph	3.5
Yard work or gardening, moderate effort	4
Climbing stairs, slow pace	4
Bicycling, casual, less than 10 mph	4
Dancing (ballet or modern)	4.8
Snorkeling	5
Mowing the lawn with hand mower	6
Shoveling snow	6
Hiking, cross country	6
Rowing, vigorous effort	6
Tennis, doubles	6
Climbing hills, no load	6.3
Skiing, downhill	7
Carrying groceries upstairs	7.5
Calisthenics, vigorous effort (push ups, sit ups, pull-ups, etc.)	8
Swimming, crawl, slow	8
Bicycling, 12-13.9 mph, leisure, moderate effort	8
Tennis, singles	8
Running, 5 mph (12 min/mile)	8.3
Bicycling, 14-15.9 mph, racing or leisure, fast, vigorous effort	10
Running, 7.5 mph (8 min/mile)	11.5
Running, 10 mph (6 min/mile)	14.5
Running, 12 mph (5 min/mile)	19

1 MET = energy expenditure/oxygen consumption while seated at rest

Inability to perform <4 METs (for any reason) is associated with increased postoperative complications [1]

1. Arch Intern Med. 1999;159(18):2185-2192.

Citation: 2011 Compendium of Physical Activities. Med Sci Sports Exerc. 2011 Aug;43(8):1575-81.



How should I estimate perioperative cardiac risk (ie, “low” [$<1\%$] vs. “elevated” [$\geq 1\%$] risk)?

No universally accepted cardiac risk predictor, available tools include:

- Revised cardiac risk index (RCRI) [1]
 - 1 point each for: CAD, CVA/TIA, h/o CHF, DM treated with insulin, SCr ≥ 2.0 , high risk surgery (intra-abdominal, intra-thoracic, supra-inguinal vascular)
 - <https://www.mdcalc.com/calc/1739/revised-cardiac-risk-index-pre-operative-risk>
- ACS/NSQIP
 - <https://riskcalculator.facs.org/RiskCalculator/index.jsp>
- Gupta MICA (MI or Cardiac Arrest)
 - https://qxmd.com/calculate/calculator_245/gupta-perioperative-cardiac-risk



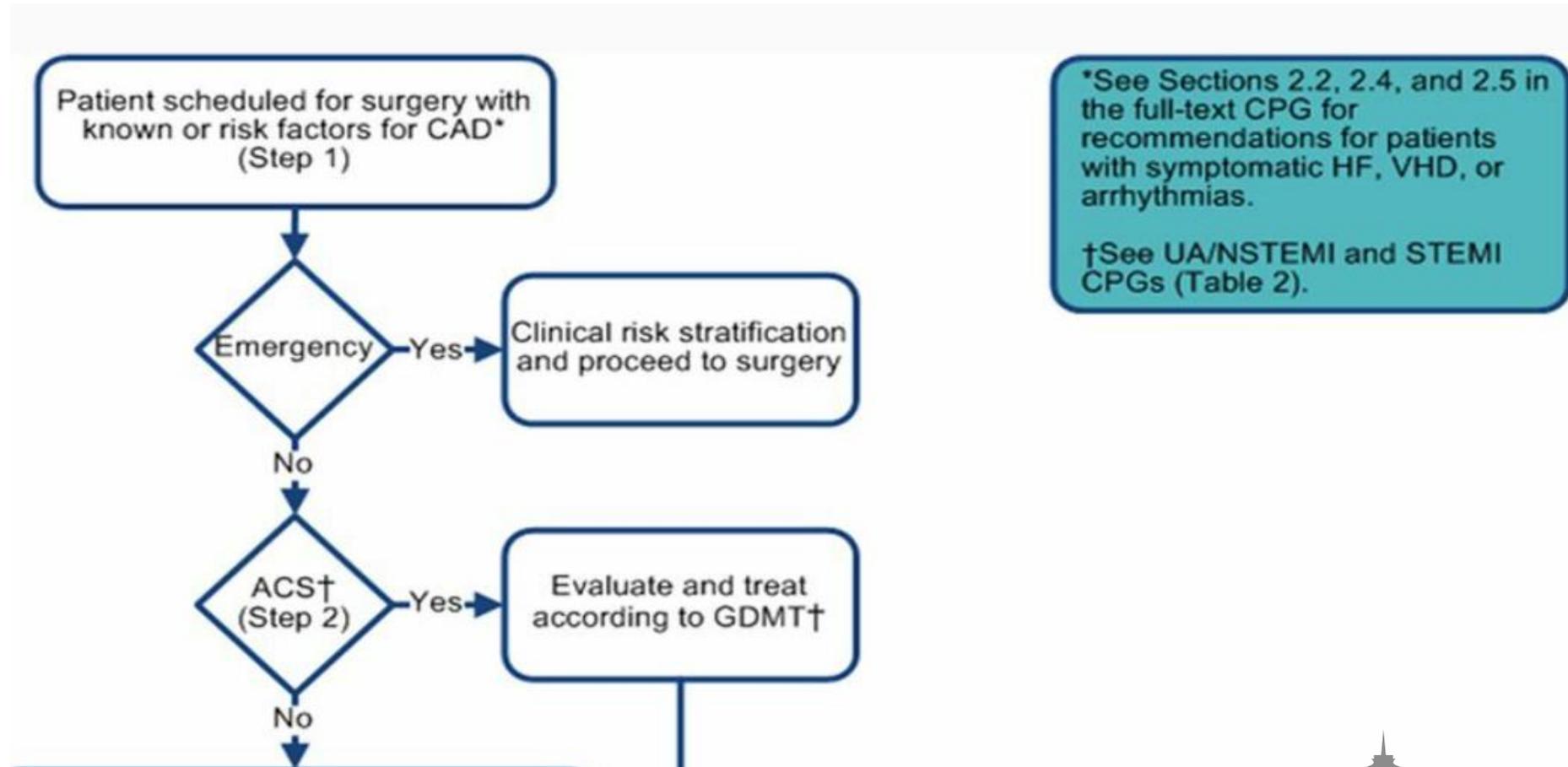
Case 3

63 yo female with CAD (MI 10 years ago), HTN, and depression referred for preop medical eval prior to partial colectomy. She walks ½-1 mile most days for exercise and is able to climb 2 flights of stairs at the community center without angina or dyspnea.

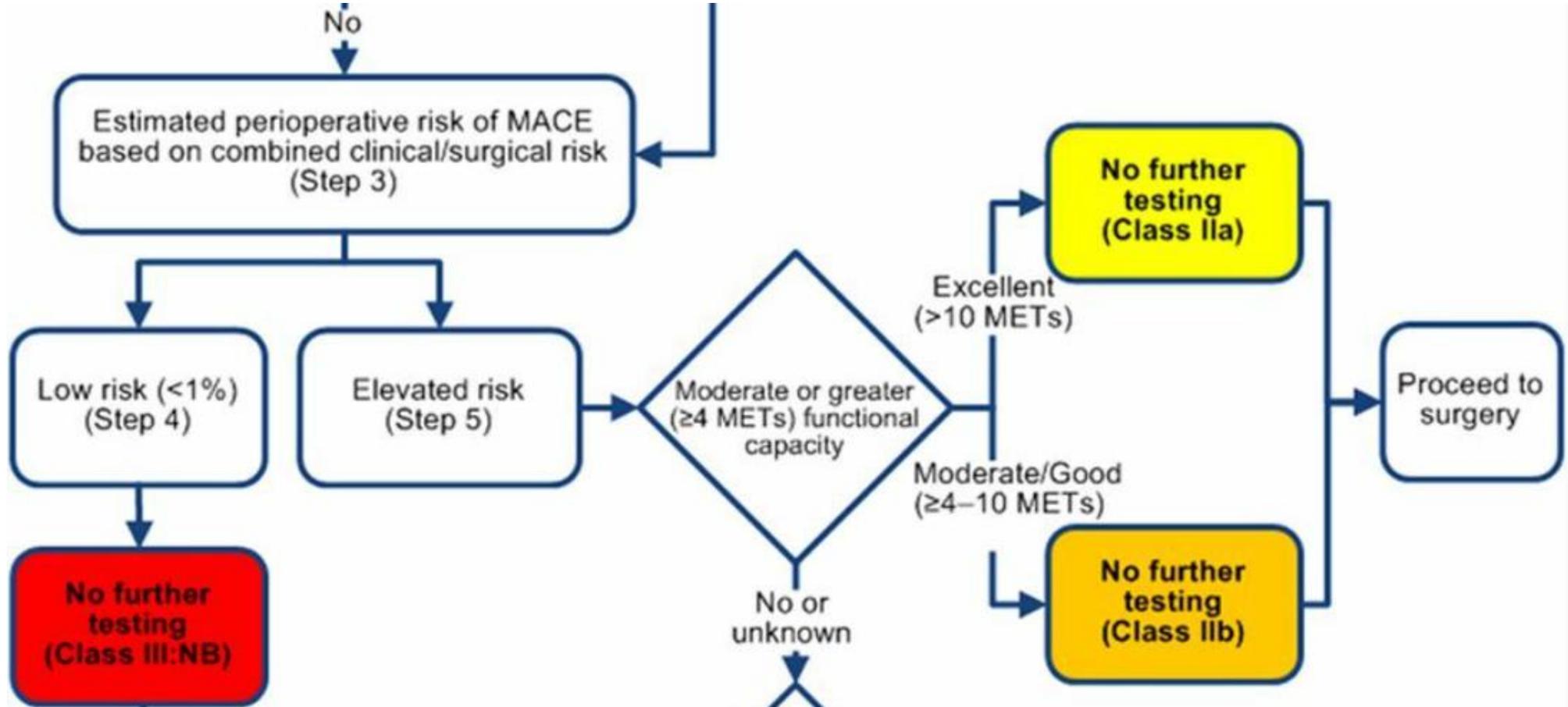
Exam is unremarkable. ECG shows NSR with Q waves 2/3/aVF.



Case 3



Case 3



Case 4

59 yo male is scheduled for a potentially curative lobectomy for lung cancer. His functional status is stable but limited by chronic DOE. He is able to walk <1 block and <1 flight of stairs due to dyspnea.

PMHx is notable for COPD, HTN, DM2, hyperlipidemia and tobacco use.

Regarding additional preoperative cardiac testing, which is most appropriate?

- A. No additional cardiac testing is indicated
- B. Exercise (treadmill) electrocardiography
- C. Transthoracic echocardiography
- D. Dobutamine stress echocardiography



Case 4

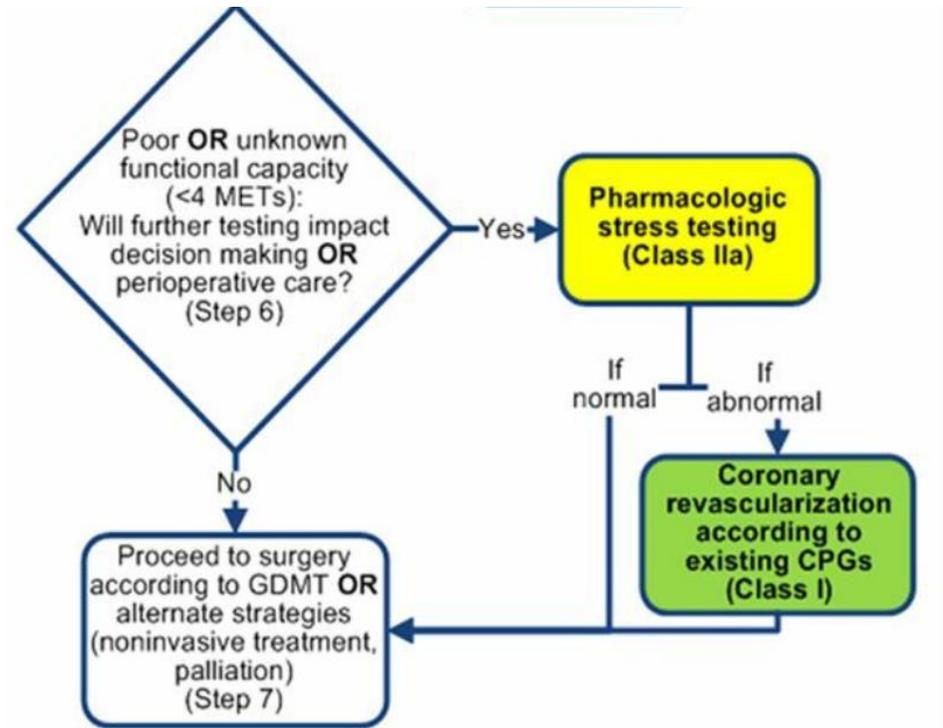
Regarding additional preoperative cardiac testing, which is most appropriate?

- A. **No additional cardiac testing is indicated**
- B. Exercise (treadmill) electrocardiography
- C. Transthoracic echocardiography
- D. Dobutamine stress echocardiography



Case 4

Order preoperative cardiac testing *only if it will influence perioperative management*



Case 5

70 yo female referred for evaluation prior to cholecystectomy.

PMHx is notable for aortic stenosis (moderate severity on echo 2 ½ years ago), HTN, OA (knees), PTSD.

Regarding additional preoperative cardiac testing, which is most appropriate?

- A. Exercise myocardial perfusion study
- B. Transthoracic echocardiography
- C. Dobutamine stress echocardiography
- D. No additional cardiac testing is indicated



Case 5

Regarding additional preoperative cardiac testing, which is most appropriate?

- A. Exercise myocardial perfusion study
- B. Transthoracic echocardiography**
- C. Dobutamine stress echocardiography
- D. No additional cardiac testing is indicated



Preoperative assessment of known valvular heart disease

Moderate or worse valvular disease (stenosis or regurgitation) → preoperative echocardiography ***if not done within 1 year*** OR significant change in clinical status/physical exam. (Class 1, LOE: C)

In addition, if intervention (valve replacement or repair) is indicated, should be performed prior to elective non-cardiac surgery. (Class 1, LOE: C)



Case 6

65 yo male was evaluated by primary care MD 6 months prior for angina. Exercise MPS showed myocardial ischemia suggesting 2 vessel CAD with normal LVEF. Medical therapy (aspirin, beta-blocker, statin, long-acting nitrate) was initiated with good response. He has developed recurrent biliary colic and cholecystectomy is recommended.

Prior to elective cholecystectomy, you recommend:

- A. Referral to cardiology for PCI
- B. Referral to cardiac surgery for CABG
- C. Increasing dose of beta-blocker to reduce resting heart rate
- D. Repeat myocardial perfusion study
- E. Proceed with surgery



Case 6

Prior to elective cholecystectomy, you recommend:

- A. Referral to cardiology for PCI
- B. Referral to cardiac surgery for CABG
- C. Increasing dose of beta-blocker to reduce resting heart rate
- D. Repeat myocardial perfusion study
- E. **Proceed with surgery**



Should coronary revascularization be performed prior to non-cardiac surgery?

...only if it is indicated independent of the planned non-cardiac surgery.

Landmark CARP trial [1]

- Patients randomized to prophylactic revascularization vs. not prior to major vascular surgery, both groups received standard medication therapy.
- No difference in postop MI (30d) or long-term mortality

1. N Engl J Med. 2004;351(27)

2. ASA - Pre-op baseline diagnostic cardiac testing | Choosing Wisely



What about perioperative beta-blockers?

Landmark POISE trial [1]

Metoprolol succinate (100mg/d) vs. placebo, started within 4 hours of non-cardiac surgery and continued for 30d postop.

Decrease in postop cardiac events but increased risk of stroke and all-cause mortality with metoprolol succinate.

- **DO** continue beta-blockers periop in patients already on them.
- **DO NOT** begin beta-blocker on day of surgery
- If starting beta-blocker prior to surgery, do so at least 1 week in advance.

1. Lancet. 2008;371(9627):1839-1847.



Case 7

59 yo female is referred for preoperative evaluation prior to splenectomy. She has COPD and smokes 1 pack of cigarettes/day.

PFTs performed 2 years ago showed moderate airflow obstruction. She has been clinically stable with stable exercise tolerance since that time.

Which of the following is true?

- A. Preop PFTs are not indicated
- B. Patient has risk factors for postoperative pulmonary complications
- C. The surgical site increases risk for postoperative pulmonary complications
- D. B,C
- E. A,B,C



Case 7

Which of the following is true?

- A. Preop PFTs are not indicated
- B. Patient has risk factors for postoperative pulmonary complications
- C. The surgical site increases risk for postoperative pulmonary complications
- D. B,C
- E. **A,B,C**



Preoperative pulmonary risk assessment

- History and exam key and direct additional eval
- Risk for postop pulm complications increased by:
 - Patient-related factors (eg, age>50, poor functional status, tobacco use, COPD, CHF, OSA, pulm HTN, low SpO2, low serum albumin)
 - Procedure-related factors (eg, duration >3hrs, upper abdominal, thoracic, head and neck, neurosurg, aortic)
- Preop PFTs usually not needed prior to non-thoracic surgery (ie, do not aid in risk assessment)
 - For patients with unexplained dyspnea/functional impairment, PFTs may be appropriate to evaluate



Preoperative pulmonary risk assessment

- Risk calculators for postoperative pulmonary complications
 - ARISCAT [1]
 - Arozullah respiratory failure index [2]
 - Gupta calculator for postoperative respiratory failure [3] and pneumonia [4]

1. Anesthesiology. 2010 Dec;113(6):1338-50.

2. Ann Surg. 2000;232(2):242.

3. Chest. 2011;140(5):1207.

4. Mayo Clin Proc. 2013 Nov;88(11):1241-9.



Case 8

Regarding preoperative smoking cessation for this patient:

- A. Smoking cessation prior to surgery may aid in wound healing, pulmonary recovery
- B. Smoking cessation <4 weeks prior to surgery increases risk for pulmonary complications
- C. Optimal duration of cessation prior to surgery is unknown but >4-8 weeks is preferable
- D. Initiation of pharmacotherapy for smoking cessation prior to surgery may increase postoperative pulmonary complications
- E. A and C



Case 8

Regarding preoperative smoking cessation for this patient:

- A. Smoking cessation prior to surgery may aid in wound healing, pulmonary recovery
- B. Smoking cessation <4 weeks prior to surgery increases risk for pulmonary complications
- C. Optimal duration of cessation prior to surgery is unknown but >4-8 weeks is preferable
- D. Initiation of pharmacotherapy for smoking cessation prior to surgery may increase postoperative pulmonary complications
- E. **A and C**



Case 9

47 yo female referred for preop medical evaluation prior to ventral hernia repair. She walks 1 mile, 3x/week for exercise, no dyspnea/angina.

PMHx: afib, HTN, diet controlled DM2.

BMI 37, BP 145/89, HR 77, exam unremarkable.

As part of her preop assessment, which of the following should be done:

- A. Exercise electrocardiography stress test
- B. Dobutamine stress echocardiogram
- C. Transthoracic echocardiogram
- D. Screening assessment for sleep apnea
- E. Chest x-ray



Case 9

As part of her preop assessment, which of the following should be done:

- A. Exercise electrocardiography stress test
- B. Dobutamine stress echocardiogram
- C. Transthoracic echocardiogram
- D. **Screening assessment for sleep apnea**
- E. Chest x-ray



Preoperative pulmonary risk assessment

Sleep apnea:

- Society of Anesthesia and Sleep Medicine recommends screening all preoperatively [1]
 - Screening is simple, but evidence for improved outcomes lacking
 - STOP-BANG [2] widely used and well validated
 - Sensible at least for patients at high risk for OSA (eg, obesity [BMI>35])

1. Anesth Analg. 2016;123(2):452.

2. JAMA Netw Open. 2021;4(3):e211009.



Case 10

68 yo male referred for preop eval prior to TURP. He has afib and is chronically anticoagulated with apixaban.

Regarding periop anticoagulation mgmt. of apixaban:

- A. Hold 1 day before and restart 1 day after surgery;
- B. Hold 2 days before and restart 2 days after surgery;
- C. Hold 2 days before and restart 2 days after surgery and bridge with LMWH;
- D. No interruption of anticoagulation is indicated



Case 10

Regarding periop anticoagulation mgmt. of apixaban:

- A. Hold 1 day before and restart 1 day after surgery;
- B. Hold 2 days before and restart 2 days after surgery;**
- C. Hold 2 days before and restart 2 days after surgery and bridge with LMWH;
- D. No interruption of anticoagulation is indicated



Perioperative anticoagulation mgmt

- Type of anticoagulant: DOAC vs. warfarin
- DOACs
 - For low/moderate bleeding risk surgeries, omit 1 day prior to surgery and resume 1 day after surgery (assuming no bleeding complications)
 - Total duration of anticoagulation interruption =2 days
 - For high bleeding risk surgeries, omit 2 days prior to surgery and resume 2 days after surgery (assuming no bleeding complications)
 - Total duration of anticoagulation interruption =4 days
 - Bridge heparin therapy generally not needed with DOACs



Case 11

71 yo male with CAD, s/p PCI with DES 3 years ago. He has no angina and good functional status. He is scheduled for partial colectomy.

Meds include ASA 81mg QD, metoprolol, lisinopril, atorvastatin.

Regarding preop aspirin mgmt., you recommend:

- A. Hold ASA 7d prior to procedure;
- B. Hold ASA 5d prior to procedure;
- C. Do not interrupt aspirin therapy;
- D. Hold ASA 7d prior to procedure and bridge with LMWH



Case 11

Regarding preop aspirin mgmt., you recommend:

- A. Hold ASA 7d prior to procedure;
- B. Hold ASA 5d prior to procedure;
- C. **Do not interrupt aspirin therapy;**
- D. Hold ASA 7d prior to procedure and bridge with LMWH



Perioperative aspirin

If being used for primary prevention, stop ≥ 7 days prior to surgery

If being used for secondary prevention (eg, prior MI, coronary stents, prior TIA/CVA), continue uninterrupted if bleeding risk permits

- Examples of particularly high bleeding risk surgeries include: neurosurgical, prostate, inner ear



Case 12

62 yo male with cirrhosis 2/2 Hep C referred for evaluation prior to scheduled inguinal hernia repair.

Labs: Albumin 3.0, AST/ALT 70/85, Bili 1.7 mg/dL, serum Cr 1.6 mg/dL, INR 1.5

Recent ultrasound shows cirrhotic liver and moderate volume ascites.

Regarding the scheduled inguinal hernia repair, you recommend:

- A. Proceed with surgery;
- B. Oral vitamin K preop;
- C. FFP intraop;
- D. Start daily levofloxacin (SBP prophylaxis);
- E. Cancel surgery



Case 12

Regarding the scheduled inguinal hernia repair, you recommend:

- A. Proceed with surgery;
- B. Oral vitamin K preop;
- C. FFP intraop;
- D. Start daily levofloxacin (SBP prophylaxis);
- E. **Cancel surgery**



Preoperative assessment of patients with cirrhosis

In general, risk for elective surgery is prohibitive for patients with decompensated cirrhosis:

- Child-Pugh class C or MELD >15

Newer risk predictor, VOCAL-Penn [1]

- <https://www.vocalpenscore.com/>

1. Hepatology. 2021;73(1):204.



Thank you!

Questions?



Bonus case 1

68 yo male scheduled for lumbar laminectomy for back pain. He was diagnosed with DVT 3 weeks ago treated with warfarin. You recommend:

- A. Delay surgery 1 month;
- B. Delay surgery 3 months;
- C. Place an IVC filter, proceed with surgery;
- D. Admit prior to surgery for bridge heparin drip (pre- and post-op)
- E. Not pursuing surgery, risk will always be prohibitive



Bonus case 1

You recommend:

- A. Delay surgery 1 month;
- B. Delay surgery 3 months;**
- C. Place an IVC filter, proceed with surgery;
- D. Admit prior to surgery for bridge heparin drip (pre- and post-op)
- E. Not pursuing surgery, risk will always be prohibitive



Surgery after recent VTE

- High risk for recurrent VTE if anticoagulation is interrupted in the first 3-4 weeks, declines over next 2 months. Thus, preferable to delay elective surgery for 3 months following VTE.
- If urgent/emergent surgery needed after recent VTE (within 3 months) and treated with warfarin, bridge heparin appropriate.
- Rarely, temporary IVC filters may be used for patients with VTE within past 1 month (very high risk for recurrent VTE while off anticoagulation) and urgent/emergent need for surgery.



Bonus case 2

52 yo female scheduled for bladder surgery for urinary incontinence. She has not received COVID-19 vaccination and had recent COVID-19 infection. You recommend:

- A. Delay surgery at least 4 weeks following COVID infection
- B. Delay surgery at least 7 weeks following COVID infection
- C. Delay surgery at least 4 weeks following COVID infection AND wait until symptoms have resolved
- D. Delay surgery at least 7 weeks following COVID infection AND wait until symptoms have resolved



Bonus case 2

You recommend:

- A. Delay surgery at least 4 weeks following COVID infection
- B. Delay surgery at least 7 weeks following COVID infection
- C. Delay surgery at least 4 weeks following COVID infection AND wait until symptoms have resolved
- D. **Delay surgery at least 7 weeks following COVID infection AND wait until symptoms have resolved**



Surgery after recent COVID infection

COVIDSurg Collaborative, GlobalSurg Collaborative [1]

Large, international prospective trial of optimal duration of planned delay in surgery following COVID infection; performed 10/2020, prior to availability of vaccines.

- ↑ 30d postop mortality when elective surgery performed **within 7 weeks of COVID diagnosis**
- Symptomatic patients had higher postop mortality than asymptomatic (but mortality still ↑ in asymptomatic patients)
- Ongoing symptoms also associated with ↑ mortality compared to resolved symptoms



Answers

1. D

2. A

3. D

4. A

5. B

6. E

7. E

8. E

9. D

10. B

11. C

12. E

Bonus question 1. B

Bonus question 2. D