Brigham and Women's Hospital
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Best Practices for Pre-Operative Evaluation

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- Clinical focus: Perioperative Medicine and Hospital Medicine
- Research Focus: Patient Safety

Conflicts of Interest

- I have no conflicts of interest to declare

Learning Objectives

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

- Summarize the recently revised perioperative guidelines
- Apply 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

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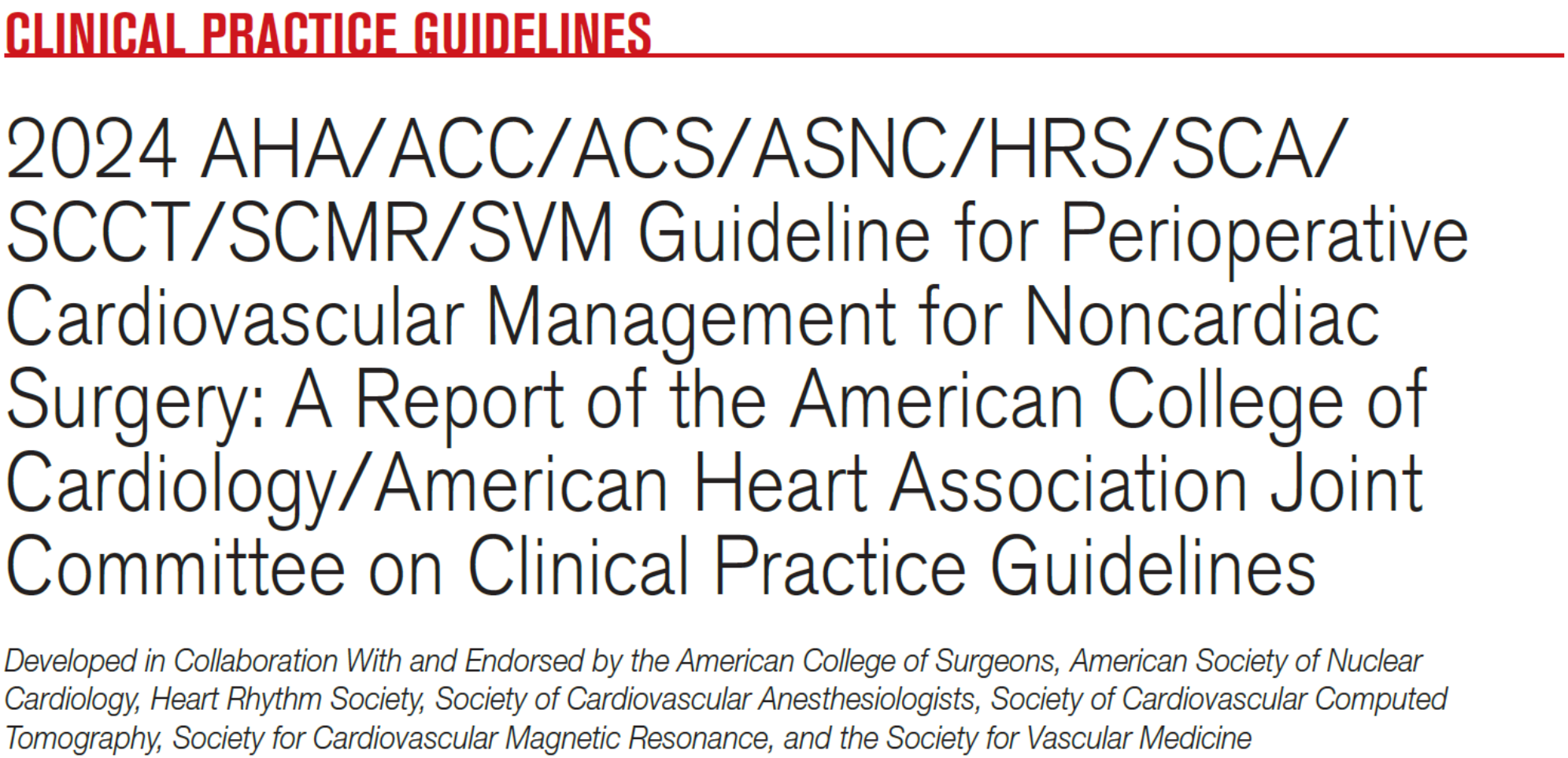
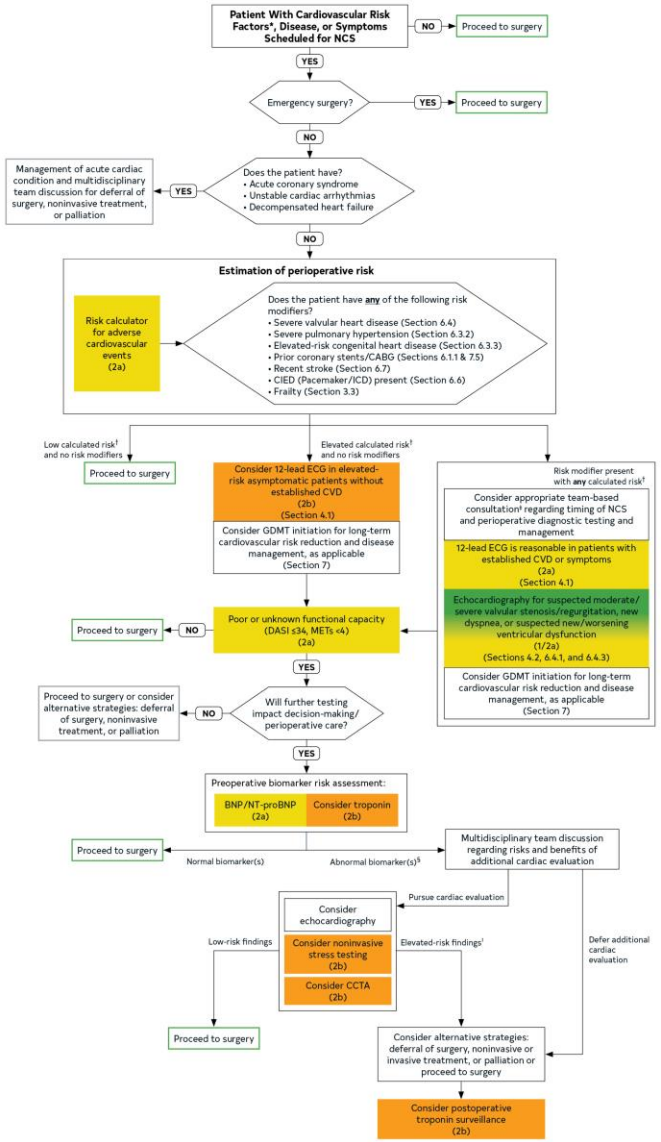
Perioperative AHA/ACC Guidelines

New Periop Guidelines were Published in November 2024

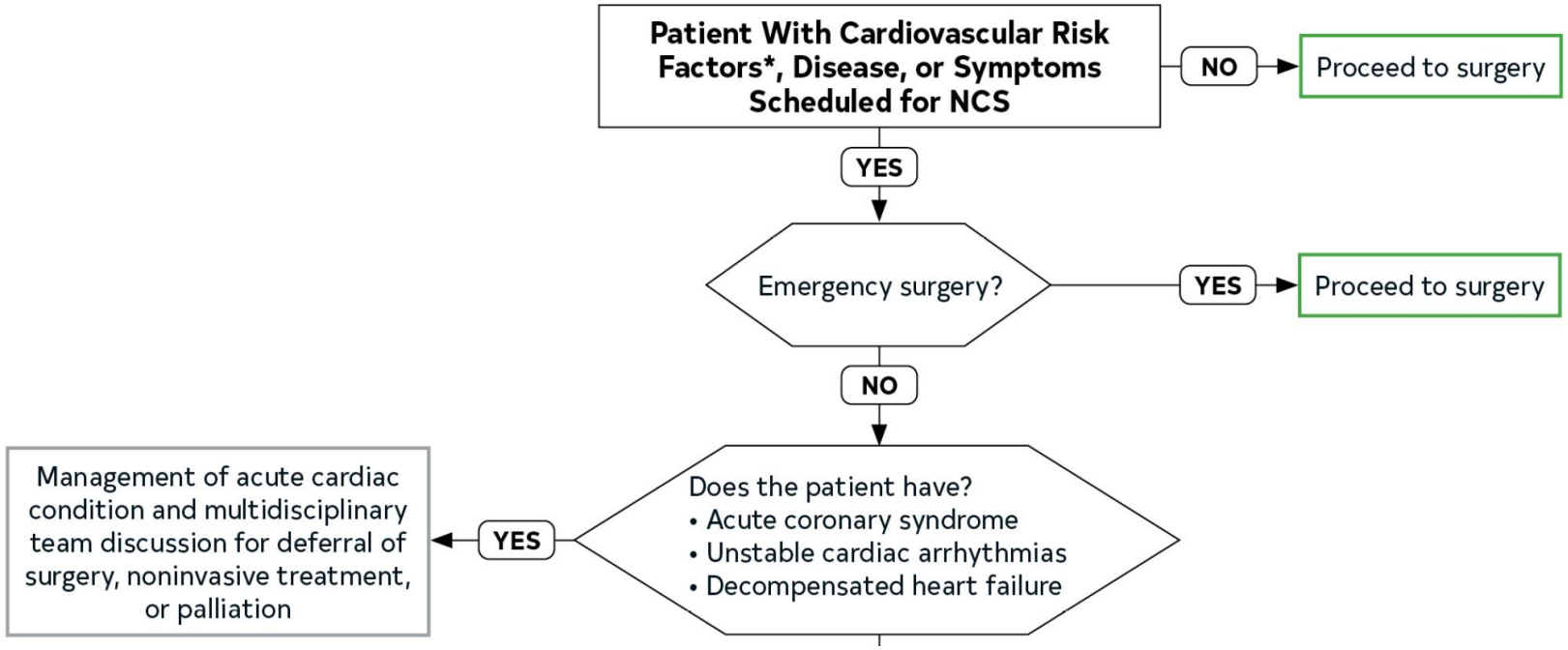


ACC/AHA 2024 Periop Guidelines



Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

ACC/AHA 2024 Periop Guidelines



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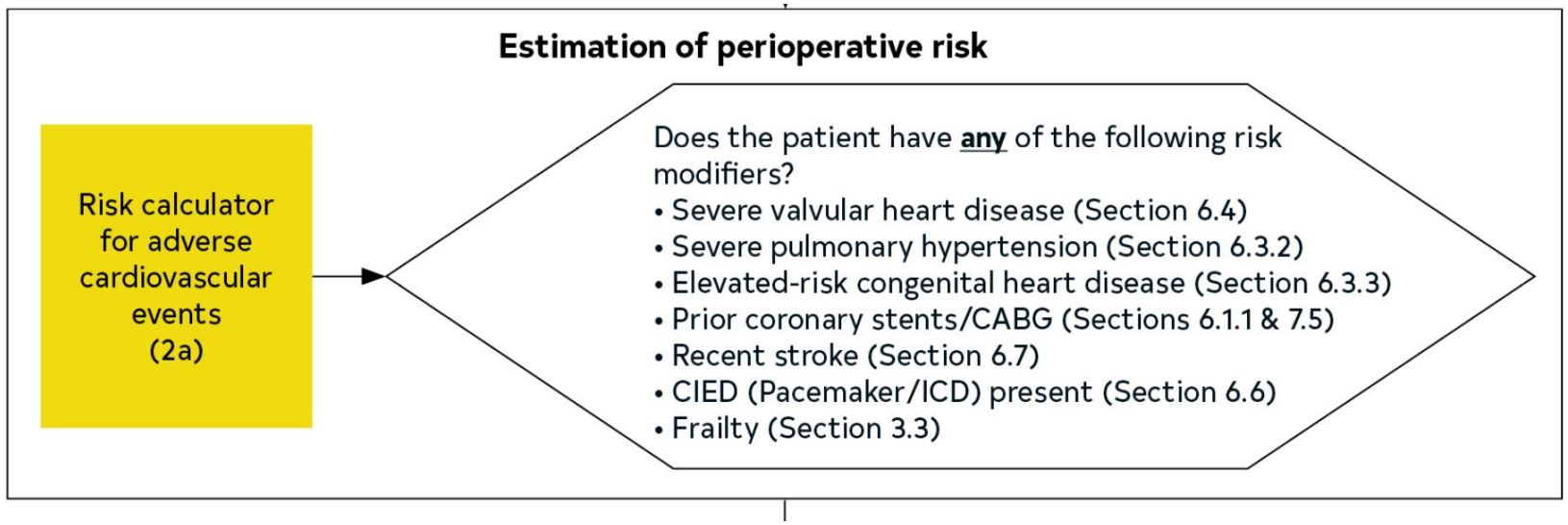


"MACE [major adverse cardiac event] with any perioperative risk calculator >1% is used as a threshold to identify patients at elevated risk."

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Risk Assessment in the 2024 Periop Guidelines

- For risk assessment, the 2024 guidelines recommend estimating the preoperative risk of a major adverse cardiac event (MACE)
- 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

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Risk Assessment in the 2024 Periop Guidelines

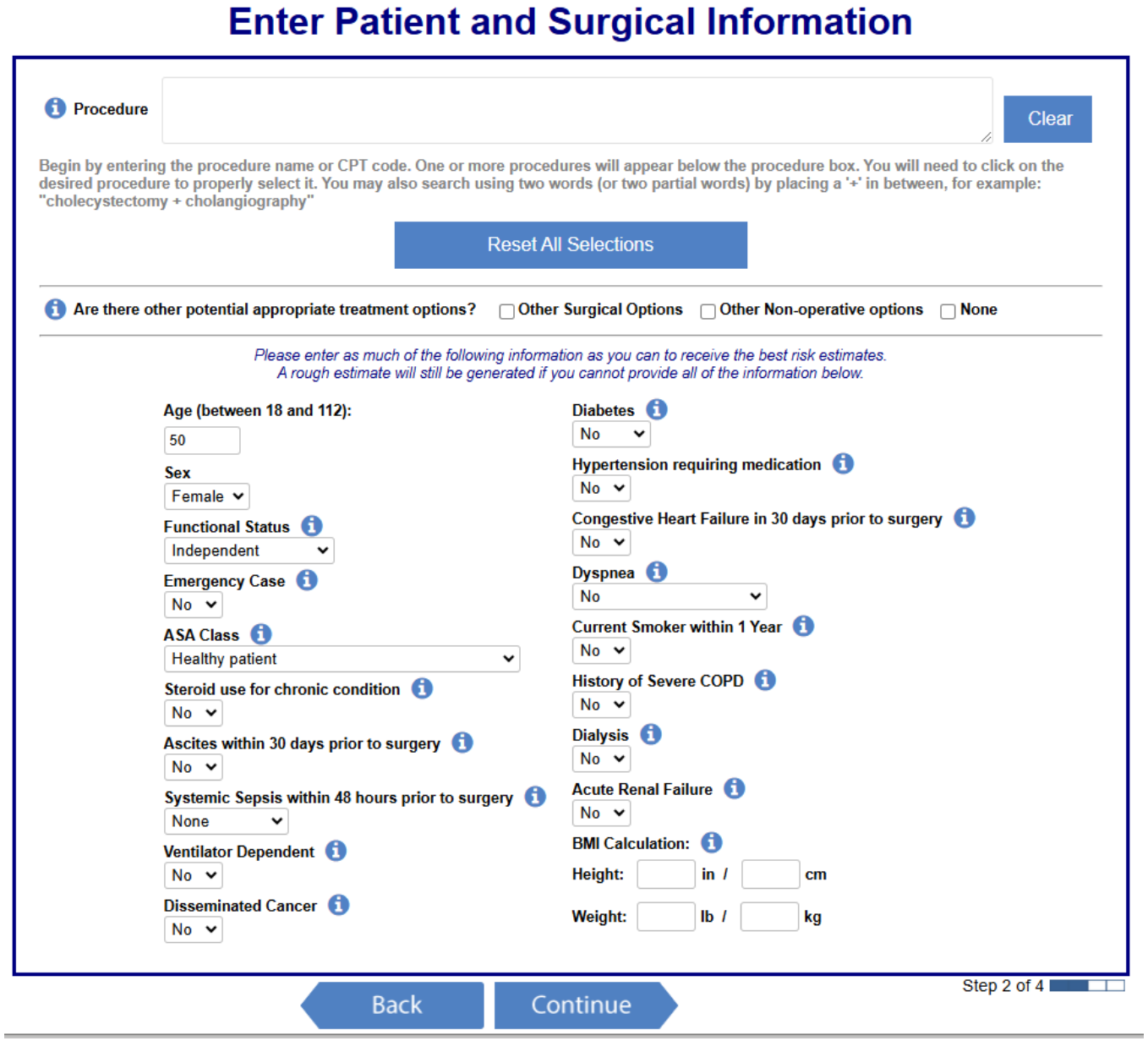
The guidelines suggest three ways to determine if the MACE risk is ≥ 1%:

1. ACS NSQIP Surgical Risk Calculator (https://riskcalculator.facs.org/RiskCalculator/)
2. Perioperative Cardiac Risk Calculator (https://www.mdcalc.com/calc/4038/gupta-perioperative-risk-myocardial-infarction-cardiac-arrest-mica)
3. RCRI score (though one of the two options above is preferred because they outperform the RCRI score)

"Although many risk scores exist, data are lacking to support the use of one risk index over another, and research is underway to further refine perioperative risk."

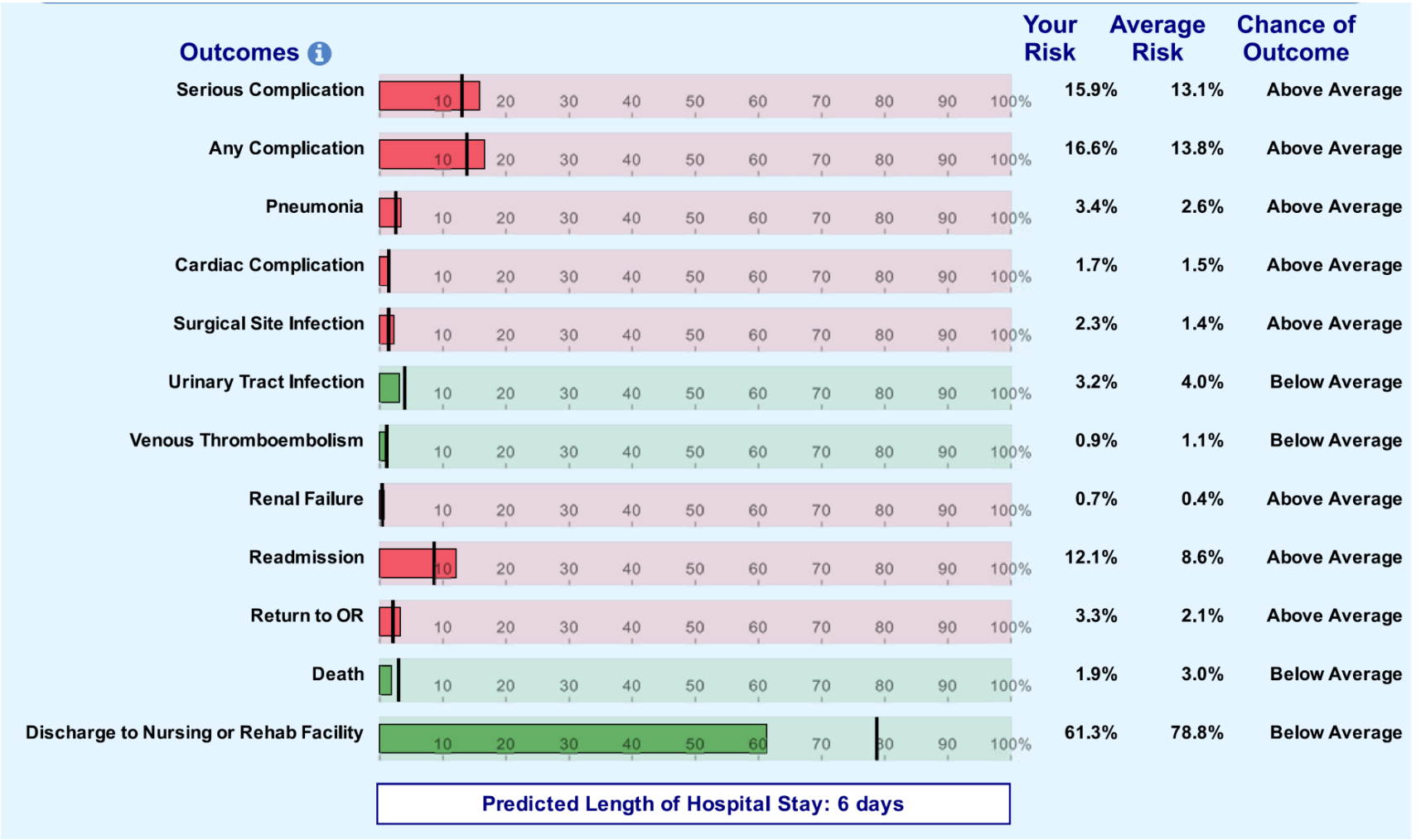
Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

ACS NSQIP Surgical Risk Calculator



Source: Cohen ME, Ko CY, Bilimoria KY, et al. Optimizing ACS NSQIP modeling for evaluation of surgical quality and risk: .... Journal of the American College of Surgeons. Aug 2013;217(2):336-346.e331.

ACS NSQIP Surgical Risk Calculator



Source: Cohen ME, Ko CY, Bilimoria KY, et al. Optimizing ACS NSQIP modeling for evaluation of surgical quality and risk: .... Journal of the American College of Surgeons. Aug 2013;217(2):336-346.e331.

Perioperative Cardiac Risk Calculator

Estimate risk of perioperative myocardial infarction or cardiac arrest.

Age	
Creatinine	<1.5 mg/dL / 133 µmol/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

Submit

Source: Gupta PK, Gupta H, et al. Development and validation of a risk calculator for prediction of cardiac risk after surgery. Circulation. Jul 26 2011;124(4):381-387.

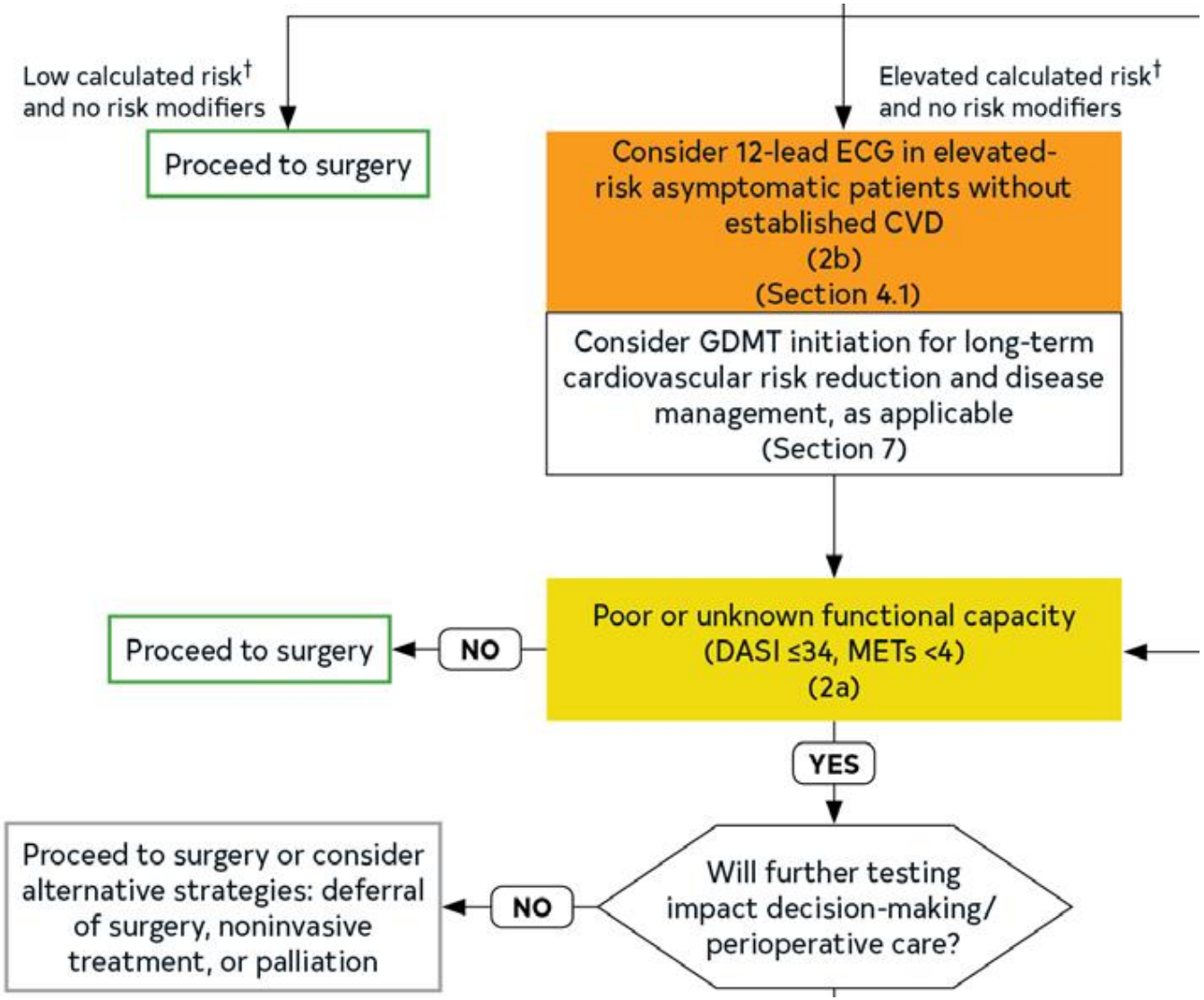
Revised Cardiac Risk Index

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	

"Traditionally **a RCRI >1** or a calculated risk of MACE with any perioperative risk calculator >1% is used as a threshold to identify patients at 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. 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442

ACC/AHA 2024 Periop Guidelines



Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

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)

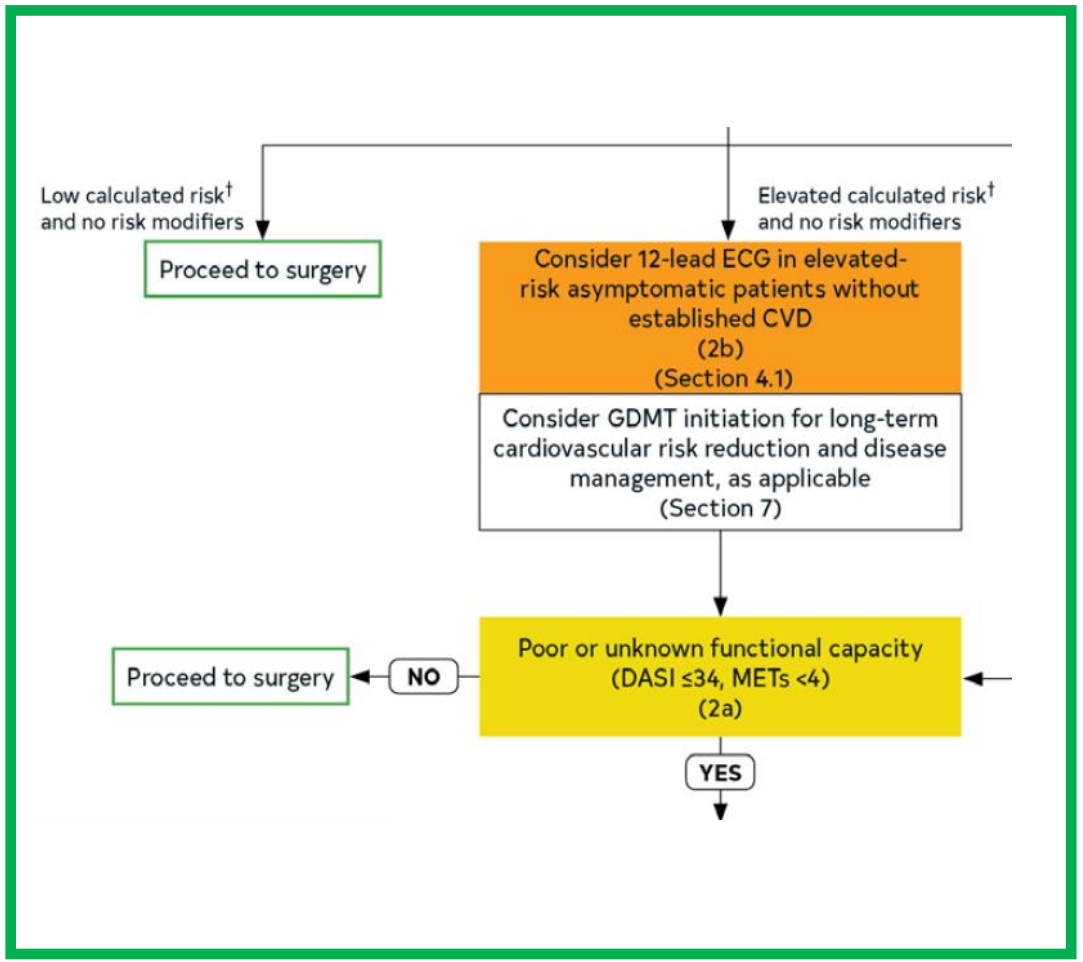
Source: Hlatky MA, et al. A brief self-administered questionnaire … (the Duke Activity Status Index). The American Journal of Cardiology. 1989;64(10):651-654.

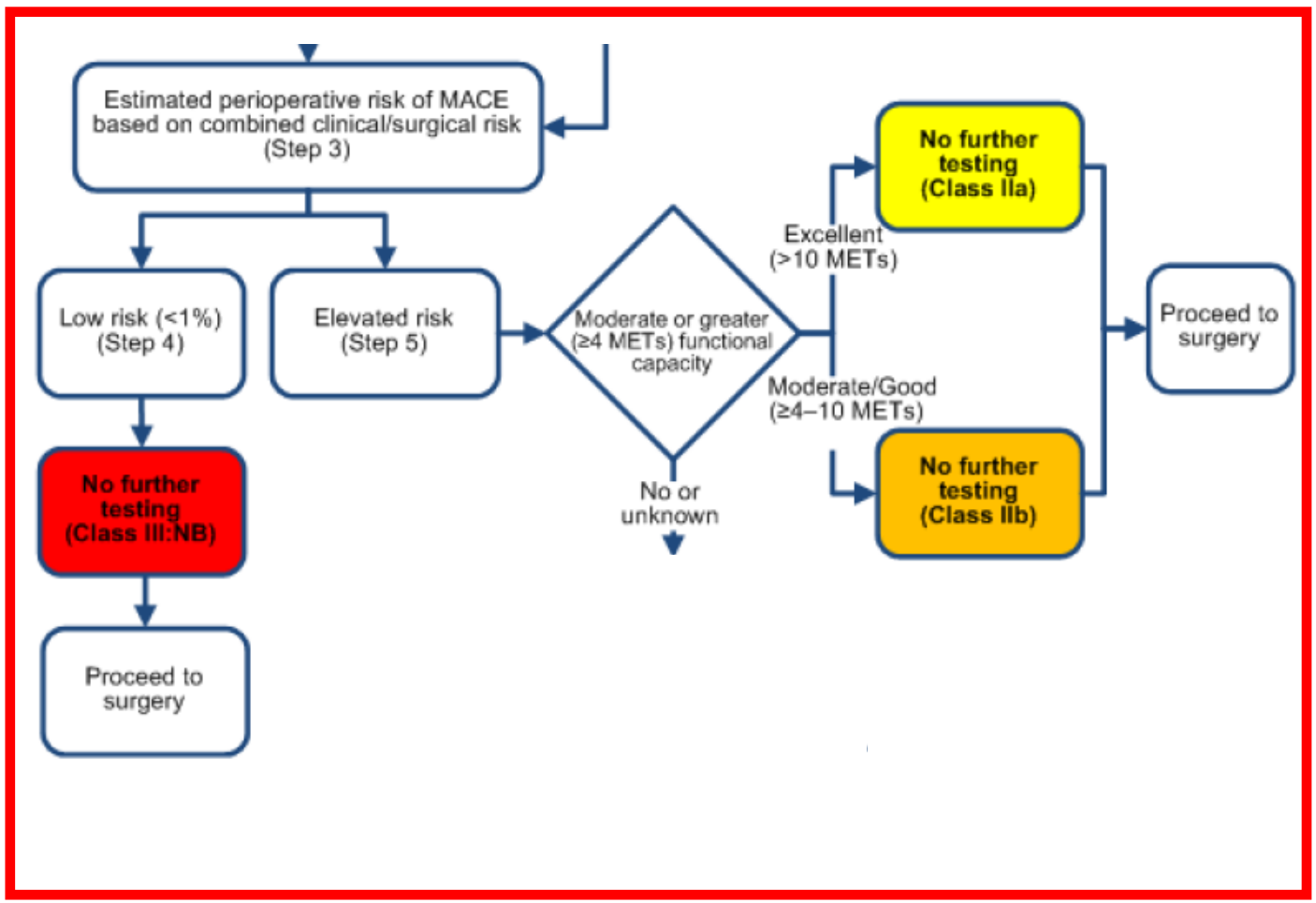
Duke Activity Status Index

- 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

Source: Wijeysundera, et al. Integration of the Duke Activity Status Index into preoperative risk evaluation …. Br J Anaesth. 2020;124(3):261-270.

ACC/AHA 2024 vs. 2014 Periop Guidelines: Fundamental Similarity





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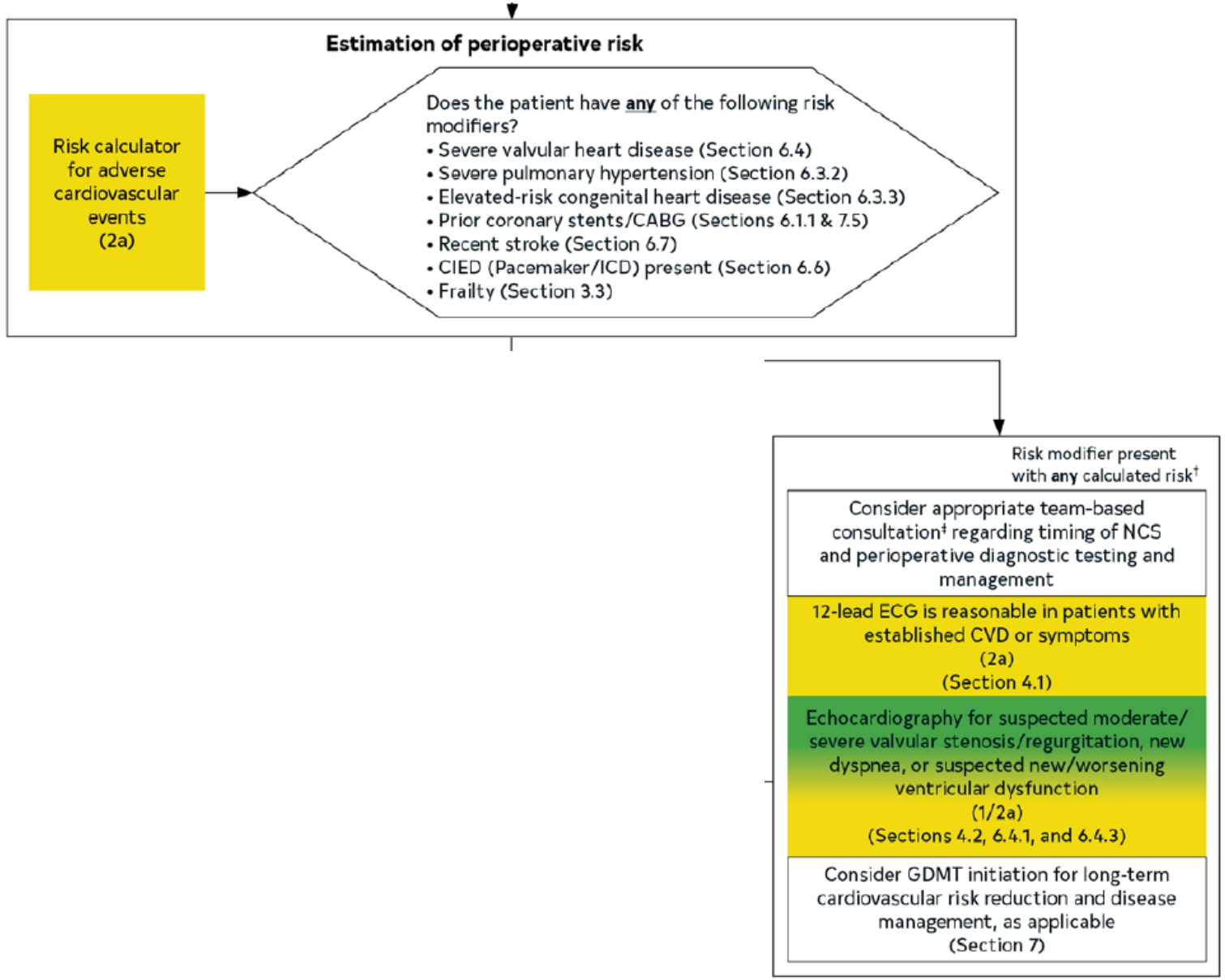
Source: 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management...Circulation. 2014 Dec 9;130(24):e278-333.

ACC/AHA 2024 Periop Guidelines



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ACC/AHA 2024 Periop Guidelines

Table 6. Frailty Assessment Tools

Name	Items	Scoring
Physical Frailty Phenotype (Fried phenotype)[15]	Slowness, low activity, weight loss, exhaustion, weakness (1 point each)	0=Nonfrail 1-2=Prefrail 3-5=Frail
Deficit Accumulation Index[16]	Variable; typically 30-70 items from multiple domains	Number of deficits/number of items scored; higher scores indicate greater frailty
Edmonton Frail Scale[17]	10 items across multiple domains	Sum of scores/17; higher scores indicate greater frailty
FRAIL Scale[18]	Fatigue, stair climb, ambulation, illnesses >5, weight loss ≥5% (1 point each)	0=Nonfrail 1-2=Intermediate 3-5=Frail
Clinical Frailty Scale[19]	9 categories ranging from very fit to terminally ill as assessed by clinicians	Categories 5-8 indicate mild, moderate, severe, and very severe frailty
SPPB[20]	Gait speed, chair stands, balance tests	Maximum 4 points per item, range, 0-12 points; ≥10=Nonfrail, 3-9=Frail, ≤2=Disabled

Adapted with permission from frailtyscience.org. Copyright 2021 FrailtyScience.org.
SPPB indicates Short Physical Performance Battery.

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Clinical Frailty Scale

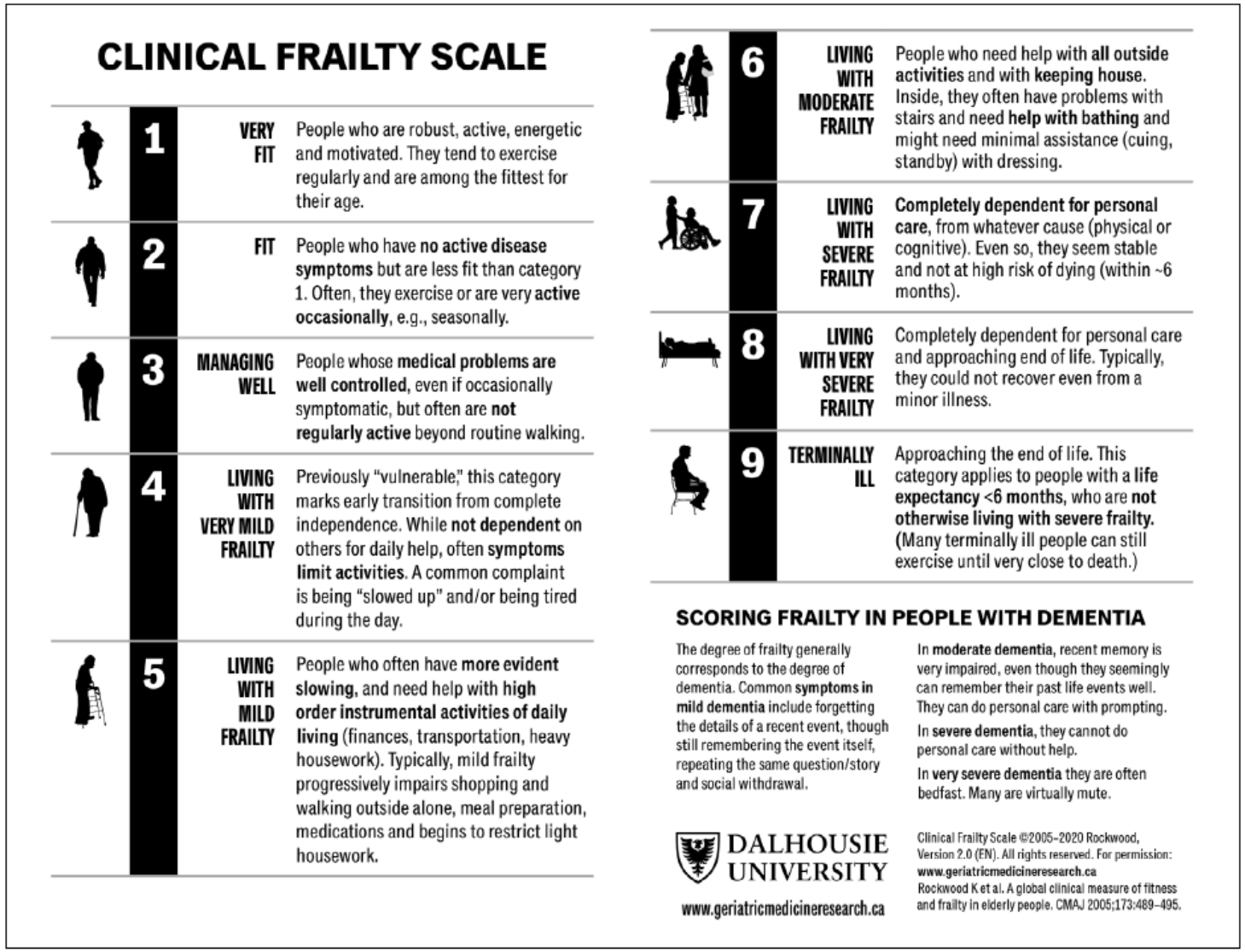
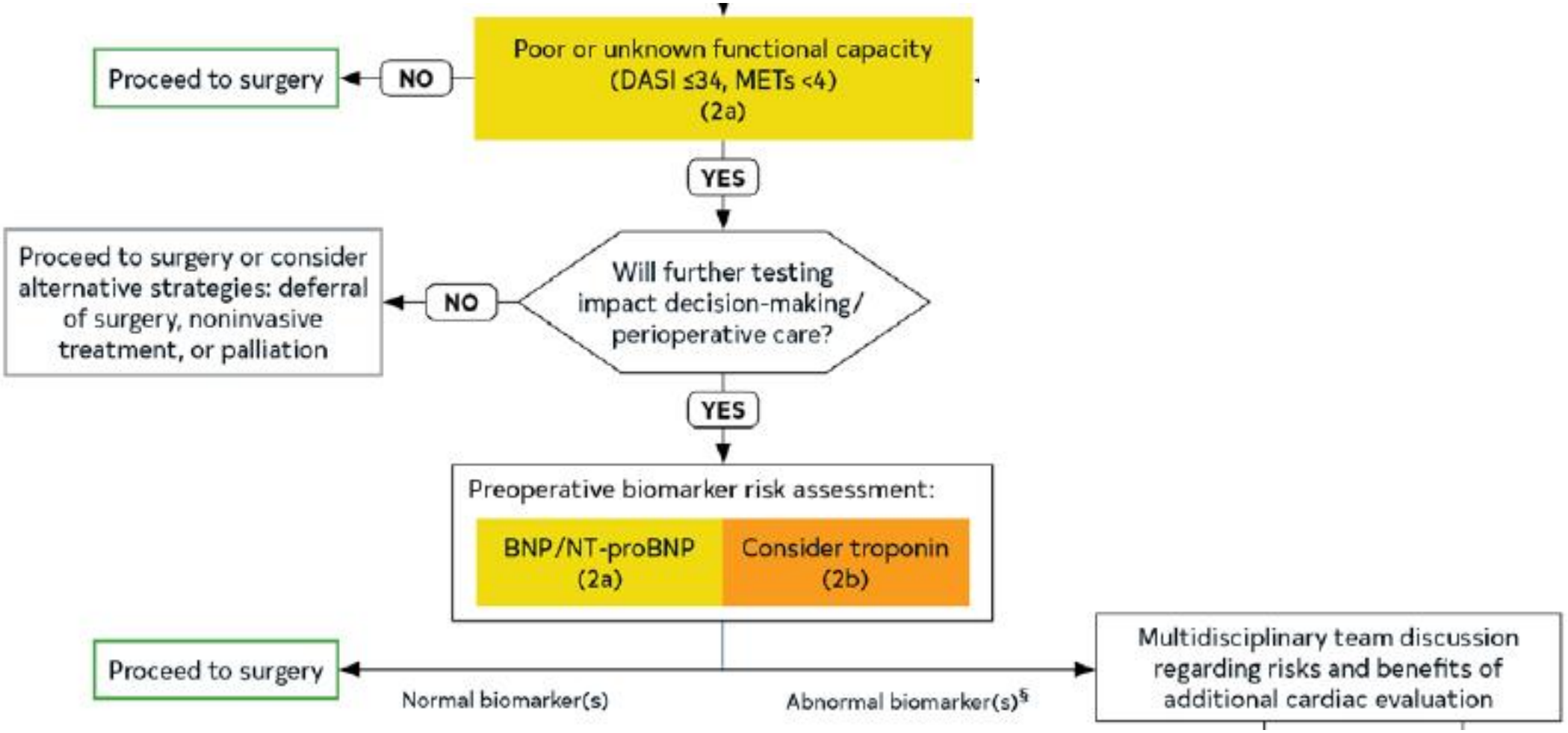


FIGURE 1. The Clinical Frailty Scale (CFS) version 2.0

Sources: Rockwood K et al. A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005 Aug 30;173(5):489-95 and Rockwood K, Theou O. Using the clinical frailty scale in allocating scarce health care resources. Can Geriatr J. 2020 Sep 1;23(3):210-215.

ACC/AHA 2024 Periop Guidelines



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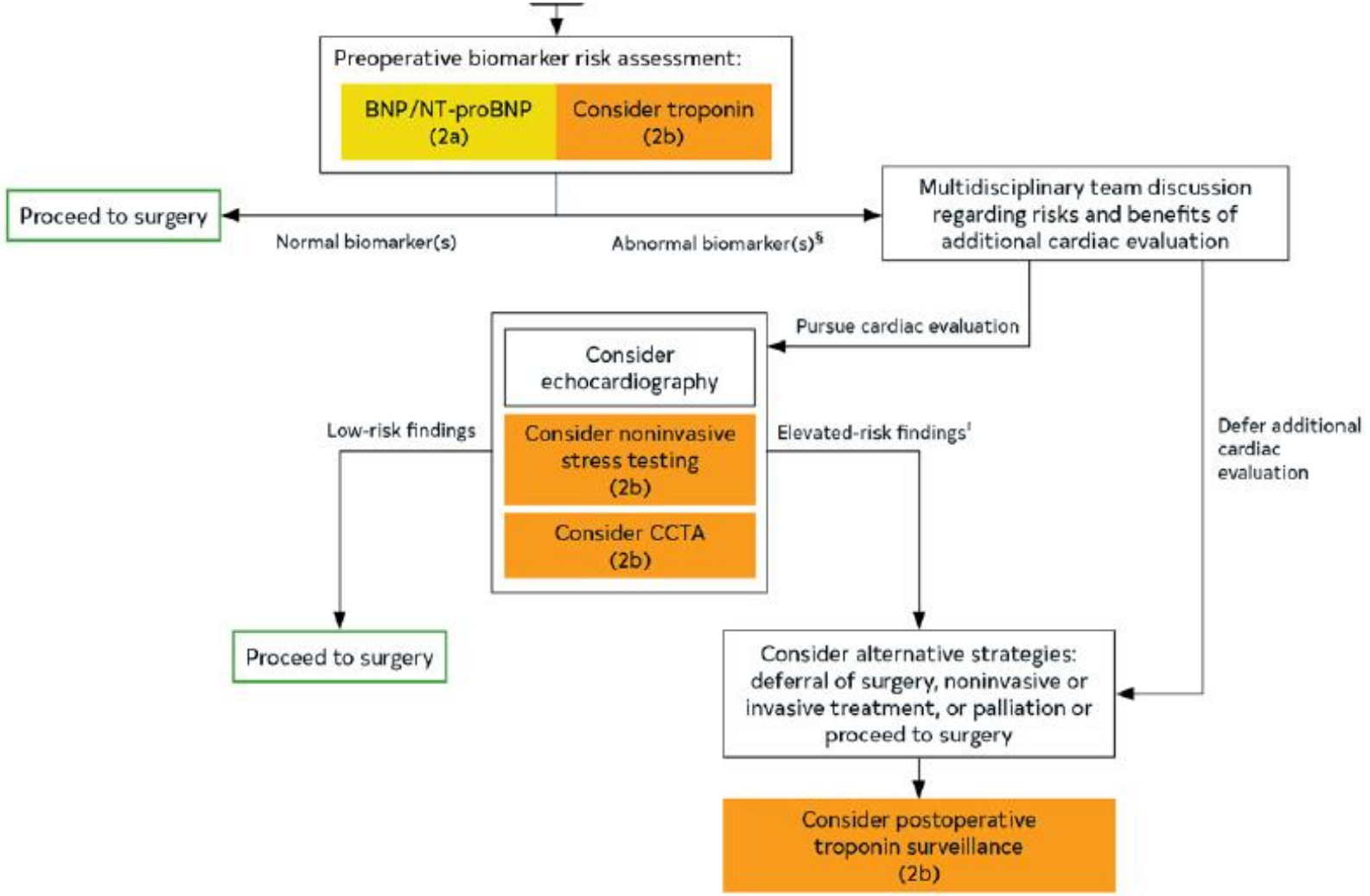

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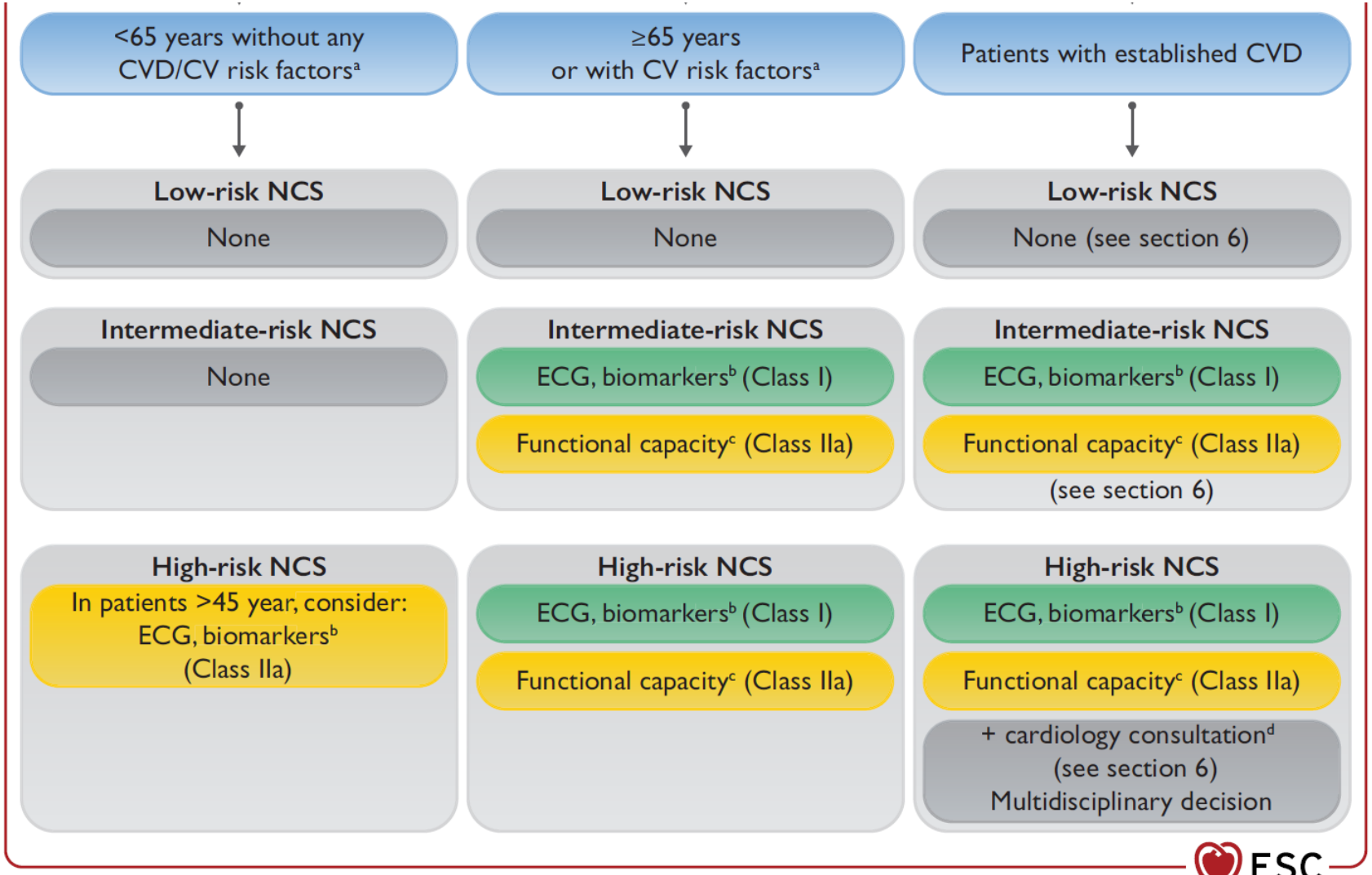
Perioperative Troponin Measurements: Guideline Recommendations

- 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”

Sources: Smilowitz NR, Berger JS. Perioperative Cardiovascular Risk Assessment and Management for Noncardiac Surgery: A Review. JAMA. 2020 Jul 21;324(3):279-290. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management...Circulation. 2014 Dec 9;130(24):e278-333. De Hert S, et al. Pre-operative evaluation of adults undergoing elective noncardiac surgery: Updated guideline from the ESA. Eur J Anaesthesiol. 2018 Jun;35(6):407-465.

Perioperative Troponin Measurements: 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.

Preoperative Troponin Measurements: ACC/AHA 2024 Periop Guidelines

3.4. Preoperative Biomarkers for Risk Stratification

Recommendations for Preoperative Biomarkers for Risk Stratification Referenced studies that support the recommendations are summarized in the Online Data Supplement.

COR	LOE	Recommendations
2a	B-NR	1. In patients with known CVD, or age ≥65 years, or age ≥45 years with symptoms suggestive of CVD undergoing elevated-risk NCS, it is reasonable to measure B-type natriuretic peptide (BNP) or N-terminal pro–B-type natriuretic peptide (NT-proBNP) before surgery to supplement evaluation of perioperative risk.[1–3]
2b	B-NR	2. In patients with known CVD, or age ≥65 years, or age ≥45 years with symptoms suggestive of CVD undergoing elevated-risk NCS, it may be reasonable to measure cardiac troponin (cTn) before surgery to supplement evaluation of peri-operative risk.[4–6]

- On BNP: "Optimal threshold values of BNP or NT-proBNP for perioperative risk prediction are not clearly established."
- On troponins: "**There is no action predicated on this knowledge alone**, although preoperative baseline troponin concentrations also inform the interpretation of postoperative troponin measurements and can help confirm a diagnosis of acute myocardial injury in the postoperative setting."
- "Abnormal biomarker thresholds: troponin >99th percentile peer reference limit for the assay; BNP >92 ng/L, NT-proBNP ≥300 ng/L"

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Postoperative Troponin Measurements: ACC/AHA 2024 Periop Guidelines

9.1. Myocardial Injury After Noncardiac Surgery Surveillance and Management

Recommendations for Myocardial Injury After Noncardiac Surgery Surveillance and Management
Referenced studies that support the recommendations are summarized in the Online Data Supplement.

COR	LOE	Recommendations
MINS Surveillance		
2b	**B-NR**	1. In patients with known CVD, symptoms of CVD, or age ≥65 years with cardiovascular risk factors undergoing elevated-risk NCS, it may be reasonable to measure cTn at 24 and 48 hours after surgery to identify myocardial injury.[1–4]
3: No benefit	**B-NR**	2. In patients undergoing low-risk NCS, routine post-operative screening with cTn levels is not indicated without signs or symptoms suggestive of myocardial ischemia or MI.[5,6]

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

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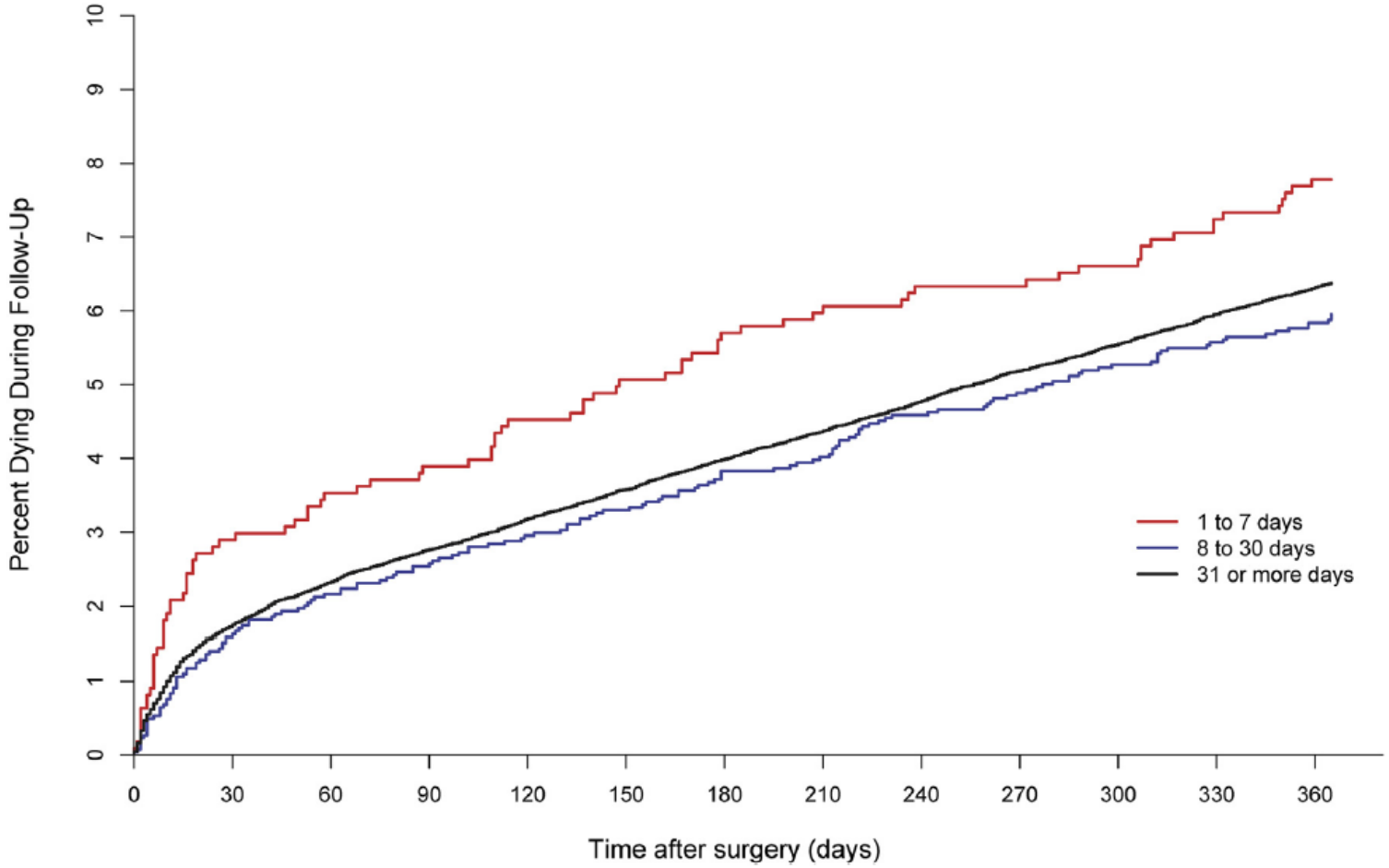
Perioperative Medical Therapy

Perioperative Beta Blockers: The POISE Trial (prospective RCT)

- 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

Source: Poise Study Group. Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial)…. *Lancet.* May 31 2008;371(9627):1839-1847.

Perioperative Beta Blockers: Cohort Study



Source: Wijeysundera DN, et al. Duration of preoperative β-blockade and outcomes after major elective noncardiac surgery. Can J Cardiol. 2014 Feb;30(2):217-23.

Perioperative Beta Blockers: ACC/AHA 2024 Periop Guidelines

Recommendations for Perioperative Beta Blockers
Referenced studies that support the recommendations are summarized in the Online Data Supplement.

COR	LOE	Recommendations
1	B-NR	1. In patients on stable doses of beta blockers undergoing NCS, beta blockers should be continued through the perioperative period as appropriate based on the clinical circumstances.[1,2]
2b	B-NR	2. In patients scheduled for elective NCS who have a new indication for beta blockade, beta blockers may be initiated far enough before surgery (optimally >7 days) to permit assessments of tolerability and drug titration if needed.[3]
3: Harm	B-R	3. In patients undergoing NCS and with no immediate need for beta blockers, beta blockers should not be initiated on the day of surgery due to increased risk for postoperative mortality.[4]

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

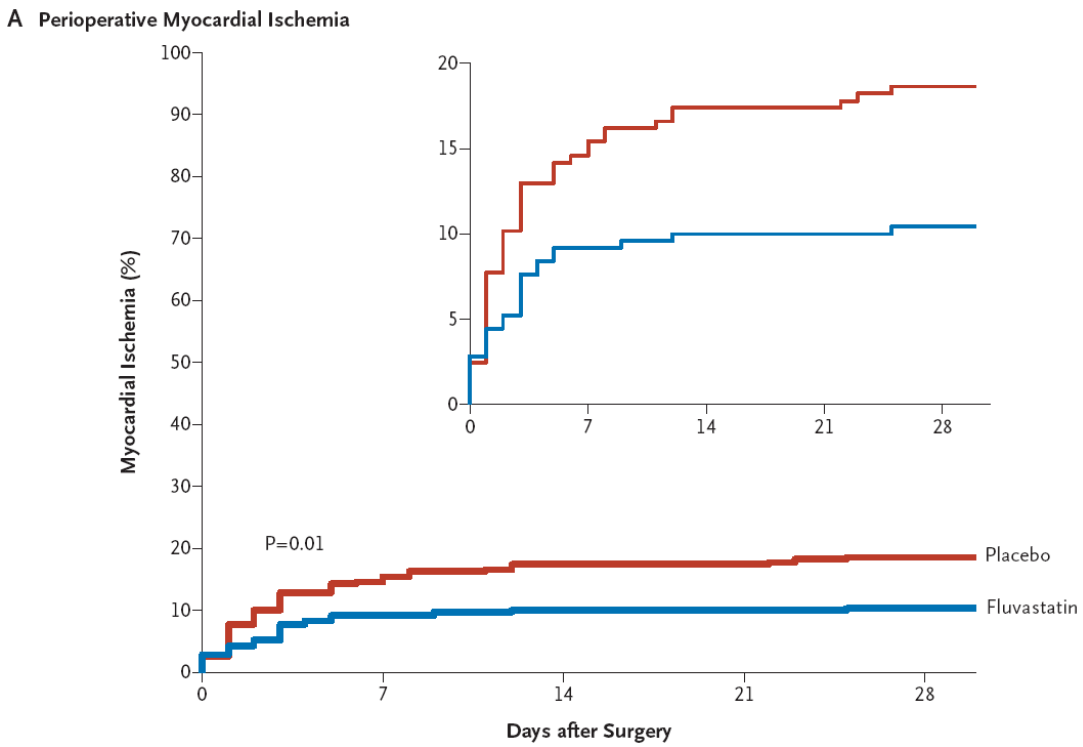
Perioperative Statins

- 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

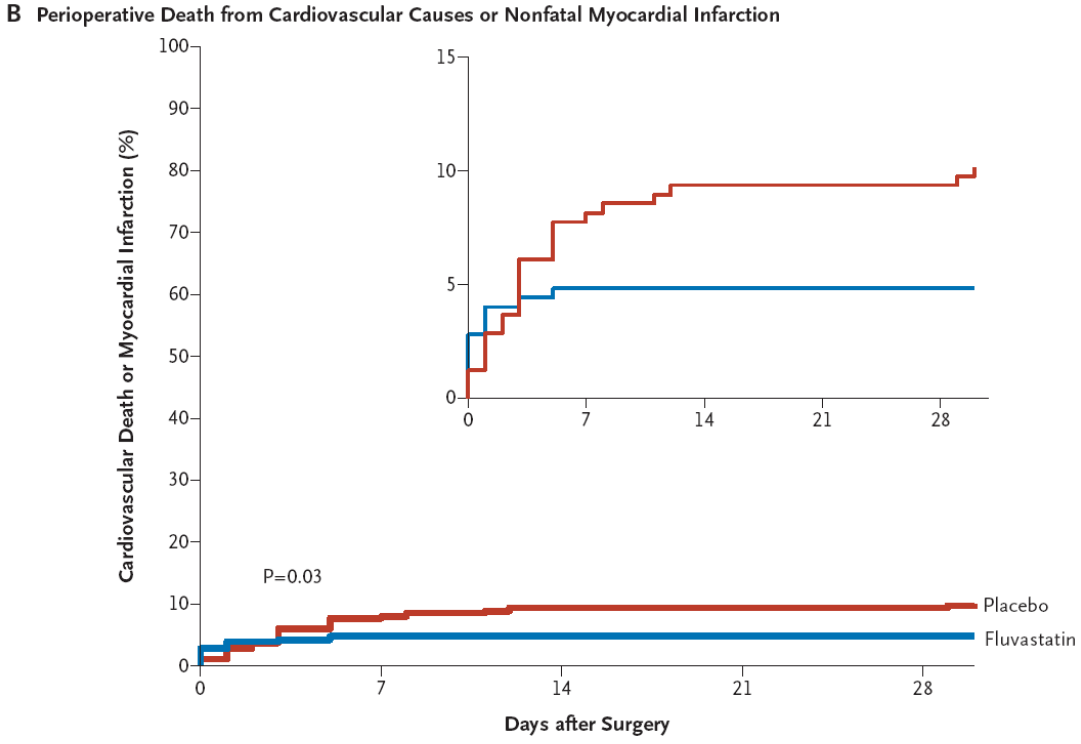
Source: Schouten O, Boersma E, Hoeks SE, et al. Fluvastatin and perioperative events in patients undergoing vascular surgery. *NEJM.* Sep 3 2009;361(10):980-989.

Perioperative Statins

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



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



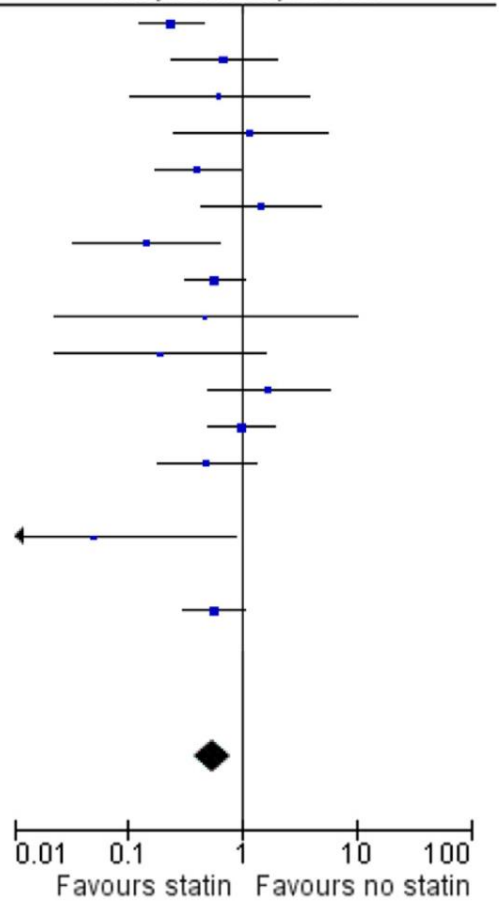
Source: Schouten O, Boersma E, Hoeks SE, et al. Fluvastatin and perioperative events in patients undergoing vascular surgery. *NEJM.* Sep 3 2009;361(10):980-989.

Perioperative Statins: Meta-Analysis

Study or Subgroup	Statin Events	Statin Total	No statin Events	No statin Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Poldermans	12	93	148	387	11.6%	0.24 [0.13, 0.45]	2003
Durazzo	7	44	10	46	7.0%	0.68 [0.23, 1.98]	2004
Abbruzzese	2	88	3	84	3.3%	0.63 [0.10, 3.86]	2004
Ward	2	72	9	374	4.2%	1.16 [0.25, 5.48]	2005
Kennedy	7	1480	21	1803	9.0%	0.40 [0.17, 0.95]	2005
O'Neil-Callahan	6	526	5	637	6.1%	1.46 [0.44, 4.81]	2005
McGirt	2	657	19	909	4.6%	0.14 [0.03, 0.62]	2005
Leurs	11	731	134	5161	11.9%	0.57 [0.31, 1.07]	2006
Gröschel	0	53	2	127	1.3%	0.47 [0.02, 9.94]	2006
Schouten 2	1	28	8	49	2.5%	0.19 [0.02, 1.61]	2006
Kor	9	85	4	62	5.9%	1.72 [0.50, 5.85]	2008
Schanzer	17	636	21	768	11.5%	0.98 [0.51, 1.87]	2008
Schouten 1	6	250	12	247	7.7%	0.48 [0.18, 1.30]	2009
Puato	0	39	0	19		Not estimable	2010
McNally	0	181	11	220	1.5%	0.05 [0.00, 0.86]	2010
Moulakakis	0	58	0	69		Not estimable	2010
Le Manach	17	880	27	794	11.9%	0.56 [0.30, 1.03]	2011
Verzini	0	465	0	618		Not estimable	2011
Neilipovitz	0	22	0	8		Not estimable	2012
Total (95% CI)		**6388**		**12382**	**100.0%**	**0.54 [0.38, 0.78]**	
Total events	99		434				

Heterogeneity: Tau² = 0.19; Chi² = 24.51, df = 14 (P = 0.04); I² = 43%

Test for overall effect: Z = 3.28 (P = 0.001)



Outcome:
all-cause mortality

Source: Antoniou GA, Hajibandeh S, Vallabhaneni SR, Brennan JA, Torella F. Meta-analysis of the effects of statins on perioperative outcomes in vascular and endovascular surgery. *Journal of Vascular Surgery*. Feb 2015;61(2):519-532 e511

Perioperative Statins: ACC/AHA 2024 Periop Guidelines

Recommendations for Statins Referenced studies that support the recommendations are summarized in the Online Data Supplement.		
COR	**LOE**	**Recommendations**
1	**B-NR**	1. In patients currently on statins and scheduled for NCS, continuation of statin therapy is recommended to reduce the risk of MACE.[1–3]
1	**B-R**	2. In statin-naïve adult patients who meet criteria for statin use based on ASCVD history or 10-year risk assessment and are scheduled for NCS, perioperative initiation of statin is recommended with intention of long-term use.[4,5]

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

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)

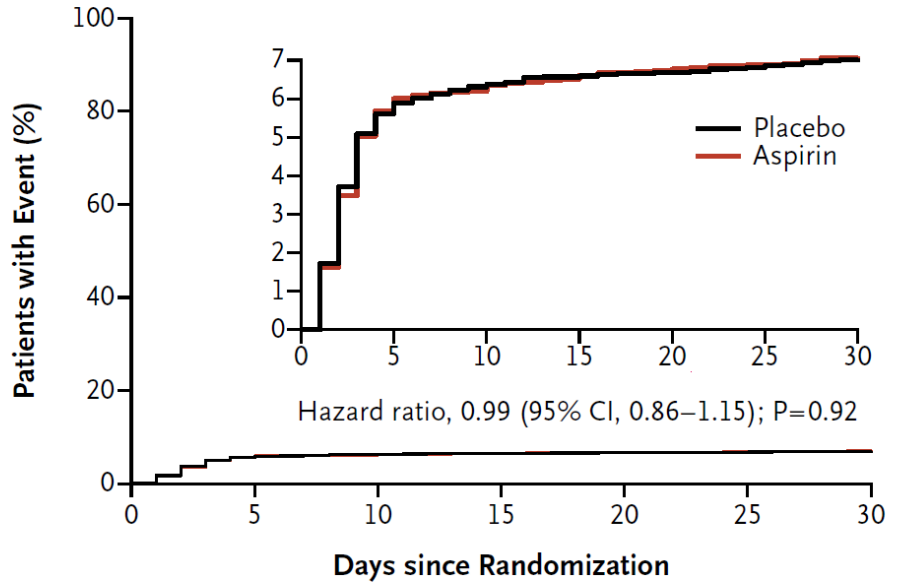
Source: Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in patients undergoing noncardiac surgery. *NEJM*. Apr 17 2014;370(16):1494-1503.

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

Source: Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in patients undergoing noncardiac surgery. *NEJM*. Apr 17 2014;370(16):1494-1503.

Perioperative Aspirin



No. at Risk

Placebo	5012	4724	4696	4680	4669	4662	4652
Aspirin	4998	4713	4678	4665	4660	4653	4643

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.

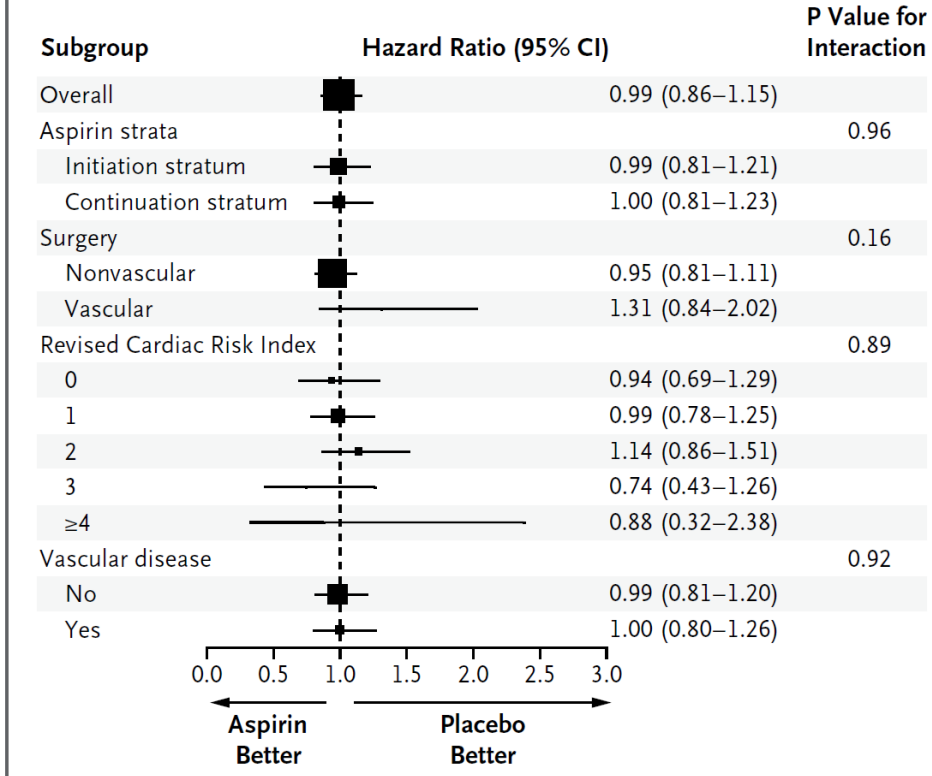


Figure 2. Subgroup Analyses of the Primary Outcome.

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.

Source: Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in patients undergoing noncardiac surgery. *NEJM*. Apr 17 2014;370(16):1494-1503.

Perioperative Aspirin: ACC/AHA 2024 Periop Guidelines

Recommendations for Antiplatelet Therapy and Timing of Noncardiac Surgery in Patients With Coronary Artery Disease
Referenced studies that support the recommendations are summarized in the Online Data Supplement.

COR	LOE	Recommendations
2b	B-R	11. In patients with CCD without prior PCI undergoing elective NCS, it may be reasonable to continue aspirin in selected patients when the risk of cardiac events outweighs the risk of bleeding.[27,34,35]
3: No benefit	B-R	12. In patients with CAD but without prior PCI who are undergoing elective noncarotid NCS, routine initiation of aspirin is not beneficial.[27,36]

CCD=chronic coronary disease

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Should We Hold ACEi/ARB Preop?

JAMA | Original Investigation

Continuation vs Discontinuation of Renin-Angiotensin System Inhibitors Before Major Noncardiac Surgery

The Stop-or-Not Randomized Clinical Trial

JAMA. 2024;332(12):970-978. doi:10.1001/jama.2024.17123
Published online August 30, 2024.

Source: Legrand M, et al; Stop-or-Not Trial Group. Continuation vs Discontinuation of Renin-Angiotensin System Inhibitors Before Major Noncardiac Surgery: The Stop-or-Not Randomized Clinical Trial. JAMA. 2024 Sep 24;332(12):970-978.

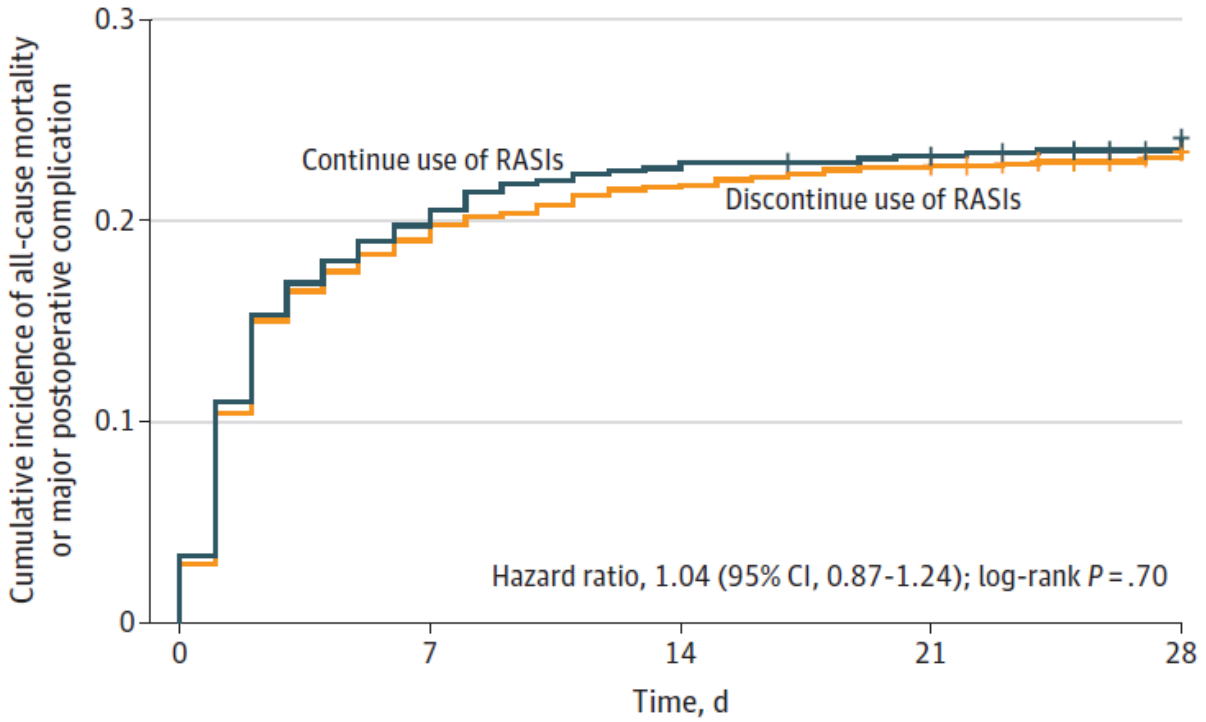
Should We Hold ACEi/ARB Preop?

- Prospective RCT of 2222 patients in France
- Patients were on a renin-angiotensin system inhibitors (RASIs) (ACEi or ARB) for ≥ 3 months
- Patients were randomized 1:1 to the continuation group (continued ACEi/ARB to the day of surgery) or discontinuation group (held ACEi/ARB for 48 h before surgery)

Source: Legrand M, et al; Stop-or-Not Trial Group. Continuation vs Discontinuation of Renin-Angiotensin System Inhibitors Before Major Noncardiac Surgery: The Stop-or-Not Randomized Clinical Trial. JAMA. 2024 Sep 24;332(12):970-978.

Should We Hold ACEi/ARB Preop?

Figure 3. Cumulative Incidence of the Primary Outcome by Treatment Group



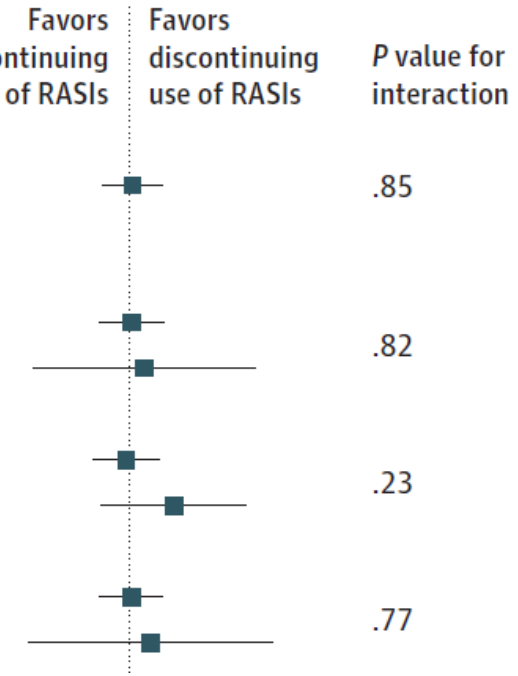
No. at risk					
Discontinue use of RASIs	1026	831	804	794	756
Continue use of RASIs	1018	817	788	781	748

Source: Legrand M, et al; Stop-or-Not Trial Group. Continuation vs Discontinuation of Renin-Angiotensin System Inhibitors Before Major Noncardiac Surgery: The Stop-or-Not Randomized Clinical Trial. JAMA. 2024 Sep 24;332(12):970-978.

Should We Hold ACEi/ARB Preop?

Figure 2. Primary Outcome for All Patients and by Individual Patient Subgroups

	Discontinued use of RASIs		Continued use of RASIs			
	No. of events	No. of patients	No. of events	No. of patients	Risk ratio (95% CI)	*P* value for interaction
Primary outcome						
All patients	245	1115	247	1107	1.02 (0.87-1.19)	.85
Patient subgroups						
Age group, y						
≤80	225	1026	230	1037	1.01 (0.86-1.19)	.82
>80	20	89	17	70	1.08 (0.61-1.90)	
History of chronic kidney disease						
No	212	1013	208	1011	0.98 (0.83-1.17)	.23
Yes	33	102	39	96	1.26 (0.87-1.82)	
History of heart failure						
No	230	1043	231	1038	1.01 (0.86-1.19)	.77
Yes	15	72	16	69	1.11 (0.60-2.07)	



Source: Legrand M, et al; Stop-or-Not Trial Group. Continuation vs Discontinuation of Renin-Angiotensin System Inhibitors Before Major Noncardiac Surgery: The Stop-or-Not Randomized Clinical Trial. JAMA. 2024 Sep 24;332(12):970-978.

Perioperative ACEi/ARB: ACC/AHA 2024 Periop Guidelines

Recommendations for Perioperative Renin-Angiotensin-Aldosterone System Inhibitors Referenced studies that support the recommendations are summarized in the Online Data Supplement.		
COR	**LOE**	**Recommendations**
2b	**B-R**	1. In select* patients on chronic renin-angiotensin-aldosterone system inhibitors (RAASi) for hypertension undergoing elevated-risk NCS, omission 24 hours before surgery may be beneficial to limit intraoperative hypotension.[1–6]
2a	**C-EO**	2. In patients on chronic RAASi for HFrEF, perioperative continuation is reasonable.†[1,2]

*Patients with controlled BP and undergoing elevated-risk surgical procedures.
†Modified from the "2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure."[7]

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Perioperative Considerations for GLP-1 Agonists

Guidance from the American Society of Anesthesiologists:

- For patients who take GLP-1 agonists daily, consider holding the medication on the day of surgery
- For patients who take GLP-1 agonists weekly, consider holding the medication a week prior to surgery
- If the patient has GI symptoms such as serious bloating or N/V, consider delaying the procedure
- If the patient has no GI symptoms but did not hold the GLP-1 agonist, then use “full stomach” precautions

Source: https://www.asahq.org/about-asa/newsroom/news-releases/2023/06/american-society-of-anesthesiologists-consensus-based-guidance-on-preoperative

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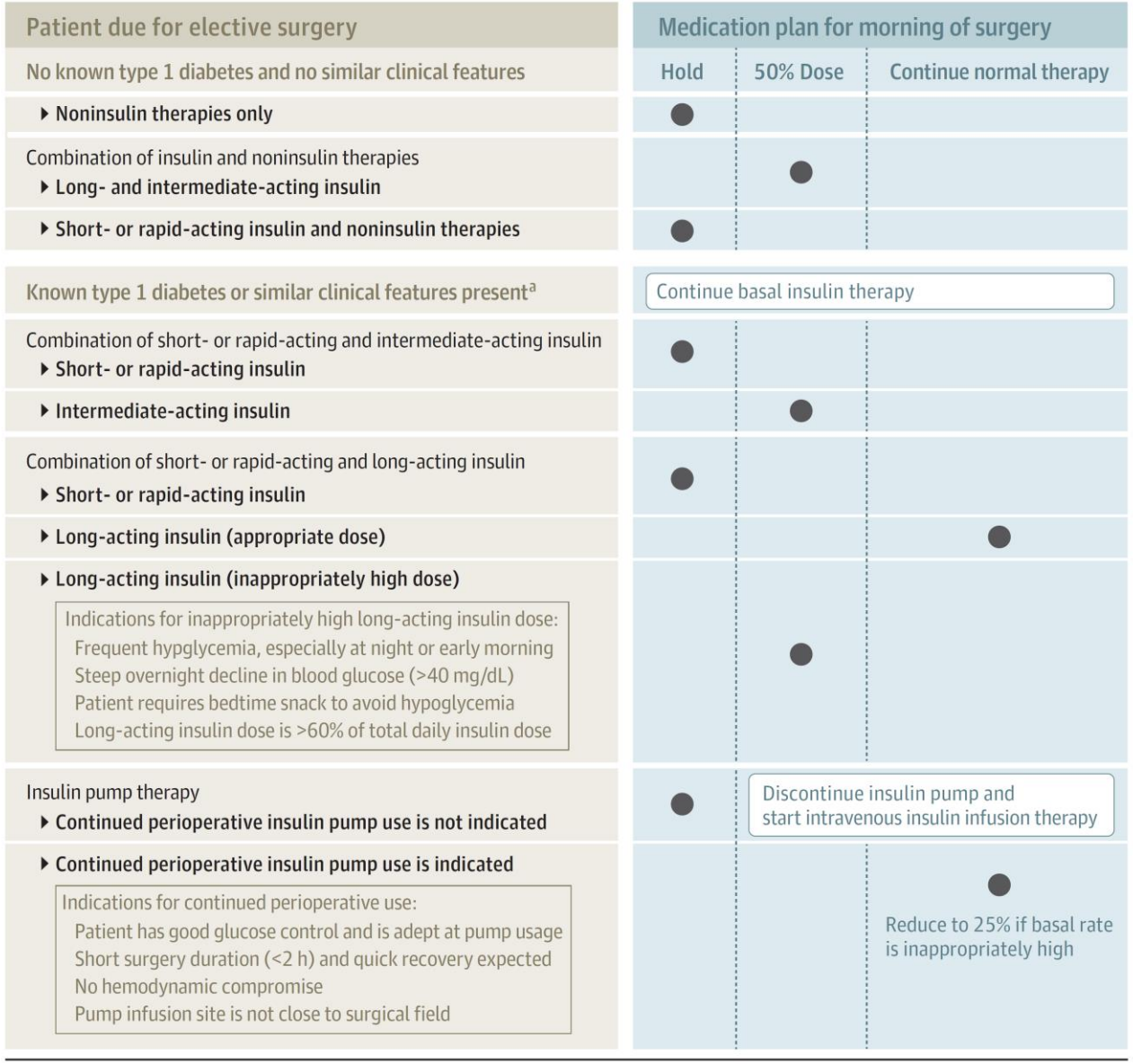
However, critics of this guidance have noted:

- EGD studies that examined whether GLP-1 agonist use is associated with retained gastric contents have yielded mixed results
- The duration that GLP-1 agonist need to be held to reduce the risk of retained gastric contents is unclear
- The benefits of better glycemic control may be offsetting, at least to some extent

Source: https://www.asahq.org/about-asa/newsroom/news-releases/2023/06/american-society-of-anesthesiologists-consensus-based-guidance-on-preoperative

Periop Management of Diabetes Medications

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



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 $CHADS_2$ risk factors.
- The mean $CHADS_2$ score was 2.3

Source: Douketis JD, Spyropoulos AC, Kaatz S, et al. Perioperative Bridging Anticoagulation in Patients with Atrial Fibrillation. *NEJM*. 2015;373(9):823-833.

Bridging Anticoagulation

Table 3. Study Outcomes.

Outcome	No Bridging (N=918)	Bridging (N=895)	P Value
	number of patients (percent)		
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.

Source: Douketis JD, Spyropoulos AC, Kaatz S, et al. Perioperative Bridging Anticoagulation in Patients with Atrial Fibrillation. *NEJM*. 2015;373(9):823-833.

Perioperative Anticoagulation with DOACS

Preoperative DOAC Schedule											
		Preoperative Interruption						Surgery/ Procedure	Postoperative Resumption		
	Procedure Bleeding Risk	Day -6	Day -5	Day -4	Day -3	Day -2	Day -1	Day 0	Day +1	Day +2	Day +3	Day +4
Apixaban, edoxaban, rivaroxaban	High	*	*	*	*	†	†	†	†	†	*	*
	Low/Moderate	*	*	*	*	*	†	†	*	*	*	*
	Minimal	*	*	*	*	*	*	*	*	*	*	*
Apixaban, edoxaban, rivaroxaban with renal impairment (CrCl <30 mL/min)	High	*	*	*	†	†	†	†	†	†	*	*
	Low/Moderate	*	*	*	*	†	†	†	*	*	*	*
	Minimal	*	*	*	*	*	*	*	*	*	*	*
Dabigatran CrCl ≥50 mL/min	High	*	*	*	*	†	†	†	†	†	*	*
	Low/Moderate	*	*	*	*	*	†	†	*	*	*	*
	Minimal	*	*	*	*	*	*	*	*	*	*	*
Dabigatran CrCl <50 mL/min	High	*	*	†	†	†	†	†	†	†	*	*
	Low/Moderate	*	*	*	*	†	†	†	*	*	*	*
	Minimal	*	*	*	*	*	*	*	*	*	*	*

Source: 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery … Circulation. 2024 Nov 5;150(19):e351-e442.

Brigham and Women's Hospital
Founding Member, Mass General Brigham

Perioperative Pulmonary Considerations

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 ≤10 g/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; SpO_2 = 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

Source: Mazo V, Sabate S, et al. Prospective external validation of a predictive score for postoperative pulmonary complications. *Anesthesiology.* 2014;121(2):219-231.

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.

Source: Lawrence VA, et al. Strategies to reduce postoperative pulmonary complications after noncardiothoracic surgery: systematic review for the American College of Physicians. *Annals of Internal Medicine.* Apr 18 2006;144(8):596-608.

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

Source: Lawrence VA, et al. Strategies to reduce postoperative pulmonary complications after noncardiothoracic surgery: systematic review for the American College of Physicians. *Annals of Internal Medicine.* Apr 18 2006;144(8):596-608.

General versus Regional Anesthesia Complications

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

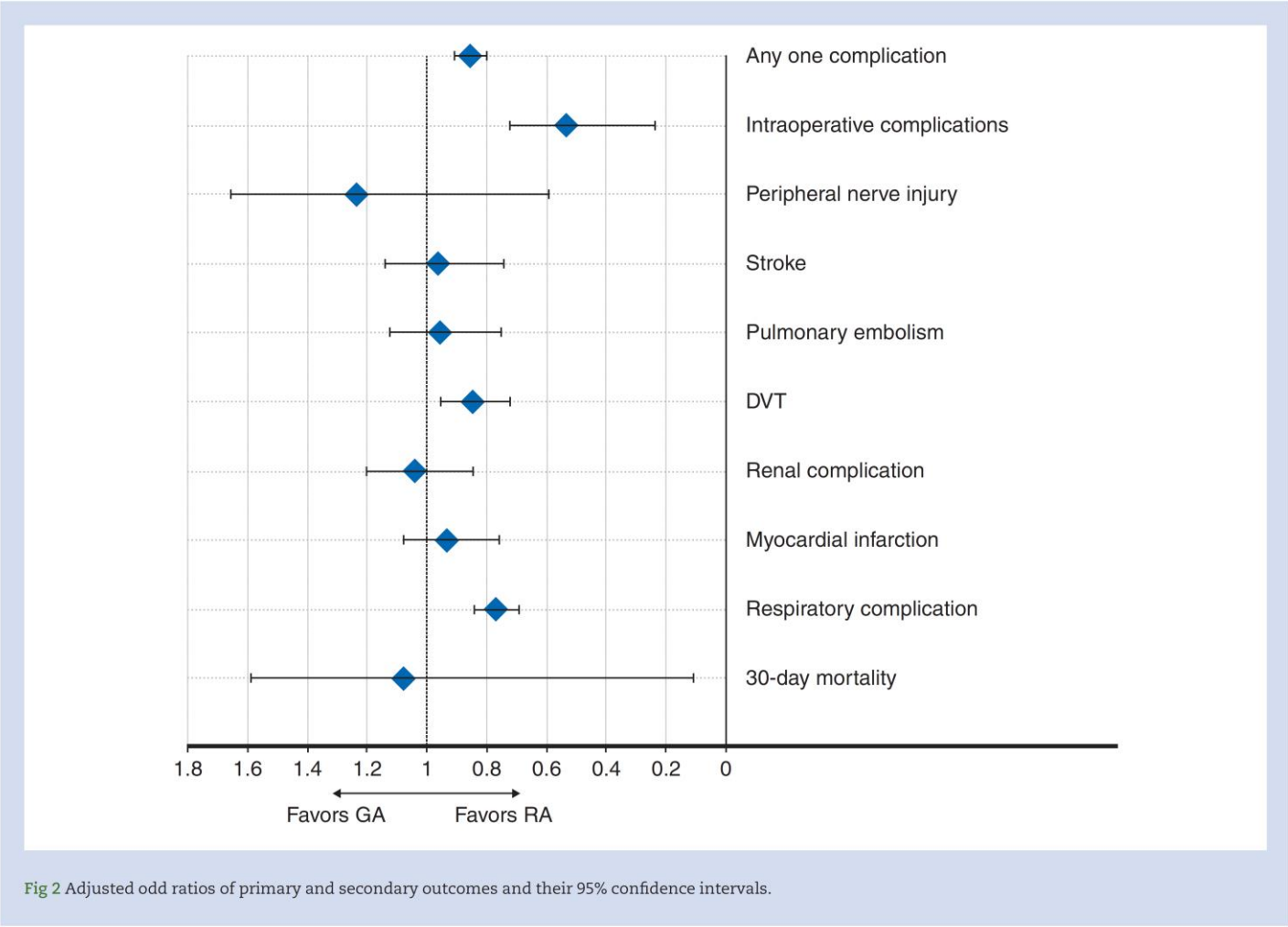
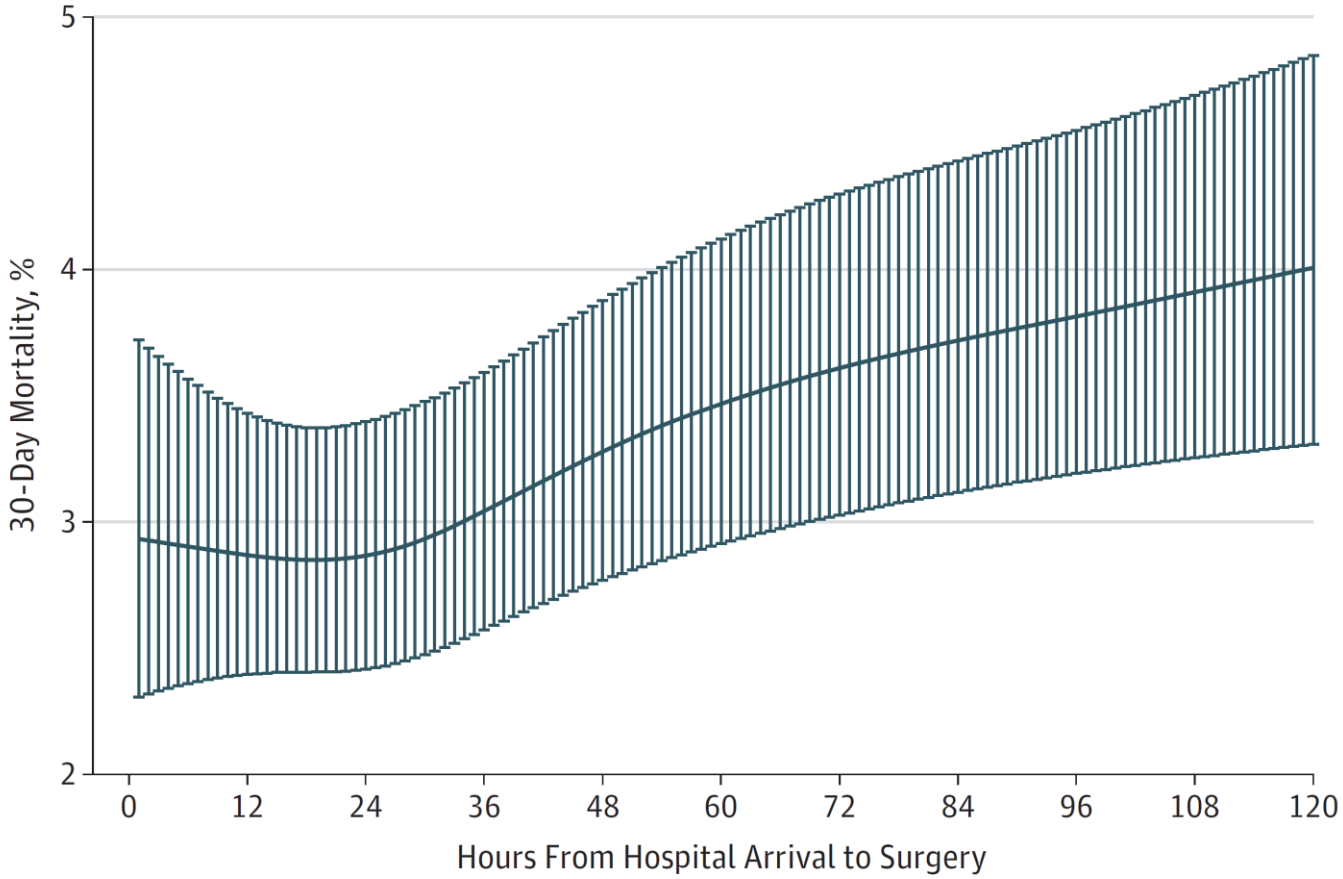


Fig 2 Adjusted odd ratios of primary and secondary outcomes and their 95% confidence intervals.

Source: Saied NN et al. Effect of anaesthesia type on postoperative mortality and morbidities: a matched analysis of the NSQIP database. Br J Anaesth. 2017 Jan;118(1):105-111.

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



Source: Pincus D, Ravi B, Wasserstein D, et al. Association Between Wait Time and 30-Day Mortality in Adults Undergoing Hip Fracture Surgery. JAMA. Nov 28 2017;318(20):1994-2003..

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 can reduce postop complications
- Neglecting to prescribe CPAP in patients on CPAP when postop in the hospital is an “unforced error”
- Opioids need to be used with caution in OSA patients

Sources: Cozowicz C, et al. Perioperative Management of the Patient with Obstructive Sleep Apnea: A Narrative Review. Anesth Analg. 2021 May 1;132(5):1231-1243. Jonsson Fagerlund M et al. Perioperative Continuous Positive Airway Pressure Therapy: A Review with the Emphasis on Randomized Controlled Trials and Obstructive Sleep Apnea. Anesth Analg. 2021 May 1;132(5):1306-1313.

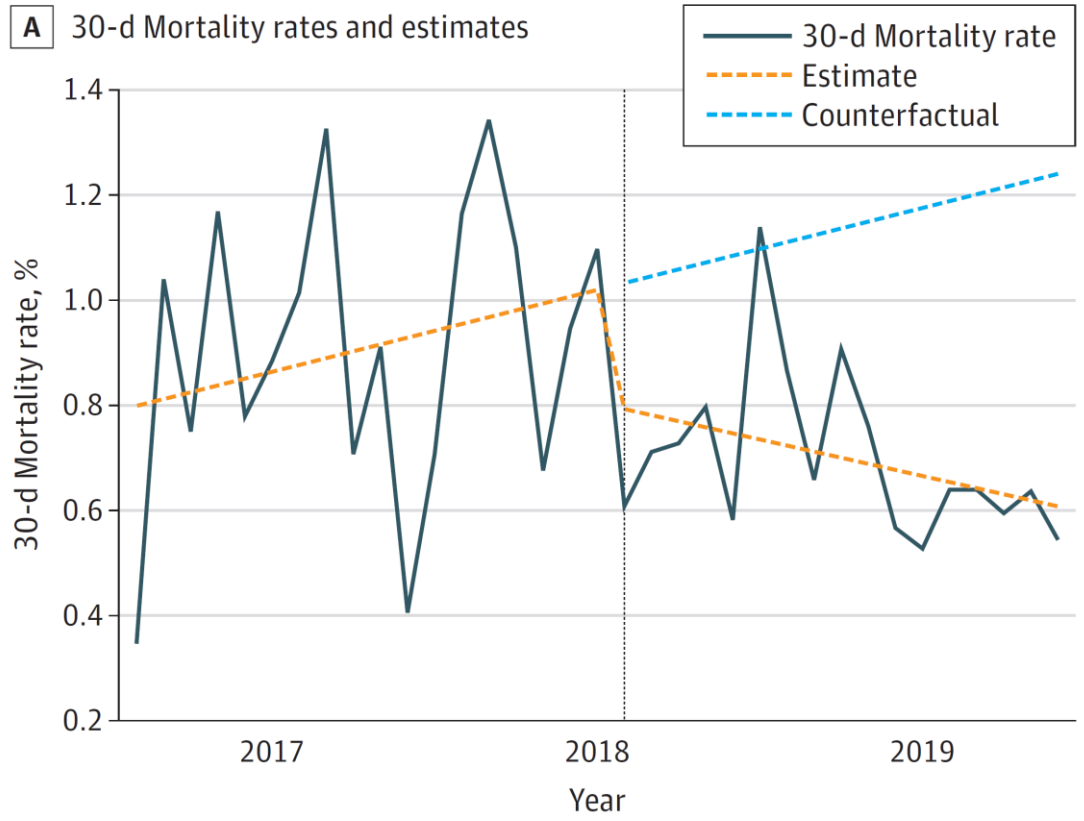
Periop Issues for Obese Patients

- 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

Source: Cote DR, Fuentes E, Elsayes AH, Ross JJ, Quraishi SA. A "crush" course on rhabdomyolysis: risk stratification and clinical management update for the perioperative clinician. J Anesth. 2020 Aug;34(4):585-598

Enhanced Preop Evaluation of Frail Patient May Impact Mortality

Figure. Interrupted Time Series Analysis



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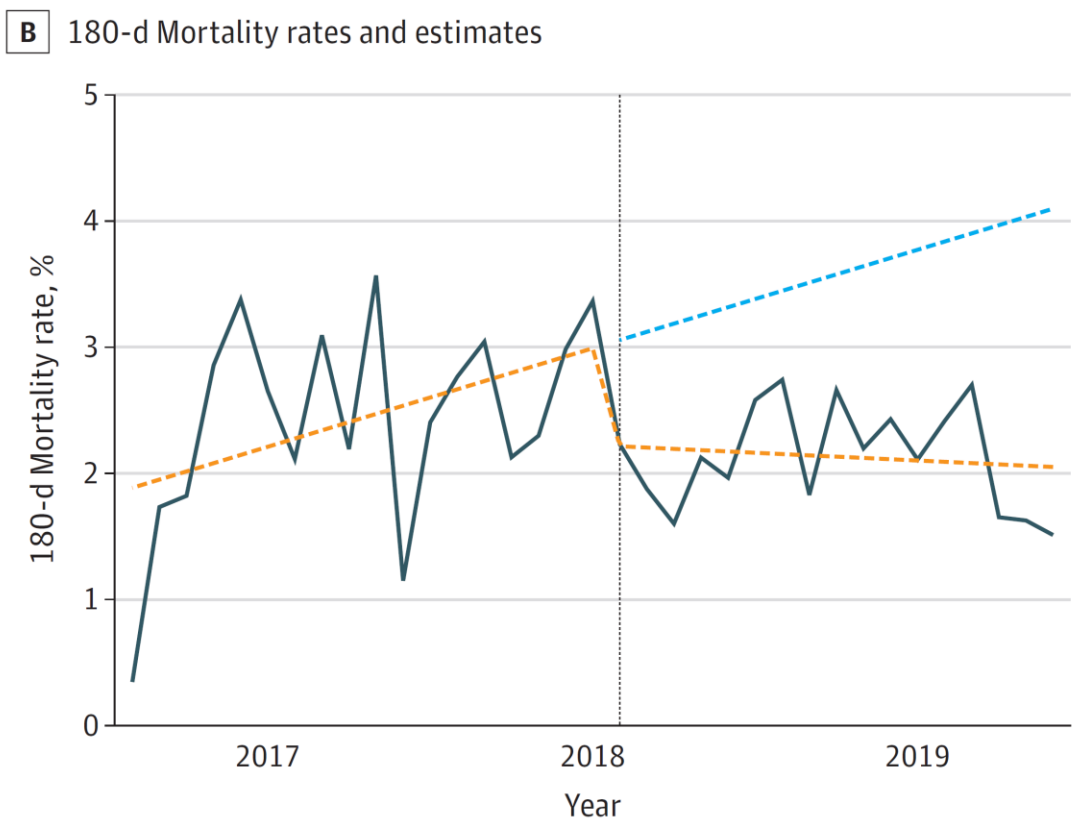

Source: Varley PR et al. Association of Routine Preoperative Frailty Assessment With 1-Year Postoperative Mortality. JAMA Surg. 2023 Feb 22:e228341.

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
  - 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
- Assess patients for frailty
- Communicate with the surgeon and anesthesiologist

Selected References

1. Thompson A, et al. 2024 AHA/ACC/ACS/ASNC/HRS/SCA/SCCT/SCMR/SVM Guideline for Perioperative Cardiovascular Management for Noncardiac Surgery: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation. 2024 Nov 5;150(19):e351-e442.
2. Legrand M, et al. Stop-or-Not Trial Group. Continuation vs Discontinuation of Renin-Angiotensin System Inhibitors Before Major Noncardiac Surgery: The Stop-or-Not Randomized Clinical Trial. JAMA. 2024 Sep 24;332(12):970-978.
3. Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in Patients Undergoing Noncardiac Surgery. *NEJM*. Apr 17 2014;370(16):1494-1503.
4. Simha V, Shah P. Perioperative Glucose Control in Patients With Diabetes Undergoing Elective Surgery. *JAMA*. Jan 7 2019;321(4):399–400.
5. Smilowitz NR, Berger JS. Perioperative Cardiovascular Risk Assessment and Management for Noncardiac Surgery: A Review. JAMA. 2020 Jul 21;324(3):279-290.