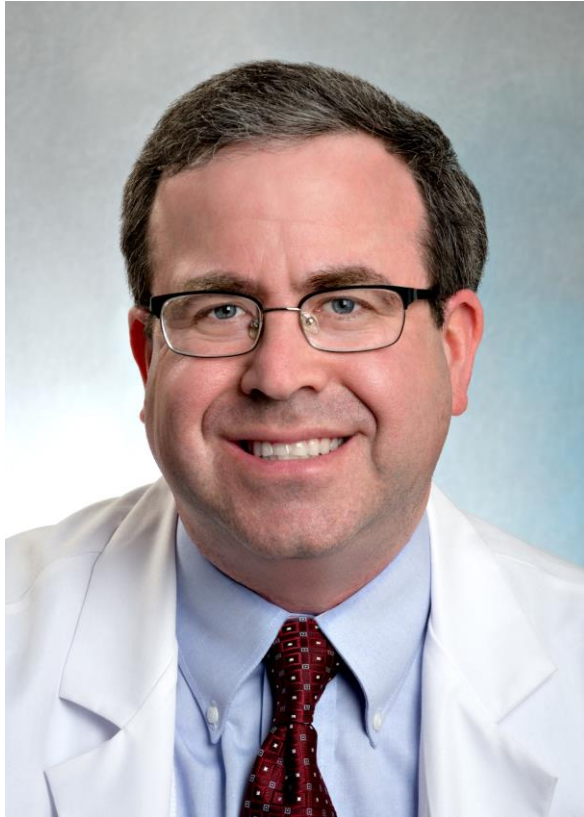


Best Practices for Pre-Operative Evaluation

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 - Research Focus: Patient Safety

Disclosures

I have no financial disclosures

Learning Objectives

Upon completion of this activity, participants will be able to:

- Discuss the key perioperative guidelines
- Review various tools for preoperative risk assessment
- Identify the importance of non-cardiac perioperative risks
- Recognize the risks specific to certain patient populations in the perioperative setting



Introduction

- The role of the clinician performing preoperative evaluation is **not** to provide medical “clearance” prior to surgery
- Instead, the clinician should:
 - Assess the patient’s cardiac and other risks going into the procedure
 - Decide whether additional preoperative testing, such as a cardiac stress test, is needed
 - When indicated, recommend measures to reduce perioperative risk, such as beta blockers and statins
 - Assist the surgeon in deciding whether the benefits of the surgery outweigh the risks



The Current Periop Guidelines were Published in 2014

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION



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

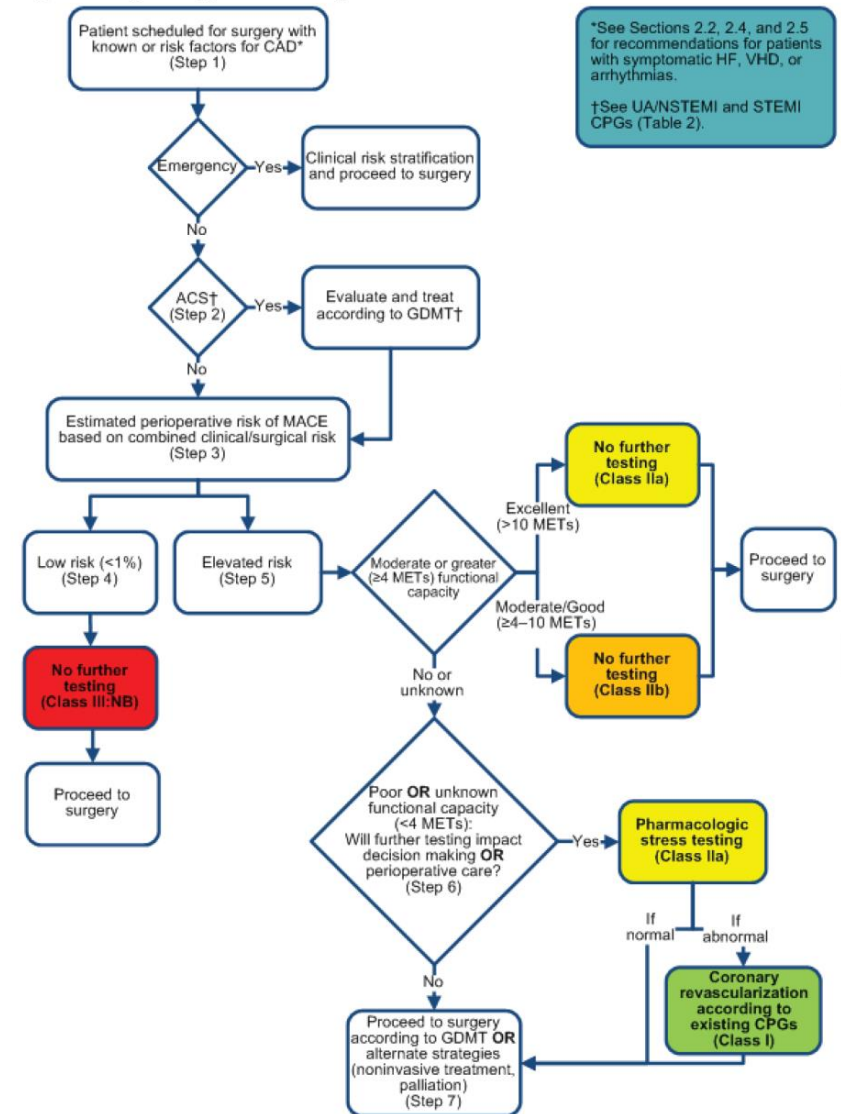
Lee A. Fleisher, Kirsten E. Fleischmann, Andrew D. Auerbach, Susan A. Barnason, Joshua A. Beckman, Biykem Bozkurt, Victor G. Davila-Roman, Marie D. Gerhard-Herman, Thomas A. Holly, Garvan C. Kane, Joseph E. Marine, M. Timothy Nelson, Crystal C. Spencer, Annemarie Thompson, Henry H. Ting, Barry F. Uretsky and Duminda N. Wijeyesundera

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ACC/AHA 2014 Periop Guidelines

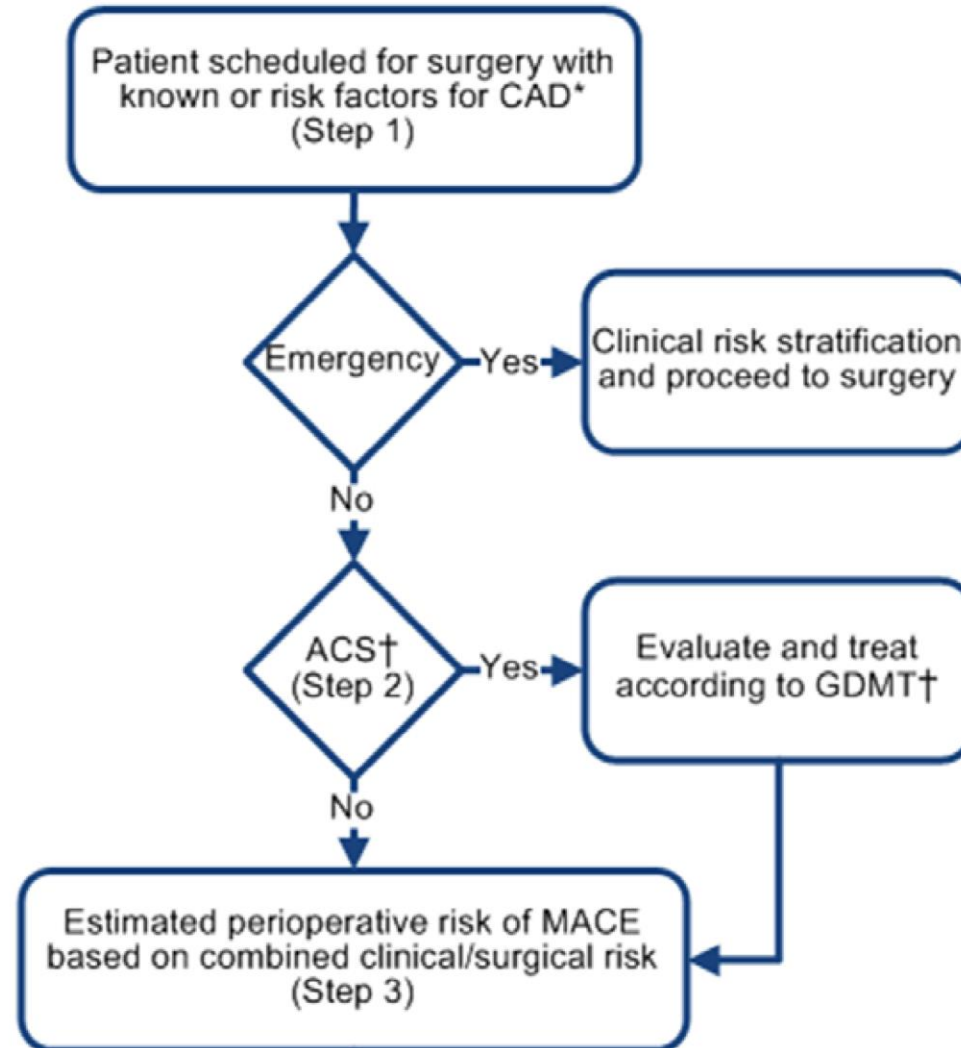
Figure 1. Stepwise Approach to Perioperative Cardiac Assessment for CAD



Source: Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management...Circulation. 2014 Dec 9;130(24):e278-333.



ACC/AHA 2014 Periop Guidelines



Source: Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management...Circulation. 2014 Dec 9;130(24):e278-333.



Risk Assessment in the 2014 Guidelines

- For risk assessment, the 2014 guidelines recommend estimating the preoperative risk of a major adverse cardiac event (MACE), which here is defined as death or MI
- The risk of MACE is a function of both the risk associated with the procedure and the risk associated with the patient
- If there is a low risk of MACE, which is defined as $< 1\%$, then one goes to surgery



Risk Assessment in the 2014 Guidelines

The guidelines suggest three ways to determine if the MACE risk is $\geq 1\%$:

1. ACS NSQIP Surgical Risk Calculator (<http://www.riskcalculator.facs.org/>)
2. Perioperative Cardiac Risk Calculator
(<http://www.surgicalriskcalculator.com/miorcardiacarrest>)
3. RCRI score (though one of the two options above is preferred because they outperform the RCRI score)



ACS NSQIP Surgical Risk Calculator

ACS Risk Calculator - Patient Information

Age Group

Under 65 years ▼

Sex

Male ▼

Functional Status *i*

Partially Dependent ▼

Emergency Case *i*

No ▼

ASA Class *i*

Severe systemic disease ▼

Steroid use for chronic condition *i*

No ▼

Ascites within 30 days prior to surgery *i*

No ▼

Systemic Sepsis within 48 hours prior to surgery *i*

None ▼

Ventilator Dependent *i*

No ▼

Disseminated Cancer *i*

No ▼

Diabetes *i*

Insulin ▼

Hypertension requiring medication *i*

Yes ▼

Congestive Heart Failure in 30 days prior to surgery *i*

No ▼

Dyspnea *i*

With Moderate exertion ▼

Current Smoker within 1 Year *i*

No ▼

History of Severe COPD *i*

No ▼

Dialysis *i*

No ▼

Acute Renal Failure *i*

No ▼

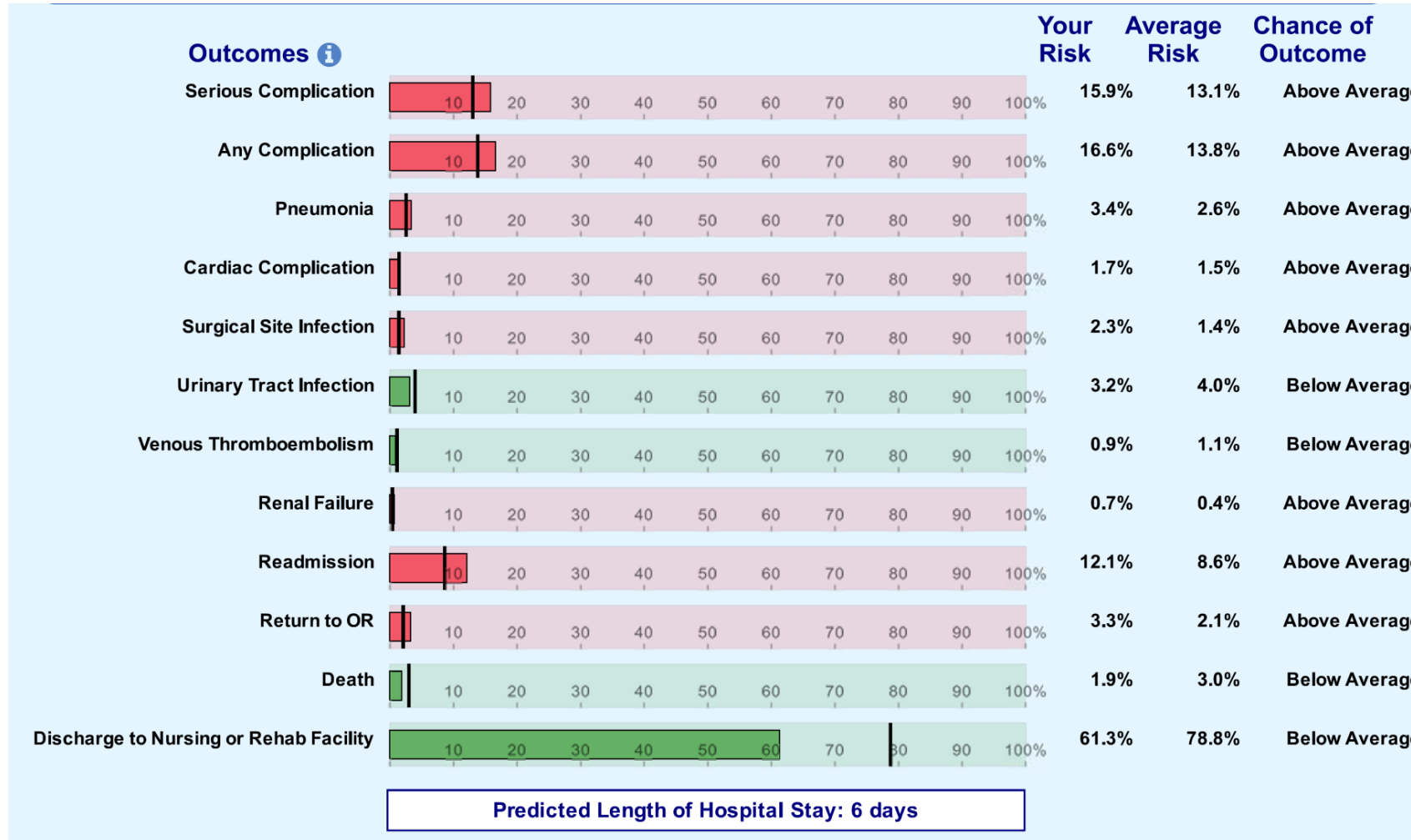
BMI Calculation: *i*

Height (in)

Weight (lbs)



ACS NSQIP Surgical Risk Calculator



Perioperative Cardiac Risk Calculator

Estimate risk of perioperative myocardial infarction or cardiac arrest.

Age

Creatinine

<1.5 mg/dL / 133 μ mol/L

ASA Class

ASA 1

ASA 1 = Normal healthy patient

ASA 2 = Patients with mild systemic disease

ASA 3 = Patients with severe systemic disease

ASA 4 = Patients with severe systemic disease
that is a constant threat to life

ASA 5 = Moribund patients who are not expected
to survive without the operation

Preoperative Function Totally Independent

Procedure

Anorectal



Revised Cardiac Risk Index

Risk Factor	Definition
1. High-risk type of surgery	Intraperitoneal, intrathoracic, or suprainguinal vascular procedures
2. Ischemic heart disease	History of MI, positive stress test, current cardiac CP, nitrate usage, ECG with pathologic Q waves
3. History of congestive heart failure	History of CHF, pulmonary edema, or PND; rales or S3 on exam; chest x-ray with pulmonary edema
4. History of cerebrovascular disease	History of transient ischemic attack or stroke
5. Insulin therapy for diabetes	
6. Preoperative serum creatinine > 2.0 mg/dL	

- “A patient with 0 or 1 [RCRI] predictor(s) of risk would have a low risk of MACE. Patients with ≥ 2 predictors of risk would have elevated risk.”

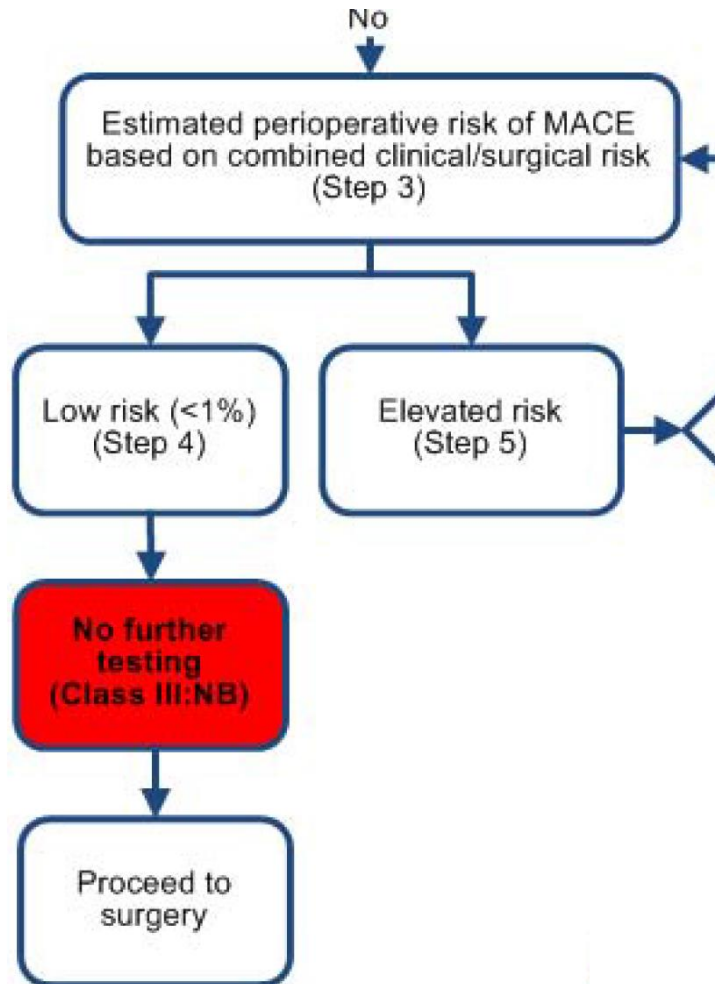
Sources: Lee TH, Marcantonio ER, Mangione CM, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery.

Circulation. Sep 7 1999;100(10):1043-1049.

Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management...*Circulation*. 2014 Dec 9;130(24):e278-333.



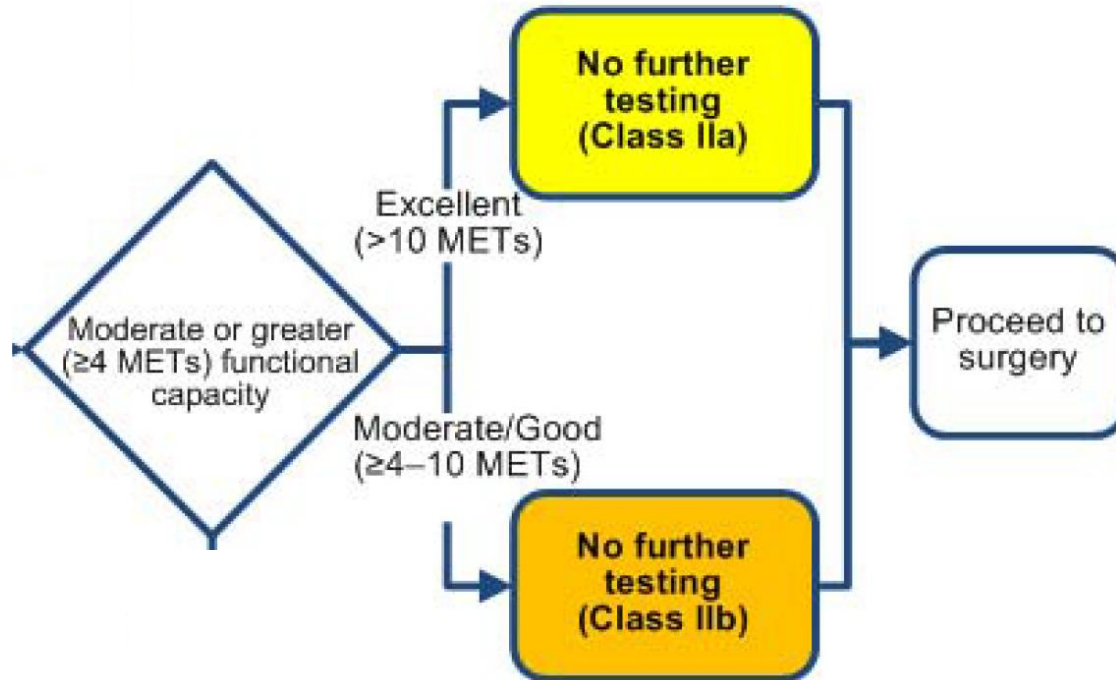
ACC/AHA 2014 Periop Guidelines



- Under the guidelines, if your risk of MACE is low ($< 1\%$), then you go to surgery
- If your risk is elevated ($\geq 1\%$), then you consider the patient's functional capacity



ACC/AHA 2014 Periop Guidelines



- If your functional capacity is ≥ 4 METs, then you proceed to surgery

Duke Activity Status Index

1. Take care of yourself by eating, dressing, bathing, toileting (2.75)
2. Walk indoors, such as around your house (1.75)
3. Walk a block or 2 on level ground (2.75)
4. Climb a flight of stairs or walk up hill (5.50)
5. Run a short distance (8.00)
6. Do light housework, such as dusting or washing dishes (2.70)
7. Do moderate housework, such as vacuuming, sweeping, or carrying groceries (3.50)
8. Do heavy housework, such as scrubbing floors or moving heavy furniture (8.00)
9. Do yard work, such as raking, weeding, or pushing a power mower (4.50)
10. Have sexual relations (5.25)
11. Moderate recreation, such as golf, bowling, dance, doubles tennis (6.00)
12. Strenuous sports, such as swimming, singles tennis, football, basketball (7.50)

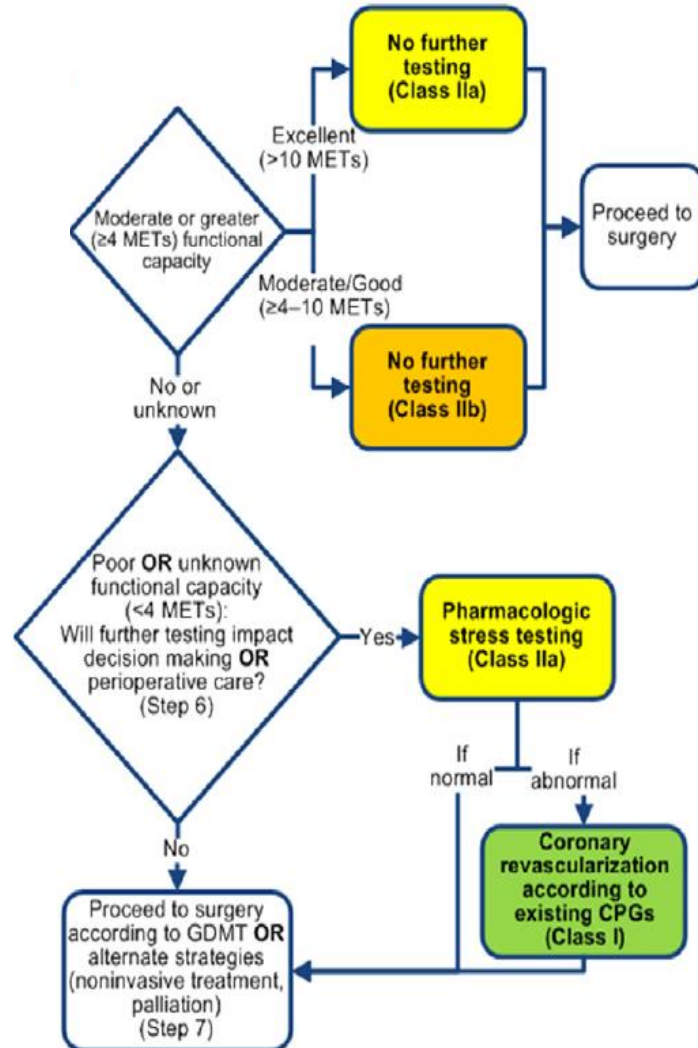


Duke Activity Status Index

- Methods to use the DASI:
 - Online METs calculators based on DASI
 - E.g.: <https://www.mdcalc.com/calc/3910/duke-activity-status-index-dasi>
 - DASI scores > 34 are associated with a reduced risk of 30-d death or MI



ACC/AHA 2014 Periop Guidelines



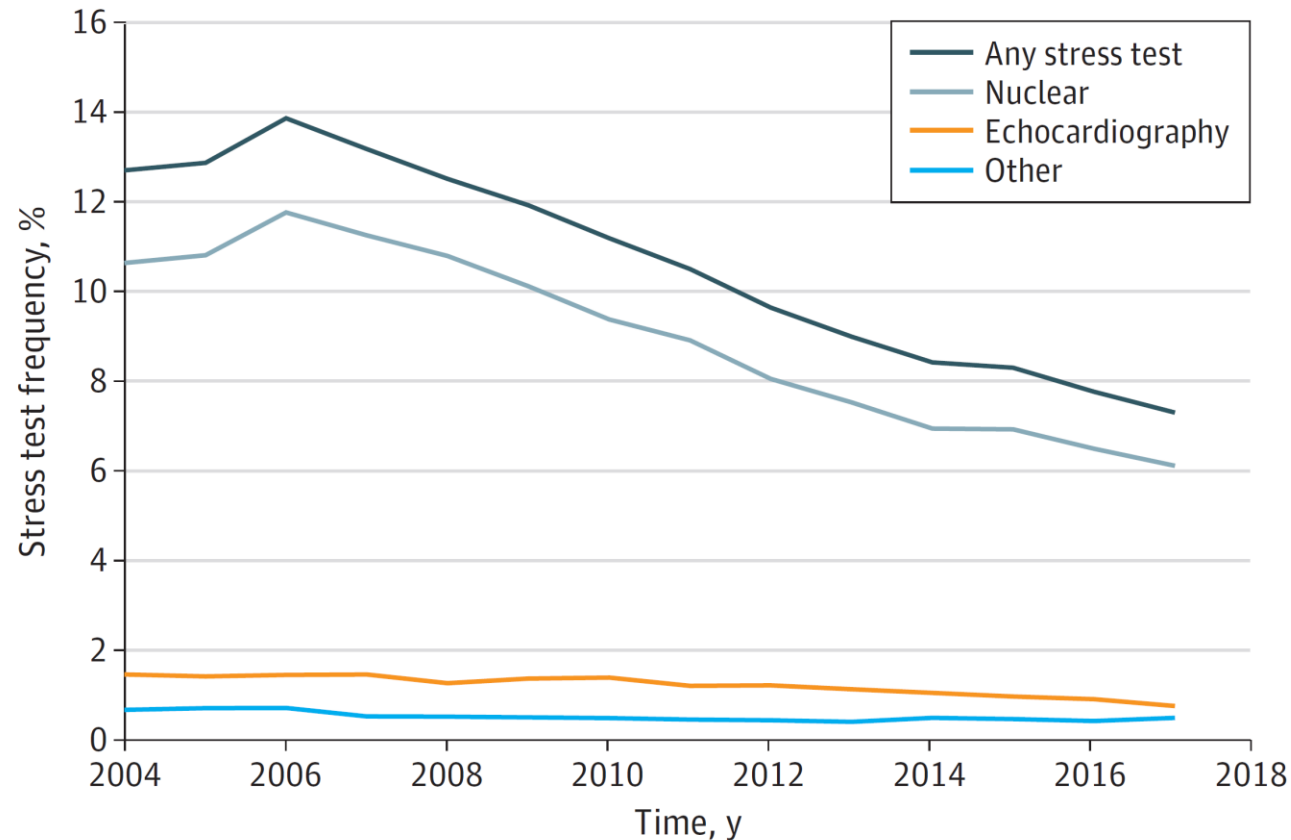
- If your functional capacity is < 4 METs, then consider pharmacologic stress testing, **if it will change management**



Preop Stress Tests Use is Declining

801,396 elective total hip or total knee arthroplasty patients

B Type of preoperative stress test performed 2004-2017



Year	RCRI, No./total No. (%)
	0
2004	1636/3659 (44.7)
2005	2393/5268 (45.4)
2006	2323/4966 (46.8)
2007	2644/5414 (48.8)
2008	2763/5670 (48.7)
2009	2992/6003 (49.8)
2010	2865/5710 (50.2)
2011	3506/6980 (50.2)
2012	3315/6514 (50.9)
2013	2674/5414 (49.4)
2014	2843/5606 (50.7)
2015	2013/4117 (48.9)
2016	1790/3552 (50.4)
2017	1594/3032 (52.6)
Total	35 351/71 905 (49.2)



PERSONAL HEALTH

Planning for Surgery? You Might Not Need All Those Tests Beforehand.

Cardiac stress tests, X-rays and other medical tests may not provide useful information before operations, and they could cause harm.

 Give this article    193



Rachel Levit Ruiz



By **Jane E. Brody**

Nov. 15, 2021



Preoperative ECGs in the 2014 ACC/AHA Guidelines

- Class IIa: Preop resting 12-lead ECG is reasonable for patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease, cerebrovascular disease, or other significant structural heart disease, except for those undergoing low-risk surgery
- Class IIb: Preop resting 12-lead ECG may be considered for asymptomatic patients without known coronary heart disease, except for those undergoing low-risk surgery
- Class III: Routine preop resting 12-lead ECG is not useful for asymptomatic patients undergoing low-risk surgical procedures

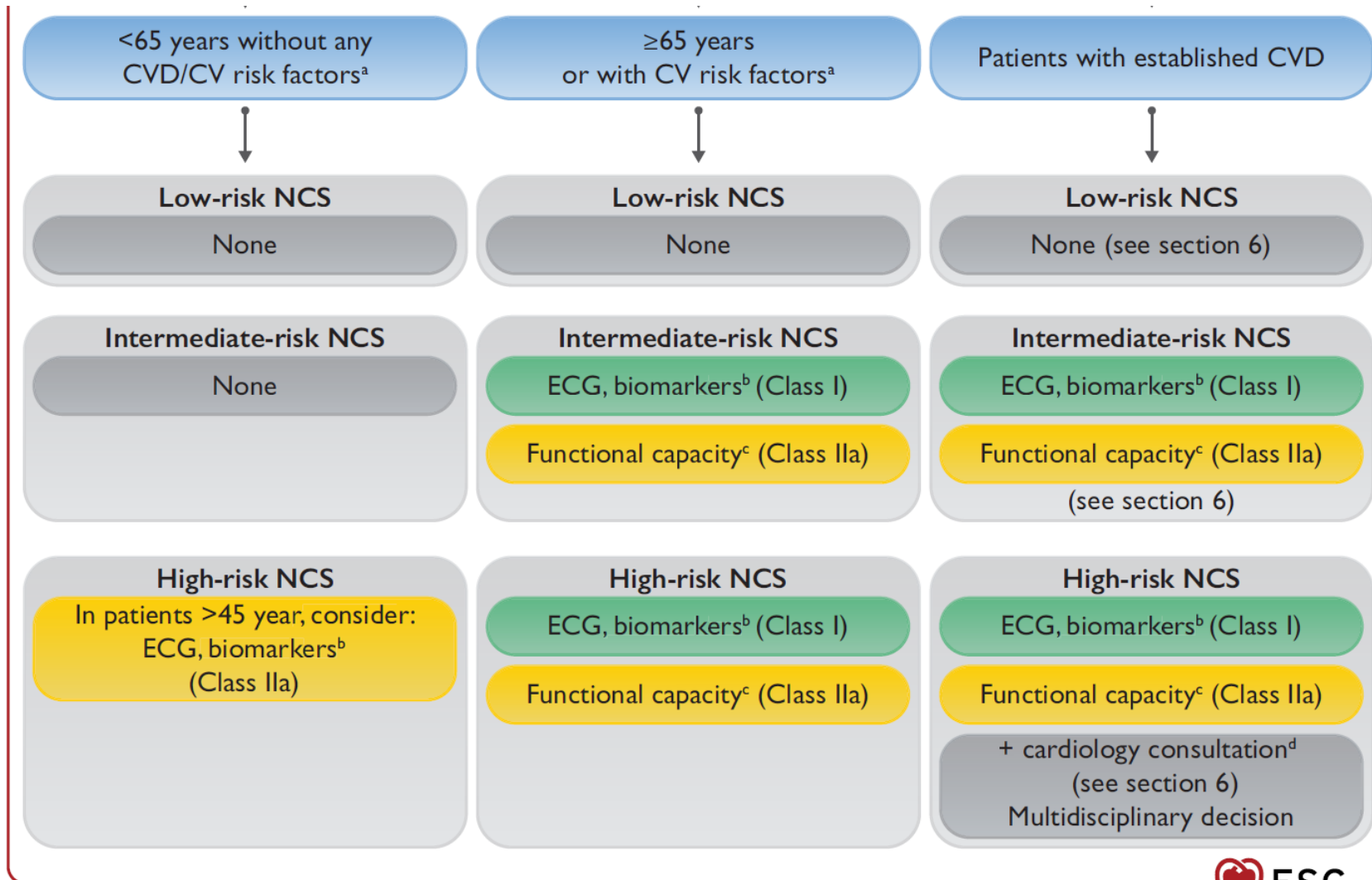


Perioperative Troponin Measurements in High-Risk Patients without Symptoms

- 2014 ACC/AHA Guidelines: “The usefulness of postoperative screening with troponin levels in patients at high risk for perioperative MI but without signs or symptoms suggestive of myocardial ischemia or MI is uncertain”
- 2018 European Society of Anaesthesiology Guidelines: “We suggest considering assessment of cardiac troponins in high-risk patients, both before and 48 to 72 h after major surgery”



Perioperative Troponin Measurements in High-Risk Patients without Symptoms: 2022 ESC Guidelines



Source: Halvorsen S, et al. ESC Scientific Document Group. 2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery. Eur Heart J. 2022 Oct 14;43(39):3826-3924.



Perioperative Troponin Measurements in High-Risk Patients without Symptoms

- Key question: will the troponin measurement change your management?
 - For example, will this information cause you to add an ASA or statin?
- A challenge: determining if the troponin elevation is a change from baseline
- May be useful should cardiac symptoms develop



Perioperative Beta Blockers: 2014 Guideline Recommendations

- Perioperative beta blockade appears to be of benefit in selected patients who are at elevated risk of perioperative cardiac events
- Per the ACC/AHA 2014 Periop Guidelines, there is one class I indication for perioperative beta-blocker use:
 - “Beta blockers should be continued in patients undergoing surgery who have been on beta blockers chronically”
- What to do in patients who are not already on beta blockers is unsettled



Perioperative Beta Blockers: The POISE Trial

- The PeriOperative ISchemic Evaluation (POISE) Trial enrolled 8351 patients undergoing noncardiac surgery with at least one cardiac risk factor
- Patients were randomized to either placebo or controlled-release metoprolol (CR metoprolol) 100 mg orally 2 – 4 h before surgery, a postop dose of CR metoprolol based on heart rate and BP, and then 200 mg of CR metoprolol orally daily for the next 30 d
- The beta blocker arm had a lower rate of the primary outcome (30-day cardiac events): 5.8% in the beta blocker arm versus 6.9% in the placebo arm (P=0.04)
- However, the total mortality was higher in the CR metoprolol group (3.1%) than in the placebo group (2.3%) (P=0.03)
- The general view of this trial is that the dose of periop beta blockers given was too large, and so led to the increased stroke rate



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- Patients were randomized to either placebo or controlled-release metoprolol (CR metoprolol) 100 mg orally 2 – 4 h before surgery, a postop dose of CR metoprolol based on next 30 d
- The beta blocker (cardiac events): 5% (P=0.04)
- However, the total mortality was higher in the CR metoprolol group (5.1%) than in the placebo group (2.3%) (P=0.03)
- The general view of this trial is that the dose of periop beta blockers given was too large, and so led to the increased stroke rate

Giving high doses of beta blockers without dose titration to beta blocker naïve patients right before surgery increases mortality



Perioperative Beta Blockers: The POISE Trial

Unanswered questions:

- What if we gave moderate-dose beta blockers?
- What if we started beta blockers a week or even 30 days before surgery?



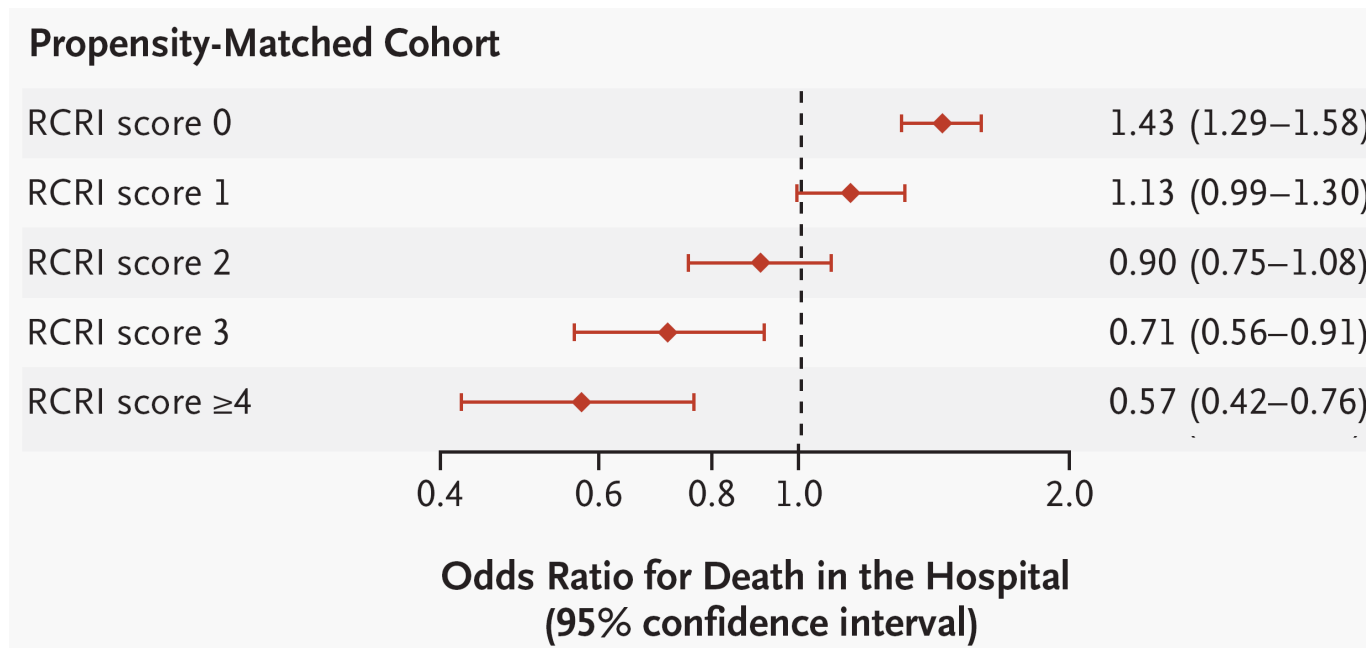
Perioperative Beta Blockers: Retrospective Data

- A large retrospective cohort study examining the benefits of periop beta blockers based on the cardiac risk of the patient
- Patients undergoing noncardiac surgery (mainly orthopedic and abdominal procedures) were included
- Patients receiving prophylactic periop beta blockers were compared with patients not receiving beta blockers
- This study is debated:
 - On the one hand, it was quite large (n=663,635)
 - On the other hand, it was retrospective, and based on the use of an administrative database. No charts were reviewed. Beta blockers started on hospital day 1 or 2 were considered prophylactic



Perioperative Beta Blockers: Retrospective Data

- Patients without cardiac risk factors who got periop beta blockers seemed to be harmed by them
- Patients with an RCRI of at least 2, and certainly with an RCRI of 3, appeared to benefit from beta blockers



Perioperative Beta Blockers: Retrospective Data

- Patients without cardiac risk factors who got periop beta blockers seemed to be harmed by them
- Patients with an RCRI of at least 2, and certainly with an RCRI of 3, appeared to benefit from beta blockers

As the RCRI score goes up, the benefit from beta blockers increases. Beta blockers conferred a mortality benefit with an RCRI score ≥ 3 .



Perioperative Beta Blockers: 2014 ACC/AHA Recommendations

- The 2014 AHA guidelines are offer mainly Ib recommendations about when to start periop beta blockers in those who are not on them
- In patients with an RCRI score of 3 or more, it may be reasonable to begin beta blockers prior to surgery (class Ib recommendation)
- “In patients with a compelling long-term indication for beta-blocker therapy but no other RCRI risk factors, initiating beta blockers in the perioperative setting as an approach to reduce perioperative risk is of uncertain benefit”
- Beta-blocker therapy should not be started on the day of surgery (class III recommendation)



Perioperative Statins

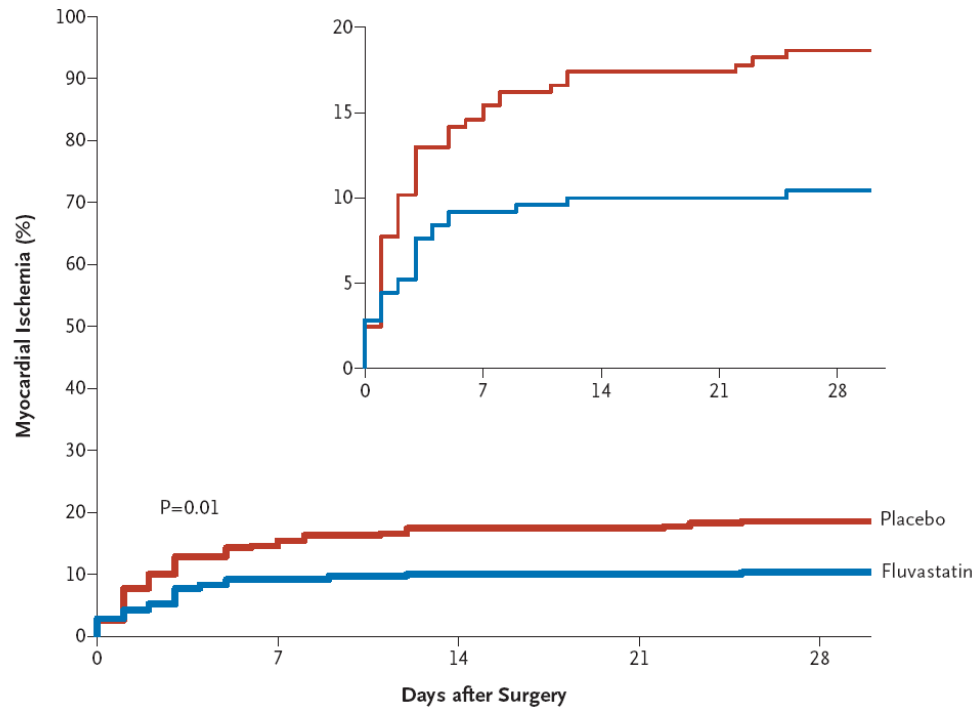
- The DECREASE-III trial enrolled 497 patients, age > 40, at elevated cardiac risk, scheduled to undergo noncardiac vascular surgery
- All patients had to be statin naïve
- All patients were on beta blockers
 - Patients who were already taking a beta blocker were continued on this beta blocker
 - Patients who were not on a beta blocker were started on one, and their dose was titrated based on their HR
- Patients were randomized to fluvastatin 80 mg daily or a placebo. This statin was started on average 37 days prior to surgery and continued for at least 30 days after surgery



Perioperative Statins

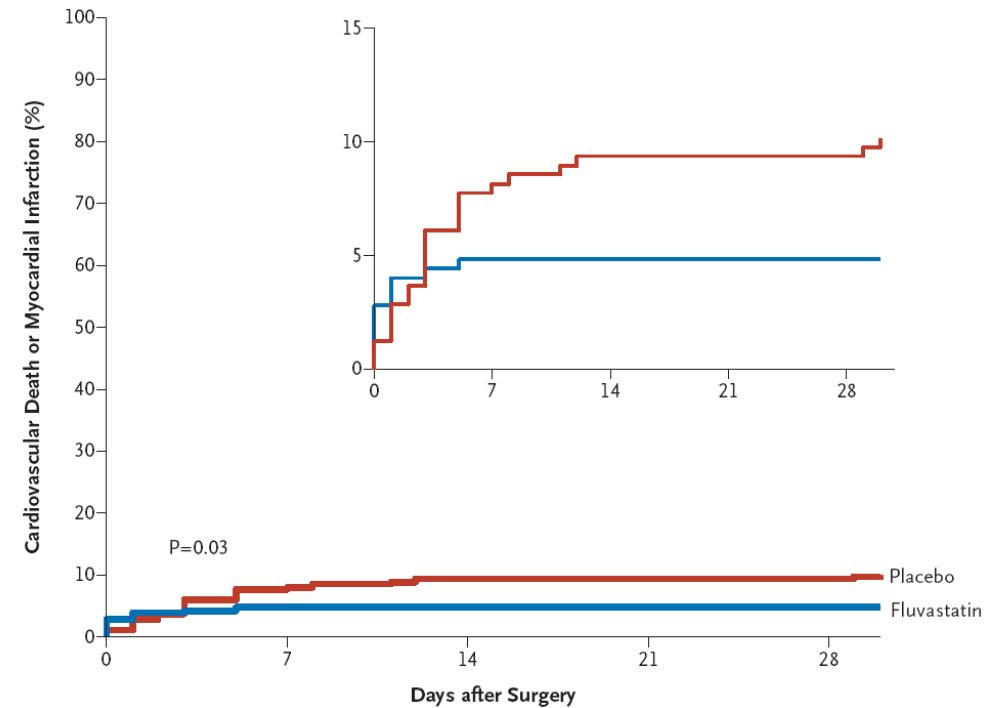
Perioperative Myocardial Ischemia: 10.8% in the statin arm vs. 19.0% in the placebo arm (P = 0.01)

A Perioperative Myocardial Ischemia

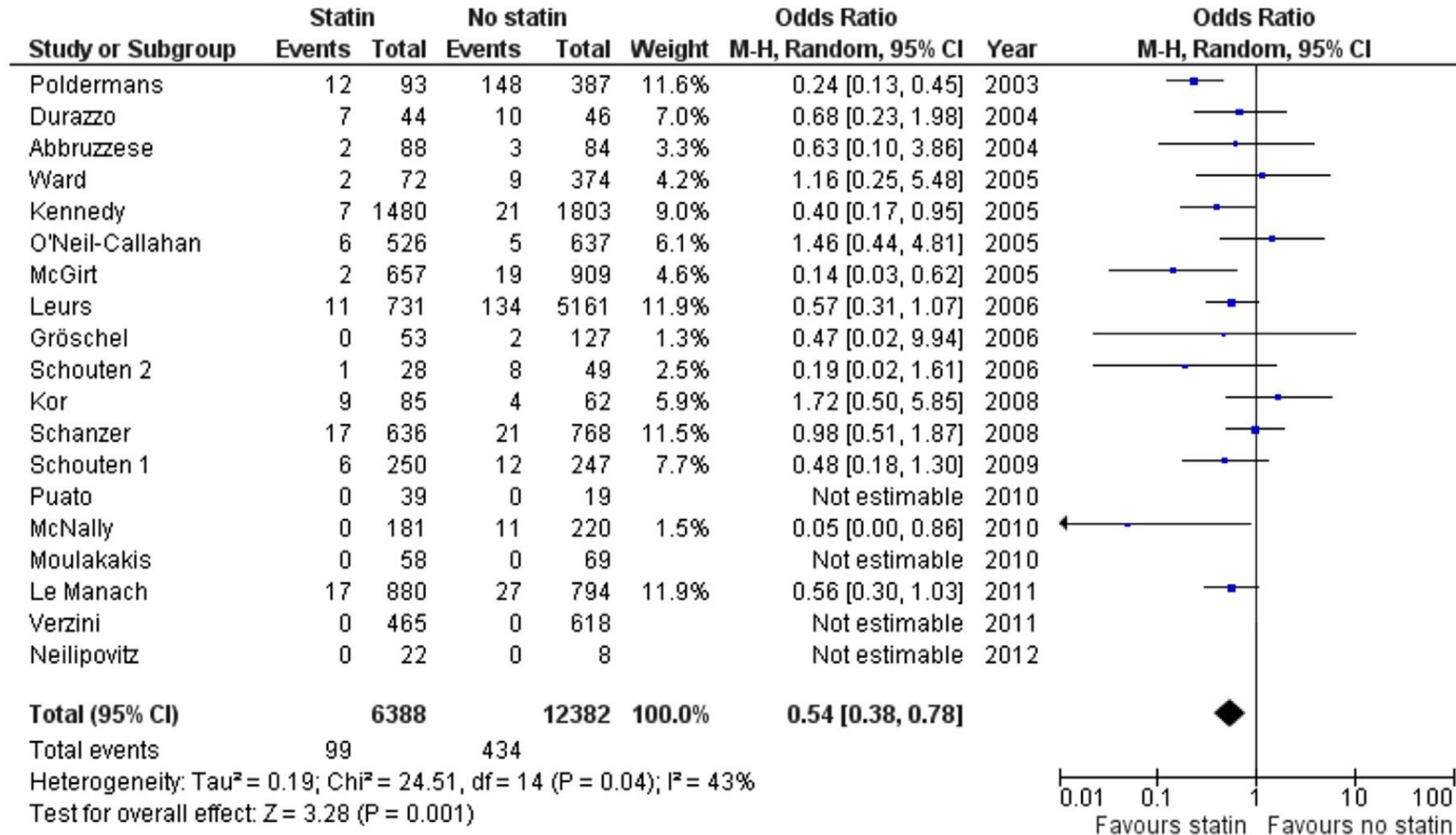


Perioperative death from CV cause or MI: 4.8% in the statin arm vs. 10.1% in the placebo arm (P = 0.03)

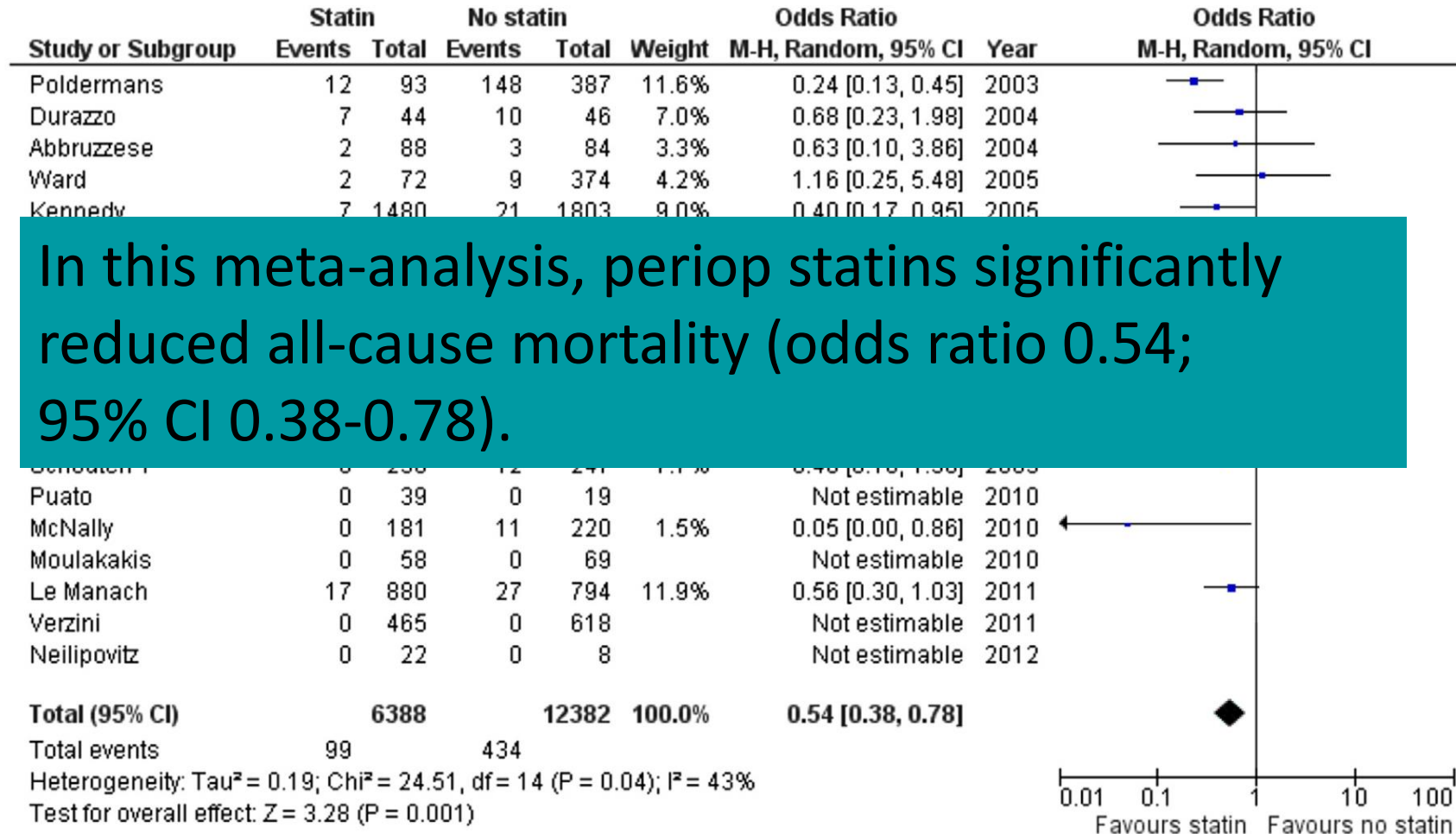
B Perioperative Death from Cardiovascular Causes or Nonfatal Myocardial Infarction



Perioperative Statins: Meta-Analysis



Perioperative Statins: Meta-Analysis



In this meta-analysis, periop statins significantly reduced all-cause mortality (odds ratio 0.54; 95% CI 0.38-0.78).



Perioperative Statins: 2014 ACC/AHA Recommendations

- Statins should be continued in patients currently taking statins and scheduled for noncardiac surgery (class I)
- Perioperative initiation of statins is reasonable in patients undergoing vascular surgery (class IIa)
- Perioperative initiation of statins may be considered in patients with clinical indications according to GDMT who are undergoing elevated-risk procedures (class IIb)



Perioperative Aspirin

- The POISE 2 Trial was an that looked at the effect of perioperative ASA
- The trial enrolled 10,010 patients undergoing noncardiac surgery who were at risk for vascular complications
- Patient within the coronary stent critical periods were excluded
- The primary endpoint was death or nonfatal MI at 30 days
- The patients were stratified by whether they were already taking ASA (continuation group) or not (initiation group)



Perioperative Aspirin

- There was no benefit to ASA in the primary outcome or any of the secondary outcomes
- The negative results were the same for the continuation group and the initiation group
- Taking ASA was associated with an increased risk of major bleeding



Perioperative Aspirin

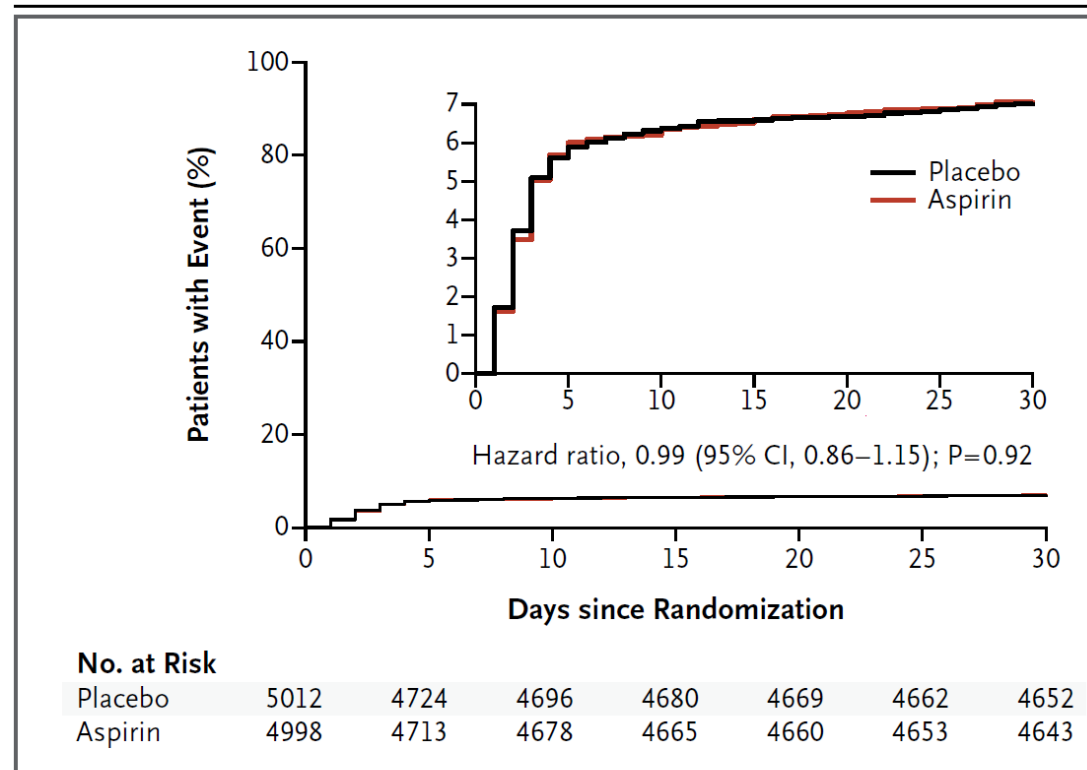


Figure 1. Kaplan–Meier Estimates of the Primary Composite Outcome of Death or Nonfatal Myocardial Infarction at 30 Days.

The inset shows the same data on an enlarged y axis.

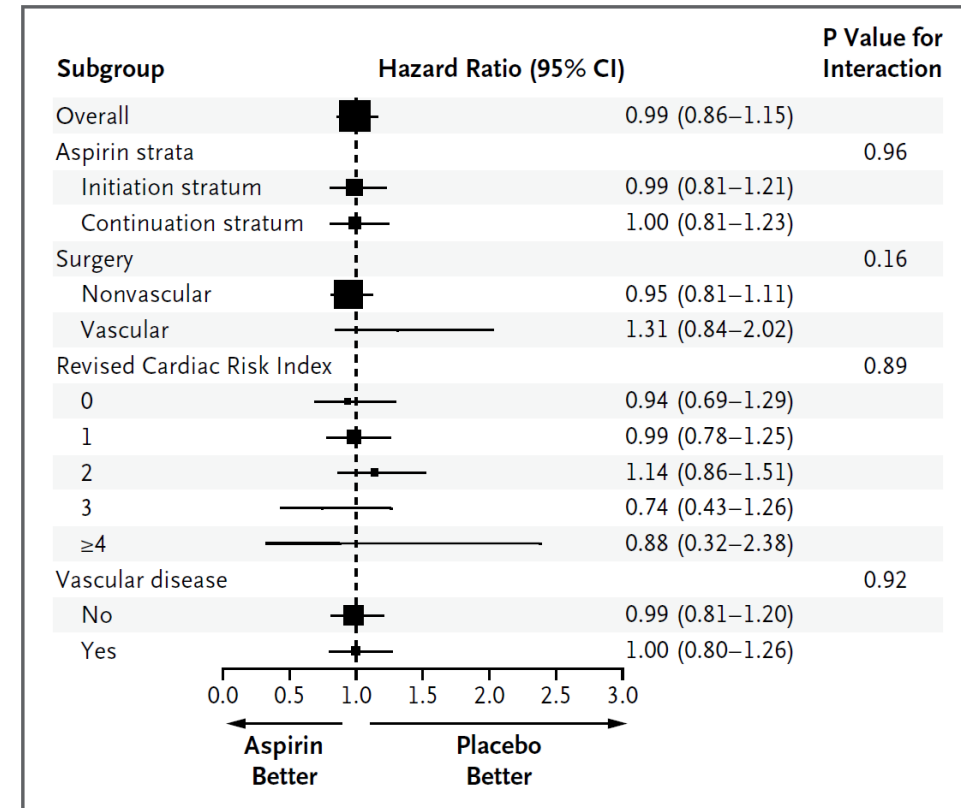


Figure 2. Subgroup Analyses of the Primary Outcome.

The primary composite outcome was death or nonfatal myocardial infarction at 30 days. The area of each square is proportional to the size of the corresponding subgroup. The Revised Cardiac Risk Index ranges from 0 to 6, with higher scores indicating greater risk.



Perioperative Aspirin

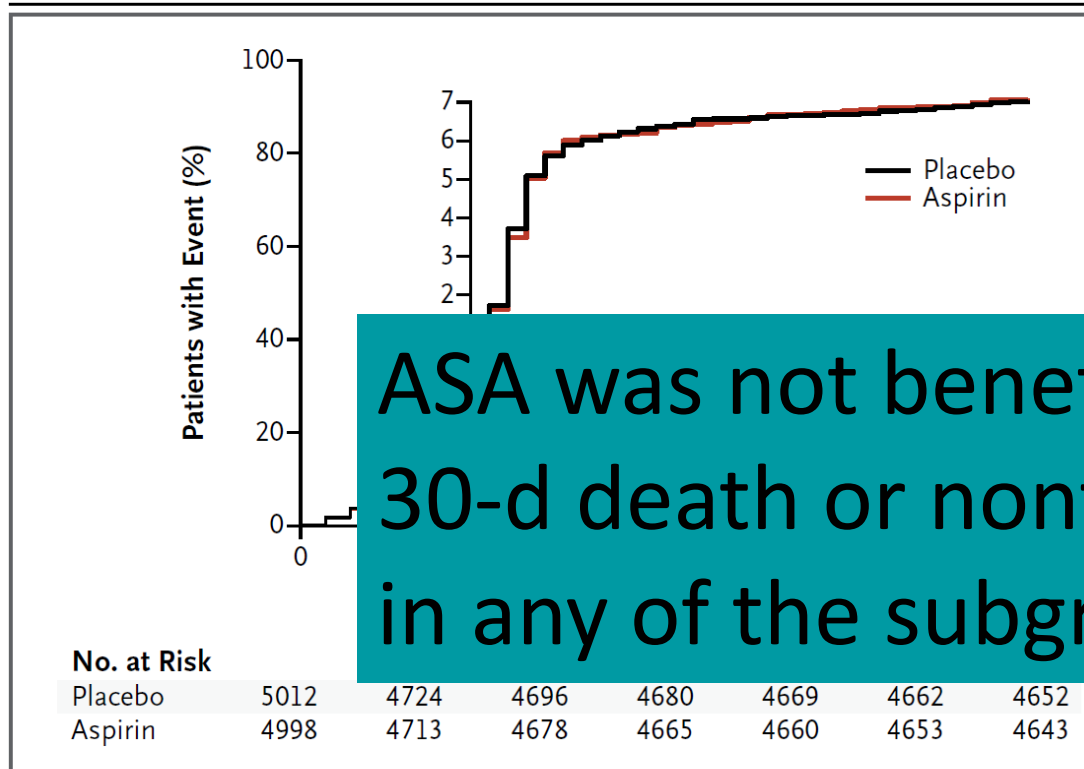


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The inset shows the same data on an enlarged y axis.

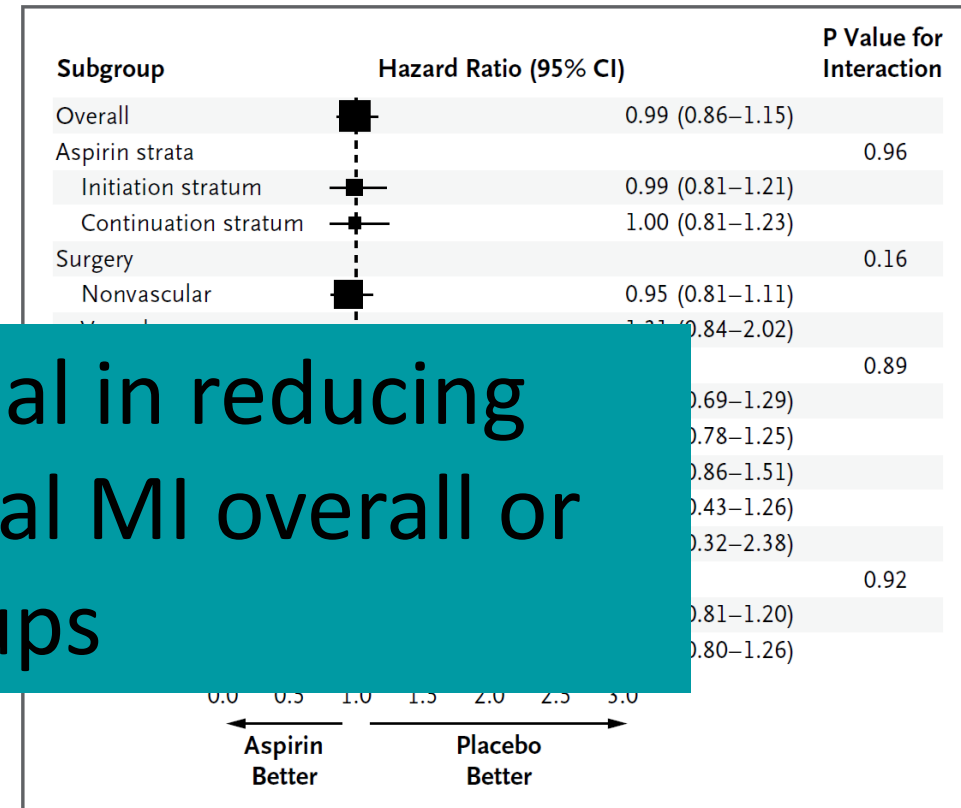


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Should We Hold ACEI/ARB Periop?

- Prospective cohort study of 14,687 patients (including 4,802 on ACEI or ARBs), ≥ 45 y.o., undergoing inpatient noncardiac surgery
- Primary endpoint was all-cause death, stroke, or myocardial injury after noncardiac surgery at 30 days postop
- 26% of patients had ACEI/ARB held in the 24 h prior to surgery



Should We Hold ACEI/ARB Periop?

- Patient characteristics were similar in those in whom ACEI/ARB were held and those in whom they were continued
- The primary endpoint was lower in the held group (12.0%) compared to the continuation group (12.9%)
- But unable to analyze by subgroup (e.g., CHF)

Medication withheld	Outcome	Events in withheld vs. continued	aRR (95% CI), p-value	
ACEI/ARBs	Death, MINS, or stroke	150/1245 (12.0%) vs. 459/3557 (12.9%)	0.82 (0.70–0.96), 0.01	
	Death	25/1245 (2.0%) vs. 74/3557 (2.1%)	0.69 (0.39–1.24), 0.21	
	MINS	132/1245 (10.6%) vs. 399/3541 (11.3%)	0.84 (0.70–0.998), 0.048	
	Stroke	8/1245 (0.6%) vs. 26/3557 (0.7%)	0.81 (0.30–2.2), 0.68	
	Intraop. hypotension	290/1245 (23.3%) vs. 1017/3557 (28.6%)	0.80 (0.73–0.88), <0.001	
	Postop. hypotension	242/1245 (19.4%) vs. 719/3557 (20.2%)	0.92 (0.77–1.10), 0.36	
	MI (Exploratory)	57/1245 (4.6%) vs. 148/3557 (4.2%)	0.91 (0.66–1.27), 0.59	
	Death, MI, or stroke (Exploratory)	78/1245 (6.3%) vs. 221/3557 (6.2%)	0.81 (0.62–1.03), 0.08	



Periop Management of Diabetes Medications

Figure. Suggested Administration of Insulin and Other Diabetes Medications on the Morning of Surgery

Patient due for elective surgery	Medication plan for morning of surgery		
	Hold	50% Dose	Continue normal therapy
No known type 1 diabetes and no similar clinical features			
▶ Noninsulin therapies only	●		
Combination of insulin and noninsulin therapies			
▶ Long- and intermediate-acting insulin		●	
▶ Short- or rapid-acting insulin and noninsulin therapies	●		
Known type 1 diabetes or similar clinical features present ^a	Continue basal insulin therapy		
Combination of short- or rapid-acting and intermediate-acting insulin			
▶ Short- or rapid-acting insulin	●		
▶ Intermediate-acting insulin		●	
Combination of short- or rapid-acting and long-acting insulin			
▶ Short- or rapid-acting insulin	●		
▶ Long-acting insulin (appropriate dose)			●
▶ Long-acting insulin (inappropriately high dose)			
Indications for inappropriately high long-acting insulin dose: Frequent hypoglycemia, especially at night or early morning Steep overnight decline in blood glucose (>40 mg/dL) Patient requires bedtime snack to avoid hypoglycemia Long-acting insulin dose is >60% of total daily insulin dose		●	
Insulin pump therapy			
▶ Continued perioperative insulin pump use is not indicated	●	Discontinue insulin pump and start intravenous insulin infusion therapy	
▶ Continued perioperative insulin pump use is indicated			
Indications for continued perioperative use: Patient has good glucose control and is adept at pump usage Short surgery duration (<2 h) and quick recovery expected No hemodynamic compromise Pump infusion site is not close to surgical field			● Reduce to 25% if basal rate is inappropriately high

Source: Simha V, Shah P. Perioperative Glucose Control in Patients With Diabetes Undergoing Elective Surgery. *JAMA*. Jan 7 2019.



Bridging Anticoagulation

- The BRIDGE trial randomized 1884 patients with Afib on coumadin who were scheduled for an elective procedure to either bridging with LMWH (dalteparin) or placebo.
- Patients had to have at least 1 of the CHADS₂ risk factors.
- The mean CHADS₂ score was 2.3



Bridging Anticoagulation

Table 3. Study Outcomes.

Outcome	No Bridging (N = 918) <i>number of patients (percent)</i>	Bridging (N = 895) <i>number of patients (percent)</i>	P Value
Primary			
Arterial thromboembolism	4 (0.4)	3 (0.3)	0.01*, 0.73†
Stroke	2 (0.2)	3 (0.3)	
Transient ischemic attack	2 (0.2)	0	
Systemic embolism	0	0	
Major bleeding	12 (1.3)	29 (3.2)	0.005†
Secondary			
Death	5 (0.5)	4 (0.4)	0.88†
Myocardial infarction	7 (0.8)	14 (1.6)	0.10†
Deep-vein thrombosis	0	1 (0.1)	0.25†
Pulmonary embolism	0	1 (0.1)	0.25†
Minor bleeding	110 (12.0)	187 (20.9)	<0.001†

* P value for noninferiority.

† P value for superiority.



Bridging Anticoagulation with DOACs

Figure. Perioperative Direct Oral Anticoagulant (DOAC) Management Protocol

DOAC	Surgical Procedure-Associated Bleeding Risk	Preoperative DOAC Interruption Schedule					Day of Surgical Procedure (No DOAC)	Postoperative DOAC Resumption Schedule			
		Day -5	Day -4	Day -3	Day -2	Day -1		Day +1	Day +2	Day +3	Day +4
Apixaban	High	→							→		
	Low	→						→			
Dabigatran etexilate (CrCl ≥50 mL/min)	High	→							→		
	Low	→						→			
Dabigatran etexilate (CrCl <50 mL/min) ^a	High	→							→		
	Low	→						→			
Rivaroxaban	High	→							→		
	Low	→						→			

No DOAC was taken on certain days (shaded) and on the day of the elective surgery or procedure. The light blue arrows refer to an exception to the basic management, a subgroup of patients taking dabigatran with a creatinine clearance (CrCl) less than 50 ng/mL. The orange arrows refer to patients having a high-bleed-risk surgical procedure. Dark blue arrows refer to patients having a

low-bleed-risk surgical procedure. The thickened orange part of arrows refer to flexibility in the timing of DOAC resumption after a procedure.

^a Cancer diagnosed within 3 months or has been treated within 6 months or metastatic.



Perioperative Pulmonary Complications

Table 1. The Seven ARISCAT Risk Predictors, β Regression Coefficients, and Points Assigned*

	β Regression Coefficients	Score
Age (yr)		
≤50	0	0
51–80	0.331	3
>80	1.619	16
Preoperative SpO ₂		
≥96%	0	0
91–95%	0.802	8
≤90%	2.375	24
Respiratory infection in the last month		
No	0	0
Yes	1.698	17
Preoperative anemia (Hb ≤10g/dl)		
No	0	0
Yes	1.105	11
Surgical incision		
Peripheral	0	0
Upper abdominal	1.480	15
Intrathoracic	2.431	24
Duration of surgery (h)		
<2	0	0
2–3	1.593	16
>3	2.268	23
Emergency procedure		
No	0	0
Yes	0.768	8

*Three levels of risk were indicated by the following cutoffs: <26 points, low risk; 26–44 points, moderate risk; and ≥45 points, high risk.

ARISCAT = Assess Respiratory Risk in Surgical Patients in Catalonia; Hb = hemoglobin; SpO₂ = arterial oxyhemoglobin saturation by pulse oximetry.

- Tested on 5,859 patients in 63 centers
- Respiratory complications were defined as:
 - Respiratory infection or failure
 - Bronchospasm
 - Atelectasis
 - Pleural effusion
 - Pneumothorax
 - Aspiration pneumonitis
- Score:
 - < 26 denotes a 3.4% risk
 - 26-45 denotes a 13.0% risk
 - >45 denotes a 38.0% risk



Perioperative Pulmonary Risk Reduction Strategies: Lung Expansion

- In patients at elevated risk, such as those undergoing abdominal surgery, a lung expansion maneuver is appropriate, and is more effective than no intervention
- Options include incentive spirometry, lung expansion exercises, and continuous positive airway pressure
- There is no compelling evidence favoring one lung expansion intervention over another
- CPAP may be appropriate in patients who are unable to undergo either incentive spirometry or lung expansion exercises. CPAP is advisable in OSA patients.



Perioperative Pulmonary Risk Reduction Strategies

- Smoking cessation
 - May help reduce the incidence of postop pulmonary complications
 - However, smoking cessation immediately (< 8 weeks) prior to surgery may increase the risk of postop pulmonary complications
- Anesthesia techniques need to be considered
 - Use of regional anesthesia, compared to general anesthesia, reduces the incidence of postop pulmonary complications



General versus Regional Anesthesia Complications

Propensity Matched General Surgical Population (NSQIP) (n=328,540)

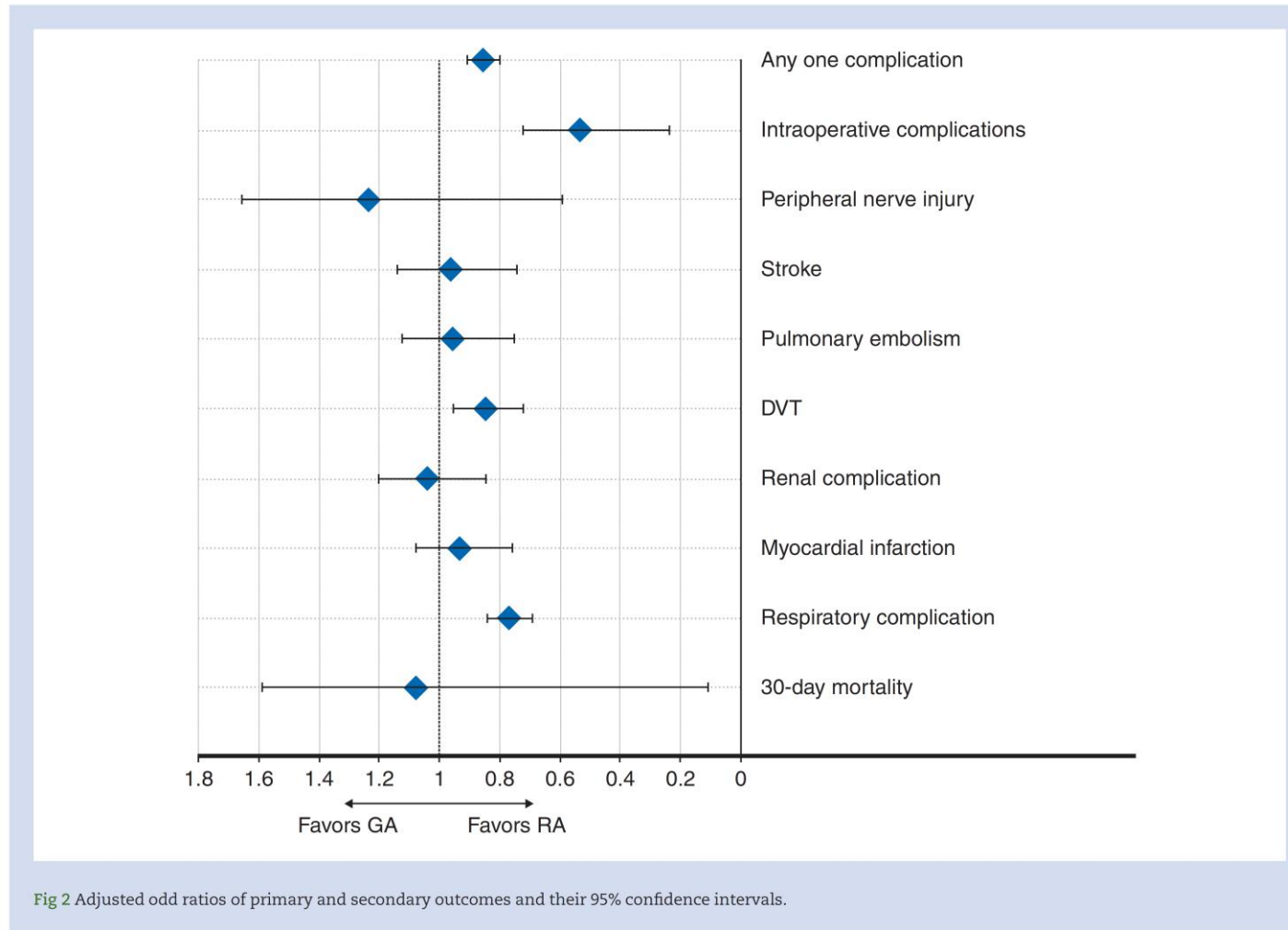
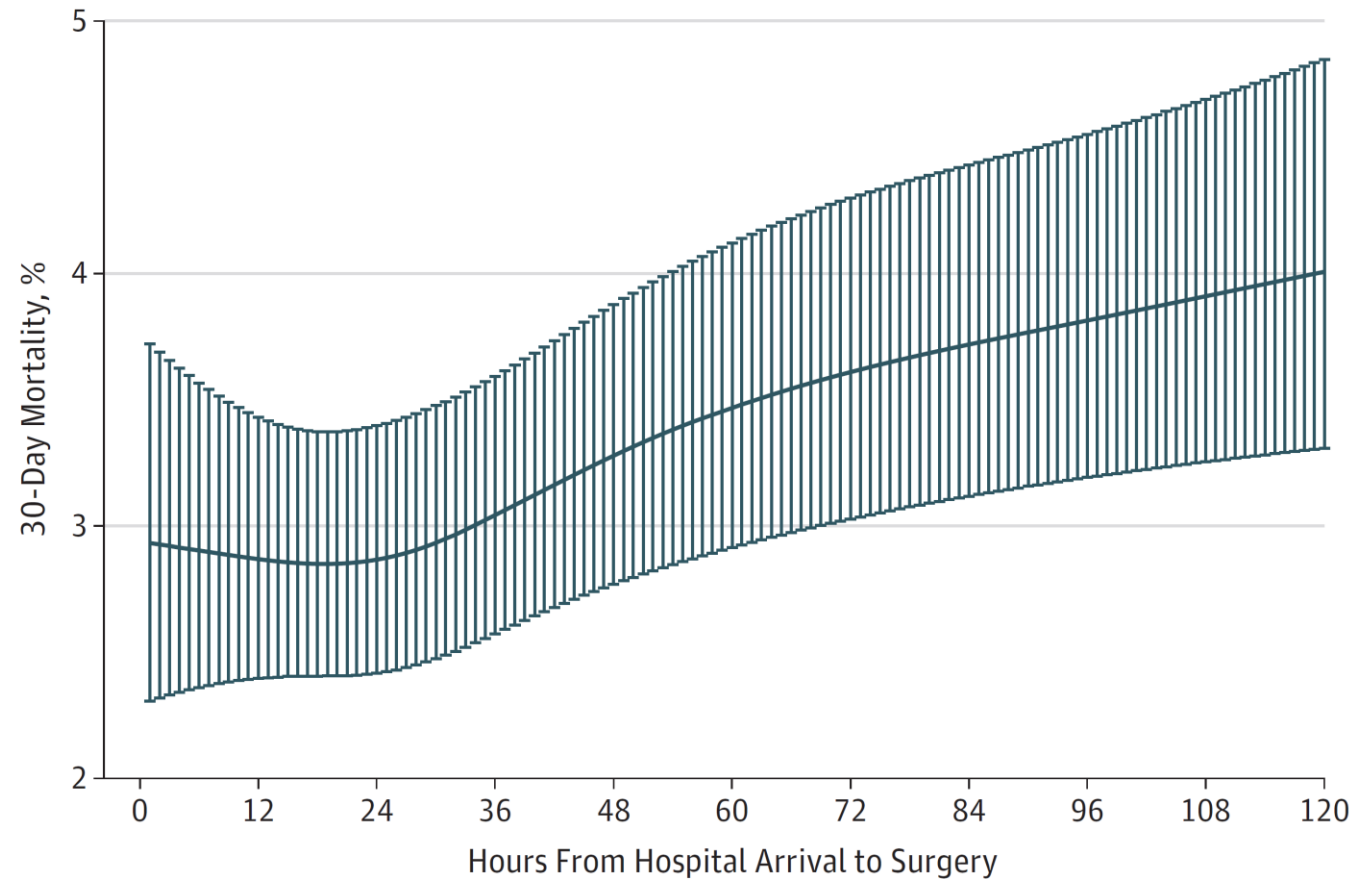


Fig 2 Adjusted odd ratios of primary and secondary outcomes and their 95% confidence intervals.



The Timing of Surgery for Hip Fracture Patients

- Retrospective cohort analysis of 42,230 hip fracture patients in Ontario
- Mean age around 80, around 70% female
- Primary outcome was 30-d mortality



Periop Issues for OSA Patients

- Both respiratory and cardiovascular periop complications are more common in patients with untreated OSA than comparable patients without OSA
- Prescribing CPAP for patients with OSA perioperatively reduced the risk of cardiovascular but not pulmonary complications
- Neglecting to prescribe CPAP in patients on CPAP when postop in the hospital is an “unforced error”



Periop Issues for Obese Patients

- There are an increasing number of case reports of obese patients having postop rhabdomyolysis
- It is likely that the immobilization and weight on the gluteal muscle results in necrosis
- If an obese patient has postop AKI, consider rhabdomyolysis and check a CK
- Obese patients has restrictive lung physiology, and so consider CPAP in hypoxic obese patients postop



Frailty

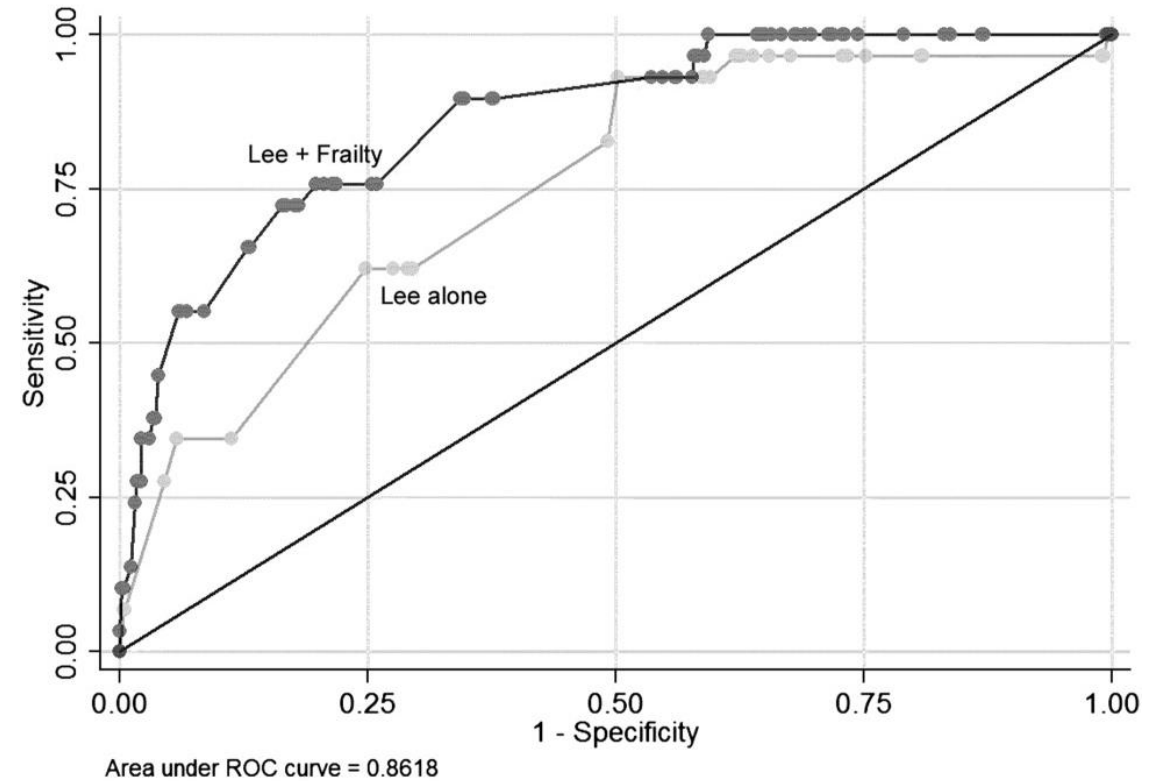
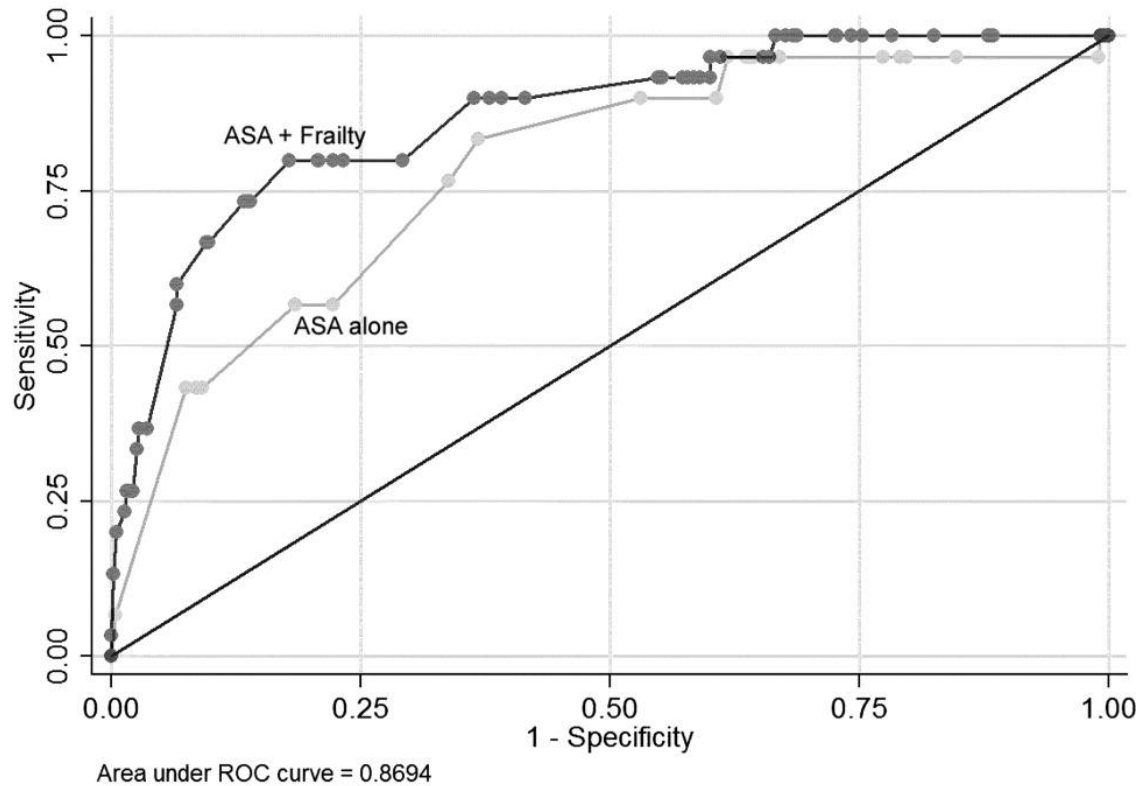
Fried Frailty Index:

1. **Shrinking:** Unintentional weight loss ≥ 10 lbs
2. **Physical endurance/energy:** During the last 4 weeks how often you rested in bed during day?
3. **Low physical activity:** Low frequency of mildly energetic, moderately energetic and very energetic physical activity
4. **Weakness:** Based on poor handgrip strength
5. **Slow walking speed:** Taking $\geq 6-7$ sec to walk over 15 feet (depending on sex and height)



Frailty Can Help Predict Outcomes

Outcome being predicted: surgical complications and discharge to an assisted or skilled nursing facility



Enhanced Preop Evaluation of Frail Patients May Impact Mortality

Figure. Interrupted Time Series Analysis

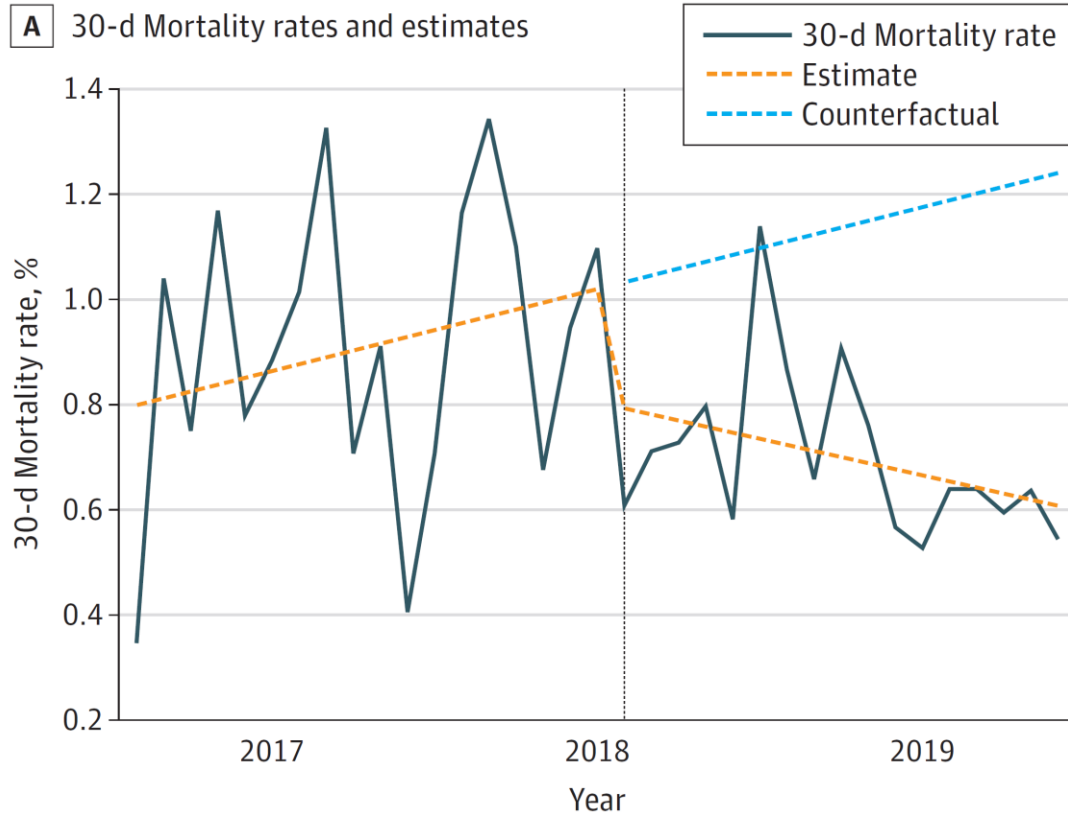
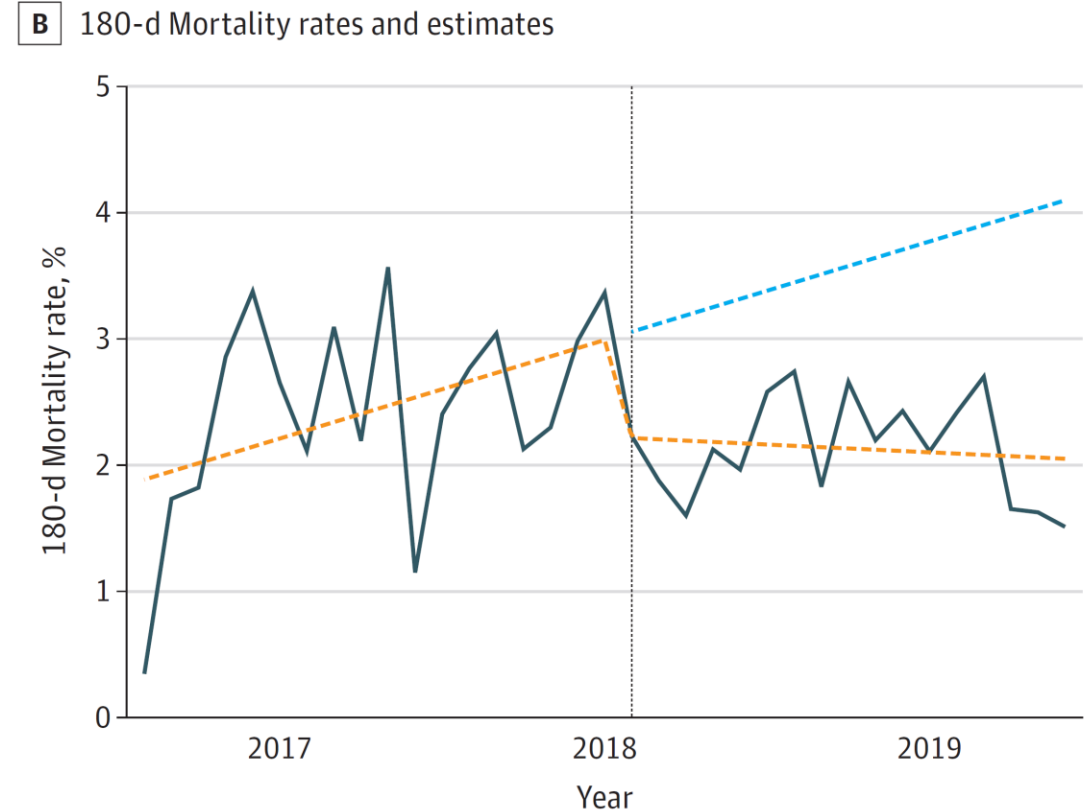


Figure. Interrupted Time Series Analysis



Key Points

- Use one of the on-line risk assessment tools to determine the MACE risk of your patients
- Consider the role for the various perioperative risk reduction interventions
 - Interventional: revascularization
 - Medical: beta blockers, statins
- Have a plan for perioperative management of different medications, such as ACEI/ARBs and ASA
- Recognize that perioperative risk is more than just cardiovascular risk
- Communicate with the surgeon and anesthesiologist



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