

Pre-Operative Evaluation: A review of Guidelines and Literature

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FINANCIAL DISCLOSURE

- I have no relevant financial disclosures or conflicts of interest

OBJECTIVES

By the end of this presentation, you will be able to:

- Use and apply risk stratification for cardiac events to your patients
- Appropriately screen for pulmonary diseases that can affect patients in the perioperative period
- Manage a patient diabetic and anticoagulant medications in the perioperative period



INCIDENCE OF CARDIAC COMPLICATIONS AFTER SURGERY

Elevated troponins seen in ~12% of patients

In patients with a known MI within 30 days of surgery, 33% will have another MI

It also increased the risk of stroke by 8x

In patients with symptomatic Heart failure, the risk of a cardiac complication is 3 times that of those with stable CAD

Devereaux PJ, et al. Association between postoperative troponin levels and 30-day mortality among patients undergoing noncardiac surgery. JAMA. 2012;307:
Livhits M, et al. Risk of surgery following recent myocardial infarction. Ann Surg. 2011;253:



Ms. M, a 74 y/o female with a history of HTN, DM controlled on oral medications presents after a fall; x-ray reveals a hip fracture necessitating surgery. You are called to “Clear her for surgery”.

Do not CLEAR patients for surgery

We inform as to risk and optimize
management!

It is important to identify your role
in the care of the patient
around the time of surgery



EMERGENT?

**EMERGENCY
EXIT**

Identify when surgery must be performed

<6 hours

Emergent

**Within 24
hours**

Urgent

**Within 6
weeks**

Time-

Sensitive

**Within a
year**

Elective

Conduct a thorough history and physical exam

Risk factors for cardiac complications

Age
ASA Classification Status
Functional Status
Diabetes (insulin dependent)
Ischemic heart disease
Heart failure
Renal disease
Smoking status

Risk factors for Pulmonary complications

Age
ASA Classification status
Chronic lung disease
Heart failure
OSA
Acute delirium
Smoking status

ASA Physical Status (PS) Classification System*

Risk factor

| ASA PS Category | Preoperative Health Status | Comments, Examples |
|--|---|---|
| ASA PS 1 | Normal healthy patient | No organic, physiologic, or psychiatric disturbance; excludes the very young and very old; healthy with good exercise tolerance |
| ASA PS 2 | Patients with mild systemic disease | No functional limitations; has a well-controlled disease of one body system; controlled hypertension or diabetes without systemic effects, cigarette smoking without chronic obstructive pulmonary disease (COPD); mild obesity, pregnancy |
| ASA PS 3 | Patients with severe systemic disease | Some functional limitation; has a controlled disease of more than one body system or one major system; no immediate danger of death; controlled congestive heart failure (CHF), stable angina, old heart attack, poorly controlled hypertension, morbid obesity, chronic renal failure; bronchospastic disease with intermittent symptoms |
| ASA PS 4 | Patients with severe systemic disease that is a constant threat to life | Has at least one severe disease that is poorly controlled or at end stage; possible risk of death; unstable angina, symptomatic COPD, symptomatic CHF, hepatorenal failure |
| ASA PS 5 | Moribund patients who are not expected to survive without the operation | Not expected to survive > 24 hours without surgery; imminent risk of death; multiorgan failure, sepsis syndrome with hemodynamic instability, hypothermia, poorly controlled coagulopathy |
| ASA PS 6 | A declared brain-dead patient who organs are being removed for donor purposes | |
| *ASA PS classifications from the American Society of Anesthesiologists | | |

ACC/AHA Clinical Practice Guideline

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

**A Report of the American College of Cardiology/American Heart
Association Task Force on Practice Guidelines**

*Developed in Collaboration With the American College of Surgeons,
American Society of Anesthesiologists, American Society of Echocardiography,
American Society of Nuclear Cardiology, Heart Rhythm Society, Society for
Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists,
and Society of Vascular Medicine*

Endorsed by the Society of Hospital Medicine

SIZE OF TREATMENT EFFECT

ESTIMATE OF CERTAINTY (PRECISION) OF TREATMENT EFFECT

| | CLASS I <i>Benefit >>> Risk</i> Procedure/Treatment SHOULD be performed/ administered | CLASS IIa <i>Benefit >> Risk</i> Additional studies with <i>focused objectives needed</i> IT IS REASONABLE to per- form procedure/administer treatment | CLASS IIb <i>Benefit ≥ Risk</i> Additional studies with broad <i>objectives needed</i> ; additional <i>registry data would be helpful</i> Procedure/Treatment MAY BE CONSIDERED | CLASS III <i>No Benefit</i> or CLASS III <i>Harm</i> <table><tr><th></th><th>Procedure/ Test</th><th>Treatment</th></tr><tr><td>COR III: No benefit</td><td>Not Helpful</td><td>No Proven Benefit</td></tr><tr><td>COR III: Harm</td><td>Excess Cost w/o Benefit or Harmful</td><td>Harmful to Patients</td></tr></table> | | Procedure/ Test | Treatment | COR III: No benefit | Not Helpful | No Proven Benefit | COR III: Harm | Excess Cost w/o Benefit or Harmful | Harmful to Patients |
|--|---|--|---|---|---|--------------------|-----------|------------------------|----------------|----------------------|------------------|--|------------------------|
| | Procedure/ Test | Treatment | | | | | | | | | | | |
| COR III: No benefit | Not Helpful | No Proven Benefit | | | | | | | | | | | |
| COR III: Harm | Excess Cost w/o Benefit or Harmful | Harmful to Patients | | | | | | | | | | | |
| LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses | <ul style="list-style-type: none">■ Recommendation that procedure or treatment is useful/effective■ Sufficient evidence from multiple randomized trials or meta-analyses | <ul style="list-style-type: none">■ Recommendation in favor of treatment or procedure being useful/effective■ Some conflicting evidence from multiple randomized trials or meta-analyses | <ul style="list-style-type: none">■ Recommendation's usefulness/efficacy less well established■ Greater conflicting evidence from multiple randomized trials or meta-analyses | <ul style="list-style-type: none">■ Recommendation that procedure or treatment is not useful/effective and may be harmful■ Sufficient evidence from multiple randomized trials or meta-analyses | | | | | | | | | |
| LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies | <ul style="list-style-type: none">■ Recommendation that procedure or treatment is useful/effective■ Evidence from single randomized trial or nonrandomized studies | <ul style="list-style-type: none">■ Recommendation in favor of treatment or procedure being useful/effective■ Some conflicting evidence from single randomized trial or nonrandomized studies | <ul style="list-style-type: none">■ Recommendation's usefulness/efficacy less well established■ Greater conflicting evidence from single randomized trial or nonrandomized studies | <ul style="list-style-type: none">■ Recommendation that procedure or treatment is not useful/effective and may be harmful■ Evidence from single randomized trial or nonrandomized studies | | | | | | | | | |
| LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care | <ul style="list-style-type: none">■ Recommendation that procedure or treatment is useful/effective■ Only expert opinion, case studies, or standard of care | <ul style="list-style-type: none">■ Recommendation in favor of treatment or procedure being useful/effective■ Only diverging expert opinion, case studies, or standard of care | <ul style="list-style-type: none">■ Recommendation's usefulness/efficacy less well established■ Only diverging expert opinion, case studies, or standard of care | <ul style="list-style-type: none">■ Recommendation that procedure or treatment is not useful/effective and may be harmful■ Only expert opinion, case studies, or standard of care | | | | | | | | | |
| Suggested phrases for writing recommendations | should is recommended is indicated is useful/effective/beneficial | is reasonable can be useful/effective/beneficial is probably recommended or indicated | may/might be considered may/might be reasonable usefulness/effectiveness is unknown/unclear/uncertain or not well established | COR III: No Benefit is not recommended is not indicated should not be performed/ administered/ other is not useful/ beneficial/ effective | COR III: Harm potentially harmful causes harm associated with excess morbidity/mortality should not be performed/ administered/ other | | | | | | | | |
| Comparative effectiveness phrases ¹ | treatment/strategy A is recommended/indicated in preference to treatment B treatment A should be chosen over treatment B | treatment/strategy A is probably recommended/indicated in preference to treatment B it is reasonable to choose treatment A over treatment B | | | | | | | | | | | |

AFTER A THOROUGH HISTORY AND PHYSICAL

Determine risk of Major Adverse Cardiac Event (MACE)

| RCRI | NSQIP MICA (Gupta) | NSQIP |
|---|--|--|
| Quick and easy. 1 point for each of 6 risk factor. Only assesses MACE | Requires a bit more information, but better than RCRI, esp for vascular procedures | Lots of data, requires subjective information Assesses MACE and 9 other complications |

Enter Patient and Surgical Information

Procedure

47562 - Laparoscopy, surgical; cholecystectomy

Clear

Begin 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 desired procedure to properly select it. You may also search using two words (or two partial words) by placing a '+' in between, for example: "cholecystectomy + cholangiography"

Reset All Selections

 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.
A rough estimate will still be generated if you cannot provide all of the information below.

Age Group

65-74 years ▼

Sex

Female ▼

Functional Status

Independent ▼

Emergency Case

No ▼

ASA Class

Mild systemic disease ▼

Steroid use for chronic condition

No ▼

Ascites within 30 days prior to surgery

No ▼

Systemic Sepsis within 48 hours prior to surgery

None ▼

Ventilator Dependent

No ▼

Disseminated Cancer

No ▼

Diabetes

Oral ▼

Hypertension requiring medication

Yes ▼

Congestive Heart Failure in 30 days prior to surgery

No ▼

Dyspnea

With Moderate exertion ▼

Current Smoker within 1 Year

No ▼

History of Severe COPD

No ▼

Dialysis

No ▼

Acute Renal Failure

No ▼

BMI Calculation:

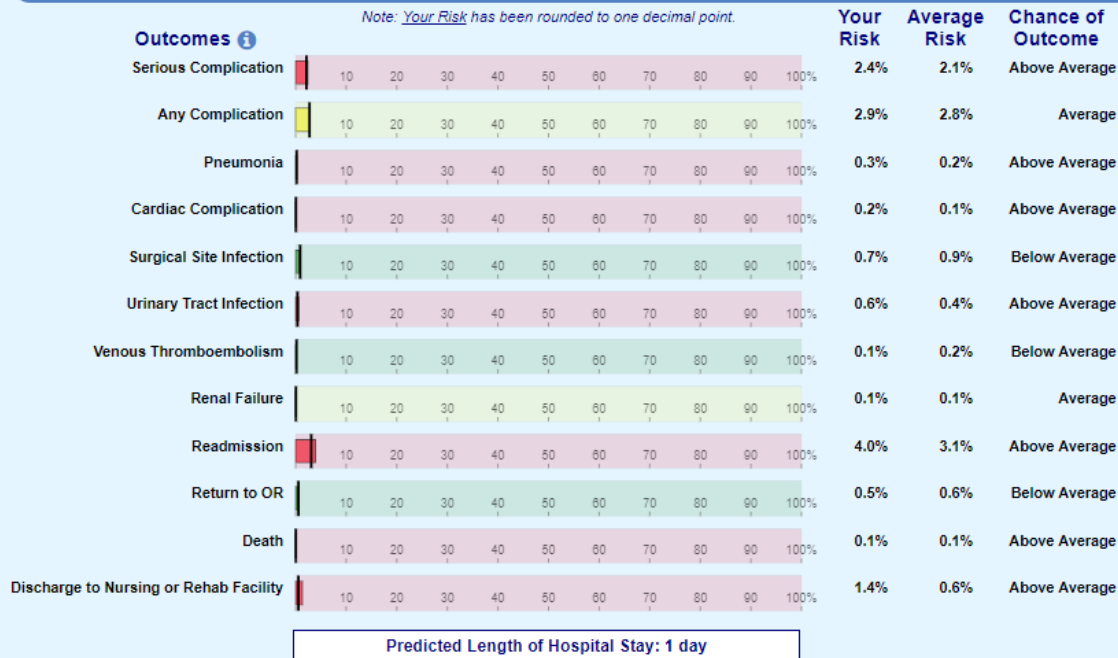
Height: 62 in / 157 cm

Weight: 130 lb / 59 kg

[Risk Calculator Home Page](#)[About](#)[FAQ](#)[ACS Website](#)[ACS NSQIP Website](#)

Procedure: 47562 - Laparoscopy, surgical; cholecystectomy

Risk Factors: 65-74 years, Mild systemic disease, Diabetes (Oral), HTN, Dyspnea with moderate exertion

[Change Patient Risk Factors](#)

How to Interpret the Graph Above:



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 underestimated. This should only be done if the reason for the increased risks was NOT already entered into the risk calculator.

1 - No adjustment necessary

RCRI

- ✓ Insulin dependent DM
- ✓ Serum creatinine >2
- ✓ History of Heart failure*
- ✓ History of ischemic heart disease*
- ✓ History of cerebrovascular disease*
- ✓ High risk surgery*
 - Intrathoracic, intra-abdominal, vascular

TABLE 4. Rates of Major Cardiac Complications and Multivariate ORs* Among Patients With Individual Risk Factors in Derivation and Validation Sets

| | Derivation Set (n=2893) | | Validation Set (n=1422) | |
|---|-------------------------|----------------------|-------------------------|----------------------|
| | Crude Data | Adjusted OR (95% CI) | Crude Data | Adjusted OR (95% CI) |
| Revised Cardiac Risk Index | | | | |
| 1. High-risk type of surgery | 27/894 (3%) | 2.8 (1.6, 4.9) | 18/490 (4%) | 2.6 (1.3, 5.3) |
| 2. Ischemic heart disease | 34/951 (4%) | 2.4 (1.3, 4.2) | 26/478 (5%) | 3.8 (1.7, 8.2) |
| 3. History of congestive heart failure | 23/434 (5%) | 1.9 (1.1, 3.5) | 19/255 (7%) | 4.3 (2.1, 8.8) |
| 4. History of cerebrovascular disease | 17/291 (6%) | 3.2 (1.8, 6.0) | 10/140 (7%) | 3.0 (1.3, 6.8) |
| 5. Insulin therapy for diabetes | 7/112 (6%) | 3.0 (1.3, 7.1) | 3/59 (5%) | 1.0 (0.3, 3.8) |
| 6. Preoperative serum creatinine >2.0 mg/dL | 9/103 (9%) | 3.0 (1.4, 6.8) | 3/55 (5%) | 0.9 (0.2, 3.3) |

*Based on logistic regression models including these 6 variables.

Table 3: Estimated risk of a major perioperative cardiac event* based on predictors in the Lee index¹⁴

| No. of risk factors† | Risk of major perioperative cardiac event, % (95% CI) |
|----------------------|---|
| 0 | 0.4 (0.1–0.8) |
| 1 | 1.0 (0.5–1.4) |
| 2 | 2.4 (1.3–3.5) |
| ≥ 3 | 5.4 (2.8–7.9) |

*Includes cardiac death, nonfatal myocardial infarction and nonfatal cardiac arrest. Not included in this table are postoperative cardiogenic pulmonary edema and complete heart block, which are included as outcomes in the Lee index.

†Risk factors include high-risk surgery (intraperitoneal, intrathoracic or suprainguinal vascular surgery); history of ischemic heart disease (defined as a history of myocardial infarction, positive exercise test result, current complaint of ischemic chest pain or nitrate use, or electrocardiogram showing pathological Q waves; patients who had undergone prior coronary bypass surgery or angioplasty were included only if they had such findings after their procedure); history of congestive heart failure (defined as a history of heart failure, pulmonary edema or paroxysmal nocturnal dyspnea; an S3 gallop or bilateral rales on physical examination; or chest radiograph showing pulmonary vascular resistance); history of cerebrovascular disease (stroke or transient ischemic attack); use of insulin therapy for diabetes; and preoperative serum creatinine level > 175 μmol/L (> 2.0 mg/dL).

Patient scheduled for surgery with known or risk factors for CAD* (Step 1)

Emergency

Yes

Clinical risk stratification and proceed to surgery

No

ACS† (Step 2)

Yes

Evaluate and treat according to GDMT†

No

Estimated perioperative risk of MACE based on combined clinical/surgical risk (Step 3)

Low risk (<1%) (Step 4)

No further testing (Class III:NB)

Proceed to surgery

Elevated risk (Step 5)

Moderate or greater (≥4 METs) functional capacity

Excellent (>10 METs)

No further testing (Class IIa)

Moderate/Good (≥4–10 METs)

No further testing (Class IIb)

Proceed to surgery

No or unknown

Poor OR unknown functional capacity (<4 METs): Will further testing impact decision making OR perioperative care? (Step 6)

No

Proceed to surgery according to GDMT OR alternate strategies (noninvasive treatment, palliation) (Step 7)

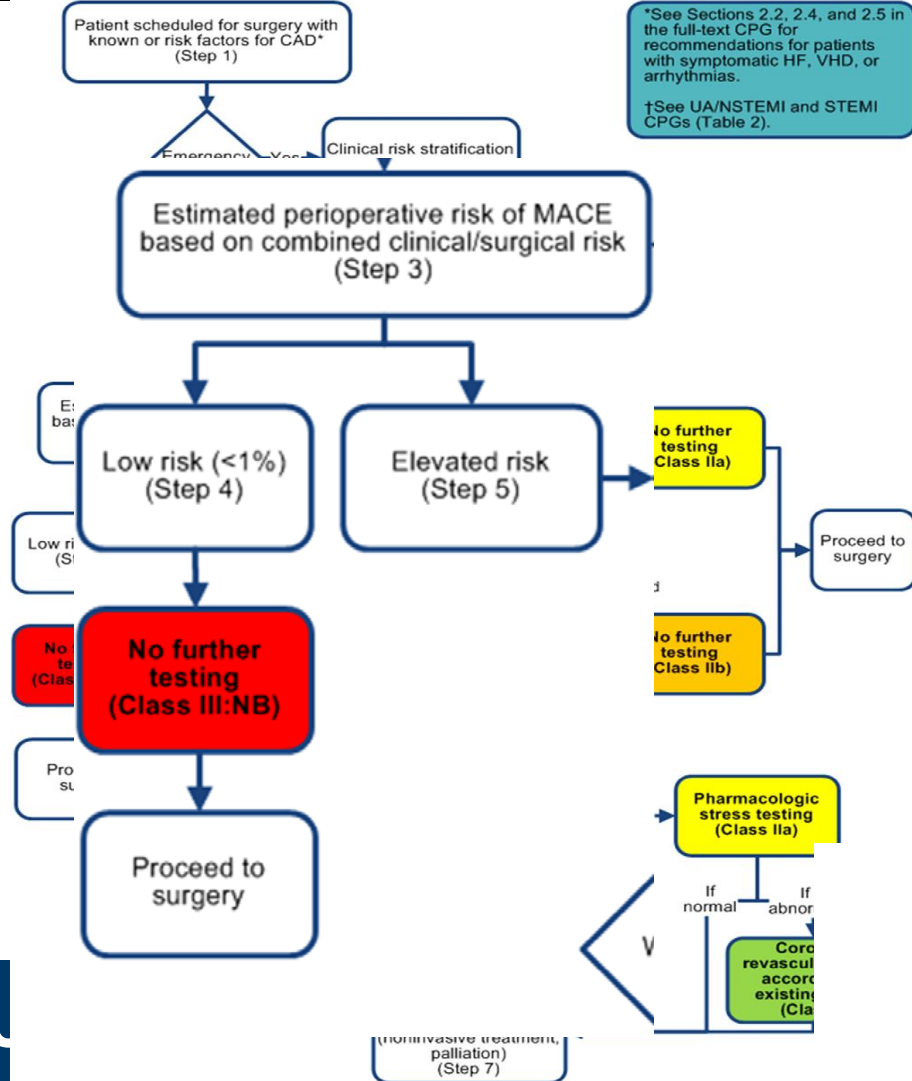
If normal

If abnormal

Pharmacologic stress testing (Class IIa)

Coronary revascularization according to existing CPGs (Class I)

*See Sections 2.2, 2.4, and 2.5 in the full-text CPG for recommendations for patients with symptomatic HF, VHD, or arrhythmias.
†See UA/NSTEMI and STEMI CPGs (Table 2).



IF LOW RISK CAN
PROCEED TO
SURGERY...
FROM A
CARDIOVASCULAR
STANDPOINT!

Patient scheduled for surgery with known or risk factors for CAD* (Step 1)

Emergency

Yes

Clinical risk stratification and proceed to surgery

No

ACS† (Step 2)

Yes

Evaluate and treat according to GDMT†

No

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No or unknown

Poor OR unknown functional capacity (<4 METs): Will further testing impact decision making OR perioperative care? (Step 6)

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Proceed to surgery according to GDMT OR alternate strategies (noninvasive treatment, palliation) (Step 7)

If normal

If abnormal

Pharmacologic stress testing (Class IIa)

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*See Sections 2.2, 2.4, and 2.5 in the full-text CPG for recommendations for patients with symptomatic HF, VHD, or arrhythmias.
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METS



<4



4-10



>10

Ability to walk 4 blocks or climb 2 flights of stairs has a 71% sensitivity and 47% specificity for predicting perioperative complications

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

- Physicians tend to underestimate patient functional status
- Sensitivity of subjective assessments is only 19%
- Use of assessments like DASI can improve prediction of adverse events

Scoring the Duke Activity Status Index (DASI): Add the point values for all questions checked in the Yes column and divide by 3.5 to calculate the estimated DASI metabolic equivalents. (Reprinted from Hltaky et al¹² (p. 652), Copyright 1989, with permission from Elsevier.)

FUNCTIONAL STATUS

Table 4. Patient Characteristics Associated With an Increased Risk for All Serious Perioperative Complications*

| Patient Characteristics | No. of Patients With Complications/Total | Odds Ratios (95% CI)† | |
|-----------------------------|---|-----------------------|----------------------|
| | | Age-Adjusted | Multivariable Model‡ |
| Poor exercise tolerance | 70/343 | 2.13 (1.33-3.42) | 1.94 (1.19-3.17) |
| Smoking ≥20 pack-years | 59/280 | 2.01 (1.29-3.13) | 2.16 (1.36-3.44) |
| Coronary disease | 32/142 | 1.64 (1.01-2.66) | NS |
| Peripheral vascular disease | 20/76 | 1.97 (1.12-3.48) | NS |
| Prior myocardial infarction | 19/72 | 1.98 (1.11-3.54) | NS |
| Congestive heart failure | 19/52 | 3.38 (1.83-6.26) | 2.88 (1.52-5.48) |
| Ventricular arrhythmia | 14/44 | 2.55 (1.29-5.03) | NS |
| Dementia | 5/10 | 4.54 (1.26-16.33) | 5.54 (1.51-20.41) |
| Parkinson disease | 5/8 | 8.26 (1.93-35.37) | 8.14 (1.76-37.67) |

*CI indicates confidence interval; NS, not significant.

†Age-adjusted odds ratios for all serious complications.

‡Independent variables in the logistic regression model include each of the patient characteristics shown and age.

Patient scheduled for surgery with known or risk factors for CAD* (Step 1)

Emergency

Yes

Clinical risk stratification and proceed to surgery

No

ACS† (Step 2)

Yes

Evaluate and treat according to GDMT†

No

Estimated perioperative risk of MACE based on combined clinical/surgical risk (Step 3)

Low risk (<1%) (Step 4)

Elevated risk (Step 5)

No further testing (Class III:NB)

Proceed to surgery

Moderate or greater (≥4 METs) functional capacity

Excellent (>10 METs)

Moderate/Good (≥4–10 METs)

No or unknown

decision making OR perioperative care? (Step 6)

No

Proceed to surgery according to GDMT OR alternate strategies (noninvasive treatment, palliation) (Step 7)

No further testing (Class IIa)

Proceed to surgery

No further testing (Class IIb)

(Class IIa)

If normal

If abnormal

Coronary revascularization according to existing CPGs (Class I)

*See Sections 2.2, 2.4, and 2.5 in the full-text CPG for recommendations for patients with symptomatic HF, VHD, or arrhythmias.
†See UA/NSTEMI and STEMI CPGs (Table 2).



ECG is not indicated for asymptomatic patients undergoing low risk surgery

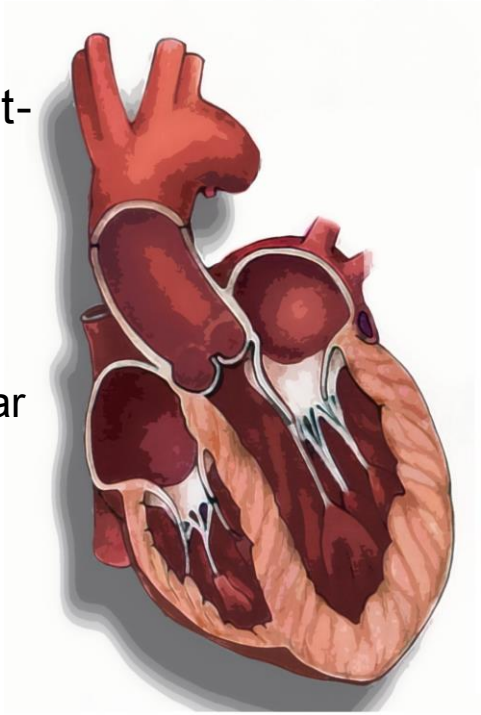
Reasonable to obtain for patients with CHD or other cardiac/vascular processes, as well as asymptomatic patients undergoing a high risk procedure

Great for baseline, however studies are inconsistent with prognosis of ECG findings

HEART FAILURE

LV dysfunction, including asymptomatic, is known to increase cardiovascular events in post-op period

- >9% 30-day mortality
- 49% with symptomatic HF have a cardiovascular event
- 18-23% with *asymptomatic* have a cardiovascular event
 - Compared with 10% for patients with normal systolic/diastolic function



Reasonable to obtain an evaluation of LV function in patients with dyspnea of unknown etiology or those with known heart failure and worsening symptoms (LoE: C)

It is NOT recommended to obtain routine evaluation of LV function (LoE: B)



Patient scheduled for surgery with known or risk factors for CAD* (Step 1)

Emergency

Yes

Clinical risk stratification and proceed to surgery

No

ACS† (Step 2)

Yes

Evaluate and treat according to GDMT†

No

Estimated perioperative risk of MACE based on combined clinical/surgical risk (Step 3)

Low risk (<1%) (Step 4)

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Proceed to surgery

Moderate or greater (≥4 METs) functional capacity

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Moderate/Good (≥4–10 METs)

No further testing (Class IIa)

Proceed to surgery

No further testing (Class IIb)

No or unknown

Poor OR unknown functional capacity (<4 METs):

Will further testing impact decision making OR perioperative care? (Step 6)

Pharmacologic stress testing (Class IIa)

If normal

If abnormal

Coronary revascularization according to existing CPGs (Class I)

Proceed to surgery according to GDMT OR alternate strategies (noninvasive treatment, palliation) (Step 7)

*See Sections 2.2, 2.4, and 2.5 in the full-text CPG for recommendations for patients with symptomatic HF, VHD, or arrhythmias.
†See UA/NSTEMI and STEMI CPGs (Table 2).



STRESS TESTING

It may be reasonable to perform exercise or pharmacologic stress test in patients with poor or unknown function capacity at high risk IF it will change management(LoE: C)

It is reasonable to forgo testing in those with excellent Functional capacity and may be reasonable to forgo in those with good functional capacity (METs 4-10) (LoE: B)



An initiative of the ABIM Foundation

American College of Physicians
**Five Things Physicians
and Patients Should Question**

ACP AMERICAN COLLEGE OF PHYSICIANS®
INTERNAL MEDICINE | *Doctors for Adults*



Don't obtain screening exercise electrocardiogram testing in individuals who are asymptomatic and at low risk for coronary heart disease.

In asymptomatic individuals at low risk for coronary heart disease (10-year risk <10%) screening for coronary heart disease with exercise electrocardiography does not improve patient outcomes.



An initiative of the ABIM Foundation

American Society of Anesthesiologists

American Society of
Anesthesiologists®



Five Things Physicians and Patients Should Question

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.

IF STRESS TEST IS ABNORMAL:

Revascularization should be done if meets criteria by current clinical practice guidelines (LoE: c) and surgery should be delayed by:

- 14 days for Ballon Angioplasty (LoE: C)
- 30 days for Bare metal stent (LoE: B)
- 365 days for drug eluting stents (180 days could be considered) (LoE: B)

Dual antiplatelet therapy should be continued if surgery must be done 4-6 weeks since stent placement. If P2Y₁₂ must be stopped, continuation of aspirin is recommended



BETA BLOCKERS



Bisoprolol and Fluvastatin for the Reduction of Perioperative Cardiac risk factors and prevention



Meta-analysis of secure randomised controlled trials of β -blockade to prevent perioperative death in non-cardiac surgery

Sonia Bouri, Matthew James Shun-Shin, Graham D Cole, Jamil Mayet, Darrel P Francis

BETA BLOCKADE

POISE:

| | Metoprolol group (n=4174) | Placebo group (n=4177) | Hazard ratio | p value |
|---|---------------------------------|------------------------------|------------------|---------|
| Cardiovascular death, non-fatal myocardial infarction, or non-fatal cardiac arrest* | 244 (5.8%) | 290 (6.9%) | 0.84 (0.70-0.99) | 0.0399 |
| Cardiovascular death | 75 (1.8%) | 58 (1.4%) | 1.30 (0.92-1.83) | 0.1368 |
| Non-fatal myocardial infarction | 152 (3.6%) | 215 (5.1%) | 0.70 (0.57-0.86) | 0.0008 |
| Non-fatal cardiac arrest | 21 (0.5%) | 19 (0.5%) | 1.11 (0.60-2.06) | 0.7436 |
| Total mortality | 129 (3.1%) | 97 (2.3%) | 1.33 (1.03-1.74) | 0.0317 |
| Myocardial infarction | 176 (4.2%) | 239 (5.7%) | 0.73 (0.60-0.89) | 0.0017 |
| Cardiac revascularisation† | 11 (0.3%) | 27 (0.6%) | 0.41 (0.20-0.82) | 0.0123 |
| Stroke | 41 (1.0%) | 19 (0.5%) | 2.17 (1.26-3.74) | 0.0053 |
| Non-fatal stroke | 27 (0.6%) | 14 (0.3%) | 1.94 (1.01-3.69) | 0.0450 |
| Congestive heart failure† | 132 (3.2%) | 116 (2.8%) | 1.14 (0.89-1.46) | 0.3005 |
| New clinically significant atrial fibrillation† | 91 (2.2%) | 120 (2.9%) | 0.76 (0.58-0.99) | 0.0435 |
| Clinically significant hypotension† | 625 (15.0%) | 404 (9.7%) | 1.55 (1.38-1.74) | <0.0001 |
| Clinically significant bradycardia† | 277 (6.6%) | 101 (2.4%) | 2.74 (2.19-3.43) | <0.0001 |
| Non-cardiovascular death | 54 (1.3%) | 39 (0.9%) | 1.39 (0.92-2.10) | 0.1169 |

Data are n (%) or hazard ratio or relative risk (95% CI). *Some patients had more than one event. †Relative risks presented, rather than hazard ratios, since we did not collect the actual date patients experienced these events.

Table 3: Effects of study treatment on primary and secondary outcomes at 30 days

2018 Cochrane review:

- No benefit to all cause mortality in cardiac surgery but increased in non-cardiac surgery
- No benefit to AMI in cardiac surgery, but improved in non-cardiac surgery
- Increased risk of CVA in non cardiac surgery, and no clear effect in cardiac surgery

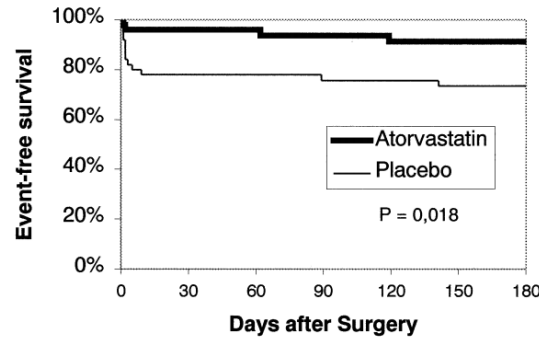
If patient is already
on them (LoE: B)

If there is evidence of moderate-high
risk ischemia on stress testing (Loe: C)

In patients with 3 or more RCRI risk
factors (LoE: B)

*Note: do not start on day of surgery. At least 2-7
days prior, but no more than 30 days





J Vasc Surg 2004

Statins should be continued in patients already taking them (LoE: B)

It is reasonable to begin them if undergoing *vascular* surgery (LoE B)

Can be started if meet clinical indications for statin use

HOW GOOD ARE WE AT FOLLOWING THESE GUIDELINES?

Table 3. Testing Rate and Net Change Using DID Estimates in Testing Rates During Preoperative Visits After the 2002 ACC/AHA and ASA Guidance in the United States

| Preoperative Test | Per 100 Visits | | Unadjusted Effect | | Adjusted Effect | |
|---|-----------------------------|----------------------------|--|---------|--|---------|
| | Testing Rate, % | | Net Change After 2002 Guidance (95% CI) ^a | | Net Change After 2002 Guidance (95% CI) ^a | |
| | Before Guidance (1997-2002) | After Guidance (2003-2010) | | P Value | | P Value |
| Plain radiography | 11.3 | 9.9 | -1.1 (-4.2 to 1.9) | .47 | -1.0 (-4.1 to 2.2) | .55 |
| Hematocrit | 9.4 | 4.1 | 0.4 (-3.5 to 4.3) | .85 | 1.2 (-2.2 to 4.7) | .48 |
| Urinalysis | 12.2 | 8.9 | 1.9 (-2.2 to 6.1) | .36 | 2.7 (-1.7 to 7.1) | .23 |
| ECG | 19.4 | 14.3 | -7.3 (-12 to -3.1) | <.001 | -6.7 (-10.6 to -2.7) | .001 |
| Cardiac stress test | 1.0 | 2.0 | 0.8 (-0.1 to 1.7) | .07 | 0.7 (-0.1 to 1.5) | .08 |
| Any test ^b | 28.1 | 25.8 | 0.8 (-4.7 to 6.3) | .78 | 1.8 (-3.7 to 7.3) | .53 |
| Any test, including hematocrit ^c | 30.5 | 27.0 | 0.2 (-8.4 to 8.8) | .97 | 1.9 (-5.8 to 9.6) | .63 |

Abbreviations: ACC/AHA, American College of Cardiology and American Heart Association; ASA, American Society of Anesthesiologists; DID, difference-in-difference; ECG, electrocardiography; OR, odds ratio.

^a Net changes incorporate pre-2002 and post-2002 testing rates in both preoperative visits and general medical examinations and reflect DID estimates.

^b Does not include hematocrit tests, which were available for 1997-2004 only.

^c The period is limited to 1997-2004.

From: Overuse of Testing in Preoperative Evaluation and Syncope: A Survey of Hospitalists Overuse of Testing in Preoperative Evaluation and Syncope

Ann Intern Med. 2015;162(2):100-108. doi:10.7326/M14-0694

Table 1. Summary of Preoperative and Syncope Clinical Vignettes

| Vignette Type | Clinical Details | Version* | Response Options (All Versions) |
|-------------------------|---|---|--|
| Preoperative evaluation | <p>A 66-year-old man is admitted to the hospitalist service for abdominal pain caused by choledocholithiasis. Clinically, the gallstones seem to have passed (pain and liver enzyme levels are resolving). The general surgeon recommends a cholecystectomy and asks the hospitalist for preoperative "clearance." The hospitalist obtains the following history from the patient with the help of the patient's son:</p> <p>Type 2 diabetes mellitus requiring insulin</p> <p>MI 4 years ago, which led to a 3-vessel CABG; the patient takes nitroglycerin tablets intermittently for angina but is able to walk up a flight of stairs on a daily basis without any symptoms</p> <p>Medications: insulin, metoprolol, aspirin, lisinopril, simvastatin, and amlodipine</p> <p>Vital signs: blood pressure, 120/70 mm Hg; heart rate, 59 beats/min</p> <p>Physical examination is normal except for mild RUQ pain with deep palpation</p> <p>Laboratory results show a creatinine value of 1.8 mg/dL (similar to prior values)</p> <p>EKG shows first-degree atrioventricular block and Q waves in leads V1 to V3, suggestive of a prior anteroapical MI</p> <p>No recent cardiac stress testing</p> | <p>A: No information about son's occupation</p> <p>B: Son identified as physician</p> <p>C: Son not identified as physician and requests testing</p> <p>D: Son identified as physician and requests testing</p> | <p>No further testing</p> <p>Cardiology consultation</p> <p>Echocardiographic testing</p> <p>Stress testing</p> <p>Cardiac catheterization</p> |
| Syncope | <p>A 59-year-old college professor with hypertension and</p> | <p>A: No information about</p> | <p>Discharge from ED, stat HCTZ, and order</p> |

From: Overuse of Testing in Preoperative Evaluation and Syncope: A Survey of Hospitalists
Overuse of Testing in Preoperative Evaluation and Syncope

Ann Intern Med. 2015;162(2):100-108. doi:10.7326/M14-0694

Table 3. Physician Treatment Responses (Use)*

| Vignette Version | Preoperative Evaluation (n = 1001) | |
|--|------------------------------------|----------|
| | Appropriate Use | Overuse† |
| A: No details on family member | 119 (48) | 130 (52) |
| B: Family member's occupation given | 107 (43) | 141 (57) |
| C: Family member asks for further treatment | 112 (43) | 151 (57) |
| D: Family member's occupation given and asks for further treatment | 84 (35) | 157 (65) |
| All | 422 (42) | 579 (58) |

* Data are numbers (percentages).

† Any selection other than "no further testing."

‡ Any selection that included hospitalization.

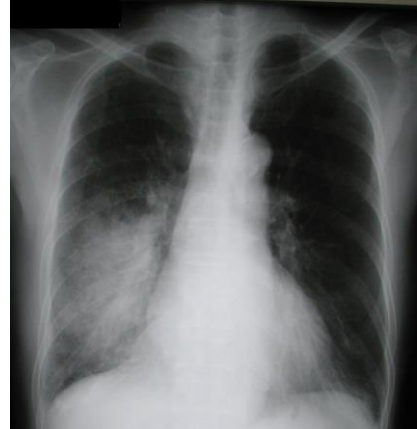


Beyond the heart

Evaluating pulmonary function

CLINICAL IMPLICATION

- Pulmonary complications one of the most common complications after surgery
 - Occur in 5-7% of those that undergo surgery
- Greatest risk in thoracic, abdominal (upper), ENT and neuro surgeries, as well as those that last >4 hrs



Risk Assessment for and Strategies To Reduce Perioperative Pulmonary Complications for Patients Undergoing Noncardiothoracic Surgery: A Guideline from the American College of Physicians

Amir Qaseem, MD, PhD, MHA; Vincenza Snow, MD; Nick Fitterman, MD; E. Rodney Hornbake, MD; Valerie A. Lawrence, MD; Gerald W. Smetana, MD; Kevin Weiss, MD, MPH; and Douglas K. Owens, MD, MS, for the Clinical Efficacy Assessment Subcommittee of the American College of Physicians*

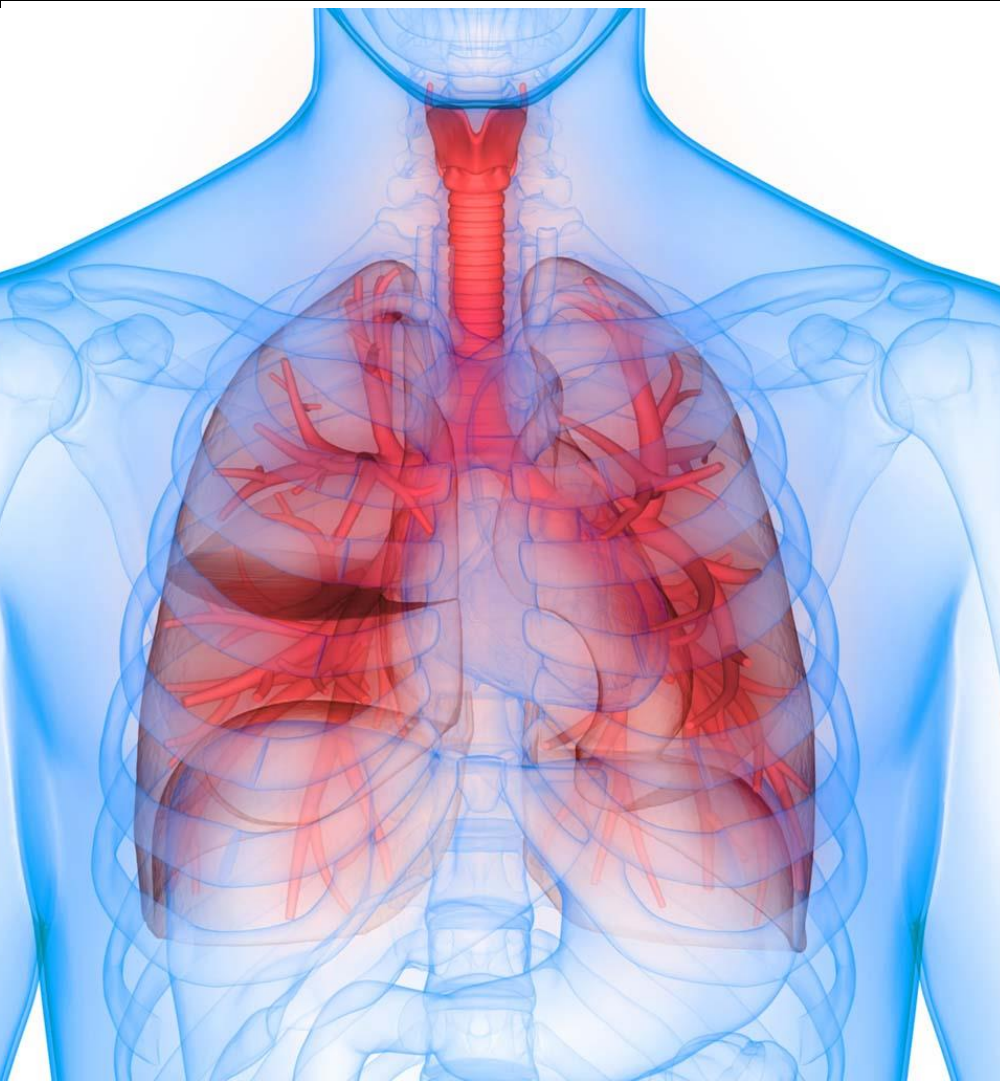
Postoperative pulmonary complications play an important role in the risk for patients undergoing noncardiothoracic surgery. Postoperative pulmonary complications are as prevalent as cardiac complications and contribute similarly to morbidity, mortality, and length of stay. Pulmonary complications may even be more likely than cardiac complications to predict long-term mortality after surgery. The purpose of this guideline is to provide guidance to clinicians on clinical and laboratory predictors of perioperative pulmonary risk before noncardiothoracic surgery. It also evaluates

strategies to reduce the perioperative pulmonary risk and focuses on atelectasis, pneumonia, and respiratory failure. The target audience for this guideline is general internists or other clinicians involved in perioperative management of surgical patients. The target patient population is all adult persons undergoing noncardiothoracic surgery.

Ann Intern Med. 2006;144:575-580.

For author affiliations, see end of text.

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ASSESS RISK FACTORS

- COPD
- Age>60
- ASA class II or greater
- Functional status
- Heart Failure
- Surgery > 3 hours or thoracic, abdominal, ENT
- OSA
- Albumin if suspect it is low

WHAT TO DO IF RISK FACTORS ARE PRESENT



PULMONARY FUNCTION TESTS

Not more useful than
history/physical

- Except for lung resection, CABG

Reasonable if history or
physical suggests COPD

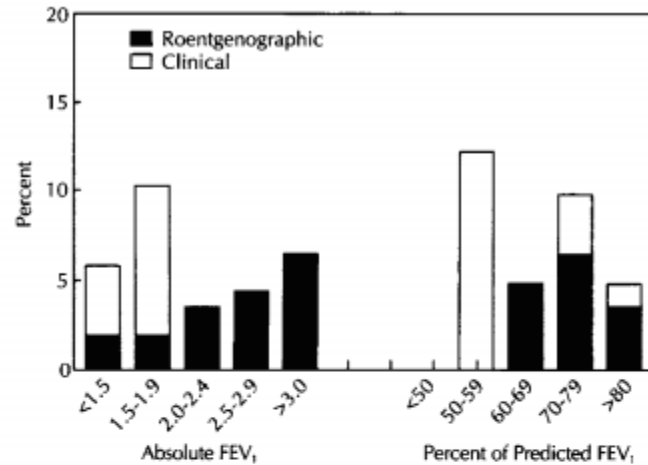


Fig 4.—Pulmonary complications according to forced expiratory volume in 1 second (FEV₁).

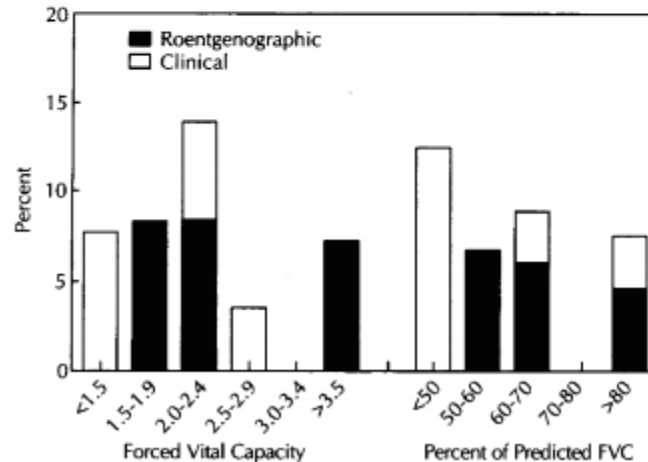


Fig 5.—Pulmonary complications according to forced vital capacity (FVC).

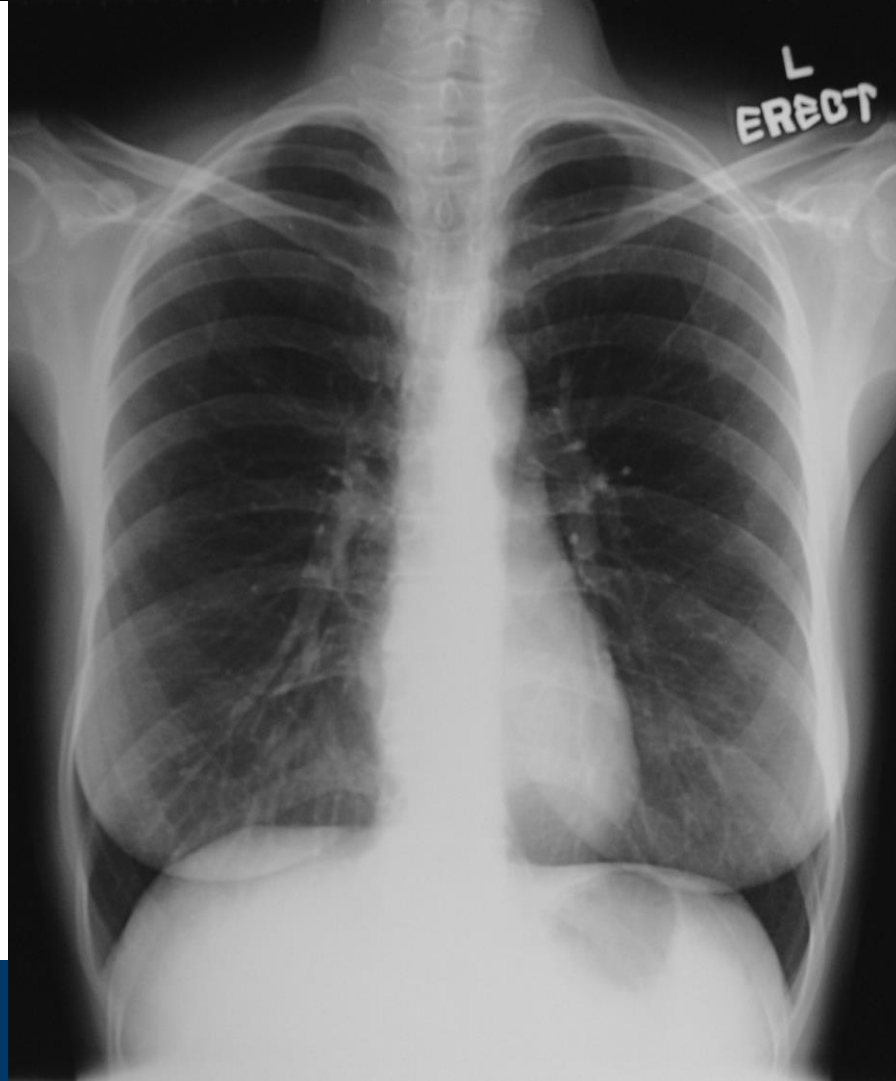


TABLE The frequency of abnormalities on routine chest x-ray examinations taken in the preoperative context

| Author | Study design | Study group | | All abnormalities | | Unsuspected abnormalities | | Influencing management | |
|---|--------------|-------------|--------|-------------------|----------|---------------------------|---------|------------------------|---------|
| | | Age (y) | N | N | % | Total | | N | % |
| | | | | | | N | % | | |
| Sane ²³ | P | 0-19 | 1500 | 111 | 7.4 | 41 | 2.7 | 0 | 0 |
| Wood ²⁴ | R | 0-19 | 749 | 35 | 4.7 | 9 | 1.21 | 3 | 0.4 |
| Farnsworth ²⁵ | R | 1-14 | 350 | 31 | 8.9 | 1 | 0.3 | 0 | 0 |
| Maigaard ²⁶ | P | >30 | 1256 | 57 | 4.5 | 2 | 0.2 | 0 | 0 |
| Lamers ²⁷ | P | >40 | 810 | 5 | 0.6 | 1 | 0.1 | 0 | 0 |
| Wyatt ²⁸ | R | >49 | 388 | 4 | 1.0 | 1 | 0.4 | 1 | 0.4 |
| Gagner ²⁹ | R | All | 1000 | 74 | 7.4 | 6 | 0.6 | 0 | 0 |
| Jeavons ³⁰ | P | Adults | 500 | 33 | 6.6 | 11 | 2.2 | 4 | 0.8 |
| Rucker ³¹ | P | All | 872 | 115 | 13.2 | 1 | 0.3 | 0 | 0 |
| Thomsen ³² | R | >40 | 1823 | 241 | 13.0 | 42 | 2.3 | 4 | 0.2 |
| Haubek ³³ | P | 1-94 | 400 | 24 | 6.0 | 6 | 1.9 | 0 | 0 |
| Tape ¹⁷ | R | 24-90 | 341 | 20 | 5.9 | - | - | 0 | 0 |
| Catchlove ³⁴ | R | 40->70 | 79 | 5 | 6.3 | - | - | 0 | 0 |
| Petterson ³⁵ | P | All | 1530 | 134 | 8.8 | - | - | 2 | 0.1 |
| Loder ³⁶ | R | 9-30 | 437 | 5 | 1.1 | 1 | 0.2 | - | - |
| Turnbull ³⁷ | R | Adults | 691 | 38 | 5.5 | 10 | 1.4 | - | - |
| Törnebrandt ³ | P | 70-94 | 91 | 43 | 47.3 | 10 | 11 | - | - |
| Seymore ¹¹ | P | >65 | 233 | 93 | 40.0 | - | - | - | - |
| Mendelson ³⁸ | P | All | 369 | 62 | 17.0 | - | - | - | - |
| Wiencek ³⁸ | P | Adults | 237 | 101 | 42.6 | - | - | - | - |
| Weibman ⁴⁰ | R | 0-90 | 734 | 213 | 29.0 | - | - | - | - |
| All studies | | | 14,390 | 1,444 | | 140 | | 14 | |
| Weighted mean* | | | | | 10.0 | | 1.3 | | 0.1 |
| 95% CI | | | | | 8.6-11.3 | | 0.0-2.8 | | 0.0-0.6 |
| Weighted mean (excluding ³) | | | | | | | 1.0 | | |
| 95% CI | | | | | | | 0.0-2.5 | | |

Abbreviations: R = retrospective; P = prospective; CI = confidence interval.

*Weighted according to the number of study subjects.

WHEN IS A CHEST X-RAY REASONABLE

- Known cardiopulmonary disease
- Abnormalities in history/physical findings
- High risk procedure such as thoracic or upper abdominal

American College of Physicians

Five Things Physicians and Patients Should Question

5

Don't obtain preoperative chest radiography in the absence of a clinical suspicion for intrathoracic pathology.

In the absence of cardiopulmonary symptoms, preoperative chest radiography rarely provides any meaningful changes in management or improved patient outcomes.



American College of Surgeons



**Five Things Physicians
and Patients Should Question**

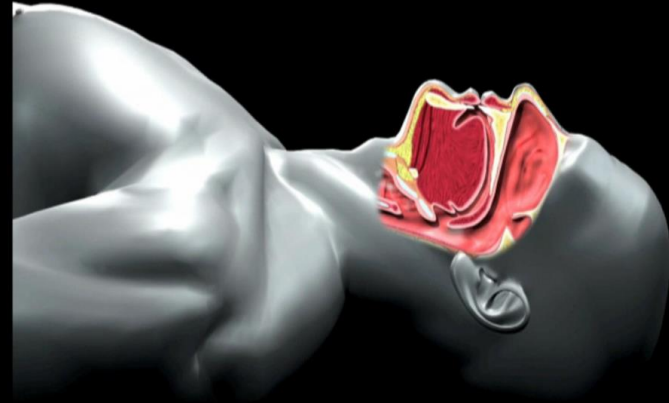
4

Avoid admission or preoperative chest X rays for ambulatory patients with unremarkable history and physical exam.

Performing routine admission or preoperative chest X rays is not recommended for ambulatory patients without specific reasons suggested by the history and/or physical examination findings. Only 2 percent of such images lead to a change in management. Obtaining a chest radiograph is reasonable if acute cardiopulmonary disease is suspected or there is a history of chronic stable cardiopulmonary diseases in patients older than age 70 who have not had chest radiography within six months.

OSA

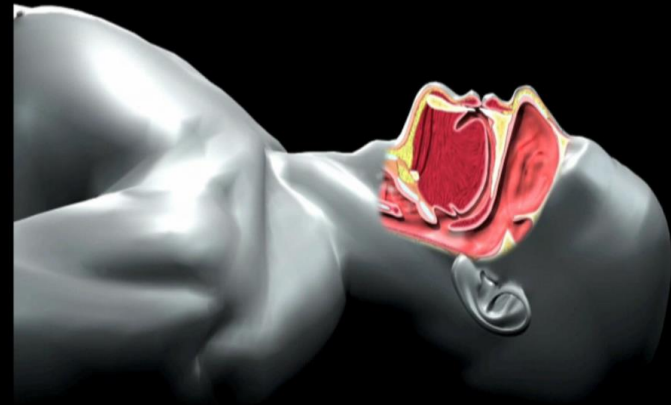
- Increased risk of ICU transfers, OSA exacerbations, intubations and acute respiratory failure
- No association with mortality



OSA

- S: Snoring
- T: Tiredness
- O: Observed Apneas
- P: blood Pressure
- B: BMI>35
- A: Age>50
- N: Neck>40cm
- G: Gender, Male

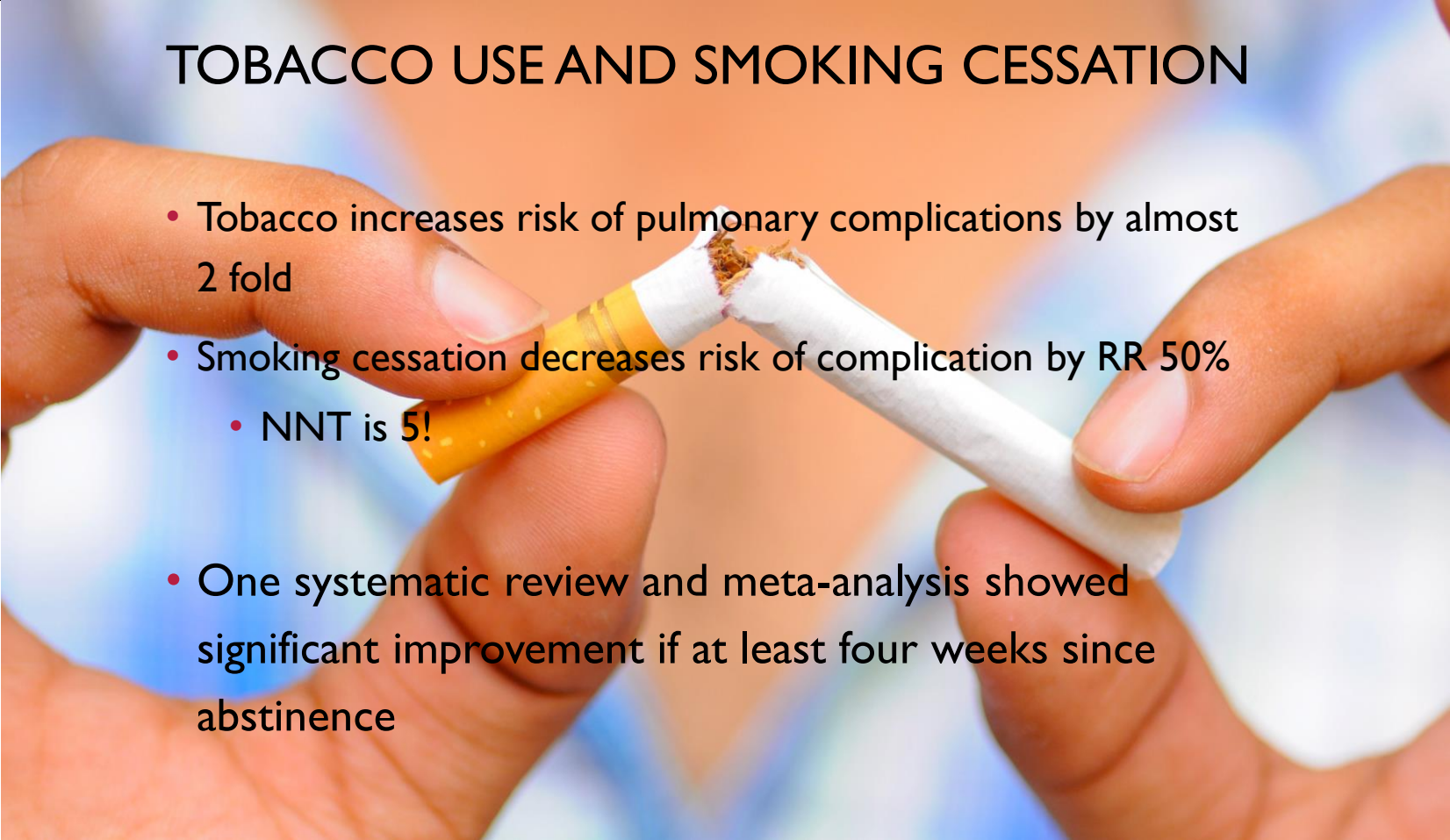
Sensitivity 84%
Specificity 40%



FOR PATIENT WITH OSA

- Continue treatment
- If undergoing low risk surgery, no need for adjustment or formal evaluation
- If adjustments are needed or initiation, leave at least one week for appropriate changes to take affect.

TOBACCO USE AND SMOKING CESSATION

- 
- Tobacco increases risk of pulmonary complications by almost 2 fold
 - Smoking cessation decreases risk of complication by RR 50%
 - NNT is 5!
 - One systematic review and meta-analysis showed significant improvement if at least four weeks since abstinence



Diabetes

PERIOPERATIVE CARE - DIABETES

- Good History

- Type of surgery
- History of Complications
- Medication history
- Glucose logs

- Laboratory

- A1C if not done in the previous 4-6 weeks
 - Increased risk of complications such as infection or MI and higher mortality
- Assess kidney function
- Glucose
- Typical Cardiopulmonary evaluation

WHAT TO DO WITH THOSE MEDS?



- Stop oral hypoglycemic, metformin or non-insulin injectables on morning of surgery
- Restart after surgery
 - If kidney function OK
 - For oral hypoglycemics only when eating is well established

WHAT TO DO WITH THOSE MEDS?



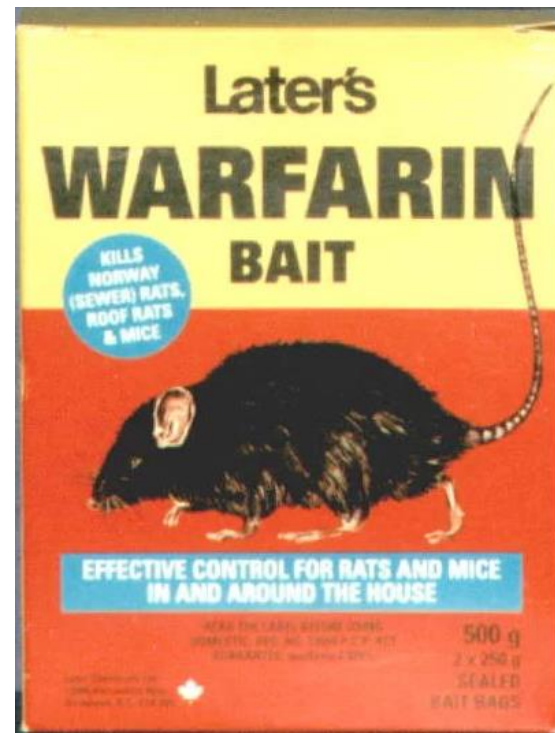
- Insulin:
 - If early morning surgery, and breakfast only delayed
 - Skip morning short acting, continue basal night time
 - If surgery to lead missed breakfast/lunch
 - Skip morning short acting, continue basal night time decreasing by 25%
 - If on intermediate bID, Morning dose cut to 1/2 dose
 - Intraoperative glucose monitoring Q1-2 hours
 - D5 maintenance fluid
 - Long procedures will often require IV insulin
- Post operative: Goal of 80-180 mg/dL
 - Can have higher goal to avoid hypoglycemia



ANTICOAGULATION

- Warfarin
 - Stop 5 days prior
 - Check INR day prior to surgery
 - Bridge with LMWH for patients at high risk:
 - Mechanical valve
 - CHADS-VASc of >6
 - Recent stroke
 - Recent VTE

***If Emergent surgery –
give FFP/ IV Vit K**



ANTICOAGULATION

- NOAC/DOAC

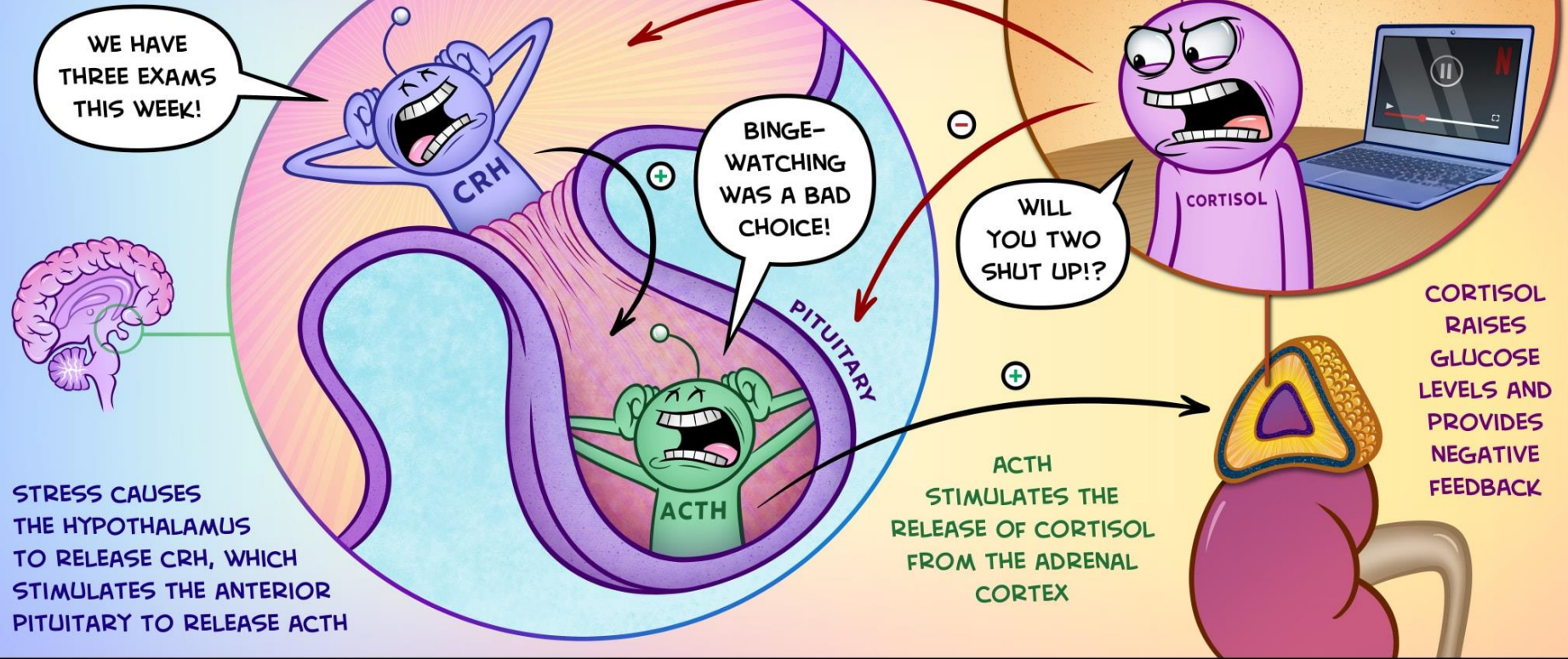
***If Emergent surgery – can give idarucizumab (Praxbind) for dabigatran**

| Table 4 Preoperative DOAC management based on drug half-life and surgical bleed risk | | |
|---|--|--|
| Creatinine Clearance (mL/min) | Interval Between Last DOAC Dose and Procedure ^a | |
| | Low-Bleed-Risk Procedure ^b | High-Bleed-Risk Procedure ^b |
| | 2–3 Drug Half-Lives | 4–5 Drug Half-Lives |
| Dabigatran | | |
| >50 | At least 24 h (skip 2 doses) | At least 48 h (skip 4 doses) |
| 30–50 | At least 48 h (skip 4 doses) | At least 96 h (skip 8 doses) |
| Rivaroxaban | | |
| >50 | At least 24 h (skip 1 dose) | At least 48 h (skip 2 doses) |
| 30–50 | At least 24 h (skip 1 dose) | At least 48 h (skip 2 doses) |
| Apixaban | | |
| >50 | At least 24 h (skip 2 doses) | At least 48 h (skip 4 doses) |
| 25–50 | At least 24 h (skip 2 doses) | At least 48 h (skip 4 doses) |
| Edoxaban | | |
| >50 | At least 24 h (skip 1 dose) | At least 48 h (skip 2 doses) |
| 30–50 | At least 24 h (skip 1 dose) | At least 48 h (skip 2 doses) |

^a DOAC not taken on day of surgery/procedure.

^b See Table 2 for procedural definitions.

HPA AXIS



HYPOTHALAMIC PITUITARY ADRENAL AXIS

- Patients on more than 5 mg prednisone/day may have suppressed HPA
- If on 5-20 or using high potency topical/inhaled steroids or more than 3 joint/spinal injections in 6 months:
 - Check morning cortisol/ACTH stim test
- If on >20 mg for more than 3 weeks assume HPA axis is suppressed

Table 2. Guidelines for Adrenal Supplementation Therapy*

| Medical or Surgical Stress | Corticosteroid Dosage |
|--|---|
| Minor Inguinal hernia repair Colonoscopy Mild febrile illness Mild-moderate nausea/vomiting Gastroenteritis | 25 mg of hydrocortisone or 5 mg of methylprednisolone intravenous on day of procedure only |
| Moderate Open cholecystectomy Hemicolectomy Significant febrile illness Pneumonia Severe gastroenteritis | 50-75 mg of hydrocortisone or 10-15 mg of methylprednisolone intravenous on day of procedure Taper quickly over 1-2 days to usual dose |
| Severe Major cardiothoracic surgery Whipple procedure Liver resection Pancreatitis | 100-150 mg of hydrocortisone or 20-30 mg of methylprednisolone intravenous on day of procedure Rapid taper to usual dose over next 1-2 days |
| Critically ill Sepsis-induced hypotension or shock | 50-100 mg of hydrocortisone intravenous every 6-8 h or 0.18 mg/kg/h as a continuous infusion + 50 µg/d of fludrocortisone until shock resolved May take several days to a week or more Then gradually taper, following vital signs and serum sodium |

*Data are based on extrapolation from the literature, expert opinion, and clinical experience.^{5,6,11,15,20-22} Patients receiving 5 mg/d or less of prednisone should receive their normal daily replacement, but do not require supplementation.¹³ Patients who receive greater than 5 mg/d of prednisone should receive the above therapy in addition to their maintenance therapy.

TAKE HOME POINTS

- Identify your role in the care of the patient
- ACC/AHA guidelines
 - Assess for risk factors using NSQIP or RCRI
 - Determine functional capacity
 - Weigh risks and benefits of interventions such as beta blockers, stress tests or catheterization
- Don't Forget the lungs!
 - Do not order routine preop CXR
 - Screen OSA
 - Encourage smoking cessation – NNT 5!
- Diabetes
 - Hold oral meds day of surgery
 - Depending on length of surgery, adjust insulin, recommend intraoperative
 - Goal glucose 80-180
- Anticoagulation
 - Warfarin – bridge if high risk
 - Hold 5 days prior
 - DOACs – no bridging necessary
 - Hold 1-2 days prior, maybe longer depending on kidney function

Questions?

Thank you!



