Update in Perioperative Medicine: Preoperative Risk Evaluation

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No Disclosures

Perioperative Medicine Co-Management

- Society of Hospital Medicine
  - “Co-Management” early 2000’s
  - Collaboration IM Hospitalists, Surgeons & Anesthesiologists
    - Outpatient Specialists (Primary Care Physicians), Cardiologists, Sleep Centers etc.
- Driving Force
  - Aging Population
    - More complex medical history and risk
  - Improved Surgical & Anesthetic Techniques
  - More Surgical Options available
  - Value Based Reimbursement (Quality/Cost Ratio)

Update in Perioperative Medicine: Preoperative Risk Evaluation

Current Influences Perioperative Medicine:

- Electronic Databases and Online Risk Calculators
  NSQIP and others
- Value Based Purchasing

Value Based Purchasing

- Pay for Quality (Outcomes)
- Penalties for 30 day readmissions
- 90 Day Bundling postoperative care
- Designating surgeries as outpatient procedures
  - Justify inpatient status (Total Knee Arthroplasty designated as outpatient)
  - Location of surgery decisions:
    - Ambulatory Surgery Centers
    - Specialty Hospitals
    - Hospital

Perioperative Medicine: A Burgeoning Field with Profound Importance to a Modern Clinician

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AIMS AND SCOPE

This article serves in introducing the readers to the developing field of perioperative medicine. We have made an effort to come up with the latest management guidelines covering multiple subspecialties in form of a special supplement. This compendium in perioperative medicine serves as a comprehensive guide to a practicing clinician, in managing patients with various medical comorbidities undergoing surgical procedures and avoiding common pitfalls.

“Perioperative medical care is an indispensable component of overall surgical case management, involving concerted efforts from **surgeons, anesthesiologists, internists, and subspecialists** alike. With increasing intricacy of the surgical procedures being performed on a spectrum of patients ranging from those in the pediatric age group to **geriatric patients with multiple comorbidities**, perioperative medicine is being increasingly recognized as a subspecialty unto itself.”

What is Preoperative Medicine?

Risk Assessment of each organ system and its' physiologic reserve to tolerate the stress of a specific surgery.

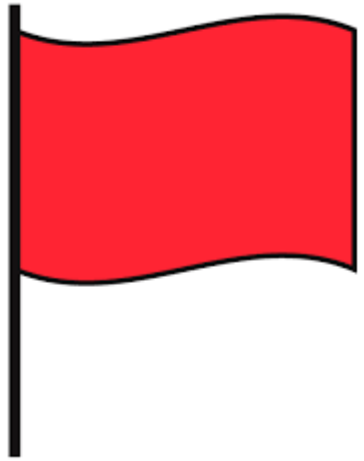
- Organ Systems:
  - Cardiovascular
  - Pulmonary
  - Neuro-cognitive
  - Hematologic
  - Renal
  - Gastrointestinal
  - Endocrine

Surgery Stress

Anesthesia Stress

- Blood Loss
- Activation Coagulation System
- Hemodynamic Instability
- Catecholamine Release
- Activation Inflammatory Cascade

Preope
Consult



History:
- HPI
- ROS
- Medications
- Allergies
- Past Medical History

Physical Examination:
- Vital Signs, BMI, Neck circumference
- Lungs
- Cardiac: Murmurs, Gallops, JVD
- Neurocognitive

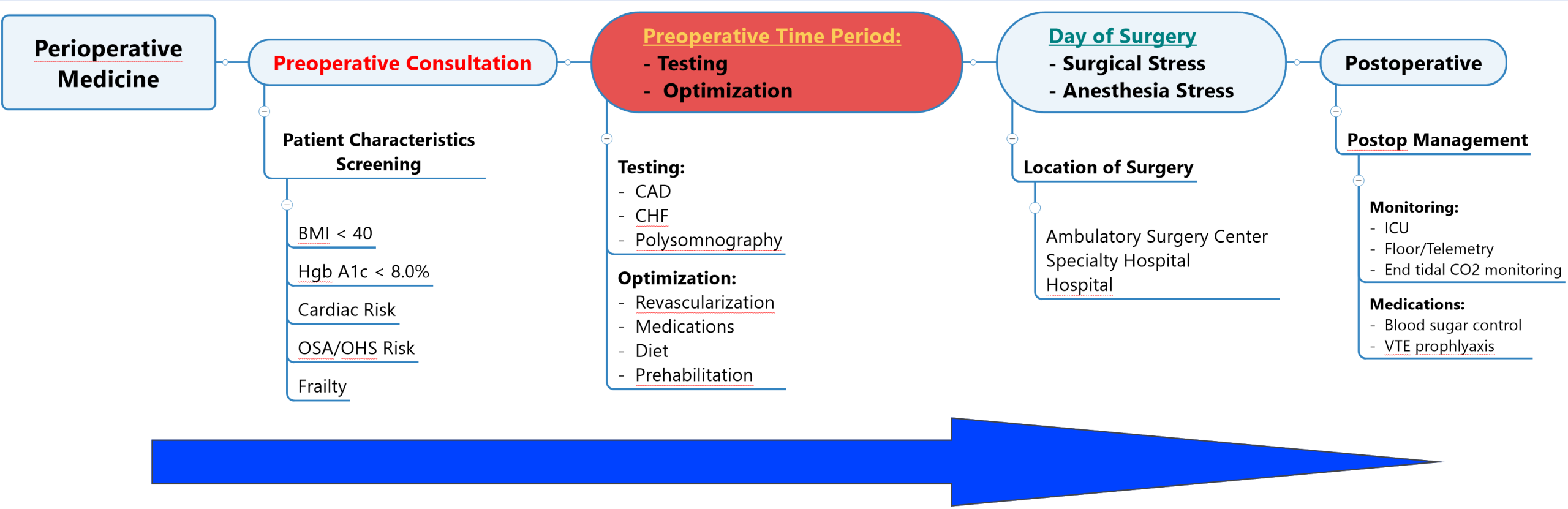
Testing:
- Routine Labs
- EKG

Preoperative Actions

Options:

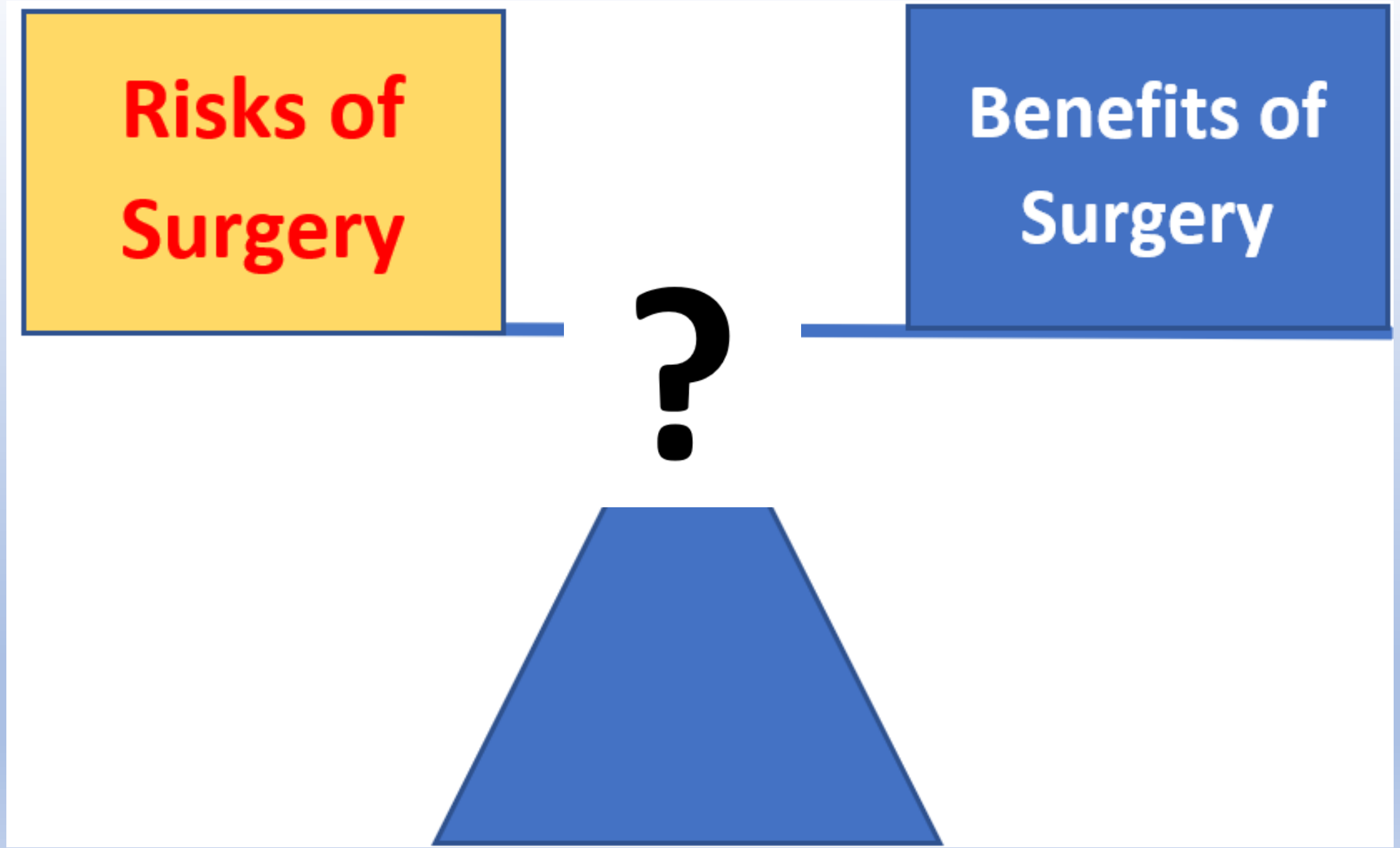
- Cancel surgery
- Postpone surgery
- Further testing to improve risk stratification accuracy
- Implement new therapeutic options:
    - Medication adjustment
    - Coronary revascularization
- Change Perioperative Locations
    - Ambulatory surgery center, Specialty Hospital, Hospital
    - Postoperative
        - ICU
        - Monitoring options
            - Telemetry, Oxygen saturation, End-Tidal CO2 monitoring

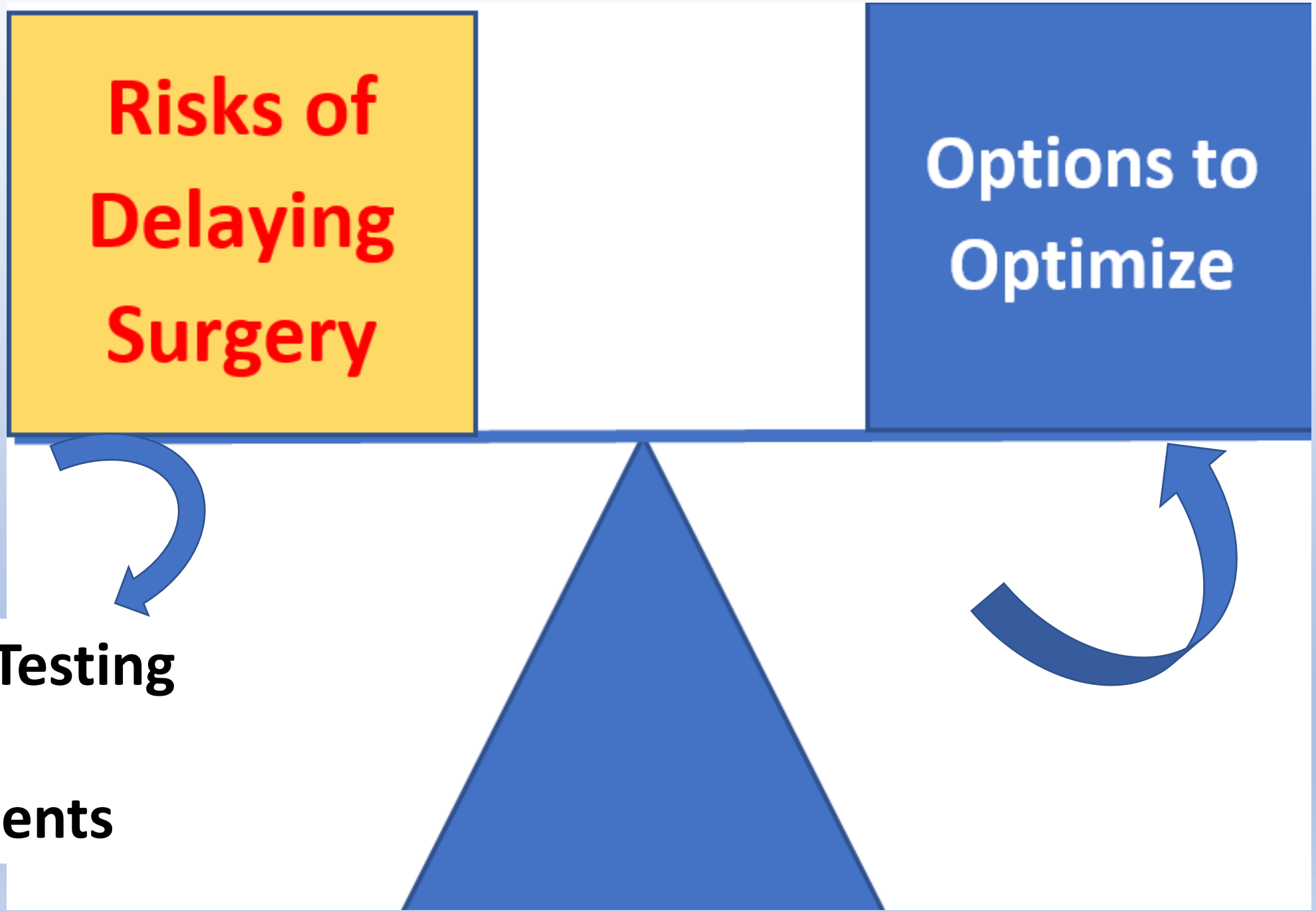
Perioperative Time Period



Preoperative Screening & Potential Actions

- **BMI > 40**
  - Postpone refer to weight loss program
- **Hemoglobin A1c > 8.0%**
  - Postpone and implement diabetic management program
- **High Risk OSA/OHS (STOPBANG score ≥ 5)/Hypercarbia**
  - Refer for Polysomnography and CPAP therapy
- **Cardiac Risk**
  - Testing for CAD
  - Echo for CHF
- **Frailty**
  - Cognitive status
  - Nutritional Status
  - Functional Status


Risks of Surgery
Benefits of Surgery
?


Risks of Delaying Surgery
Options to Optimize
Further Testing or Meds Adjustments

Preoperative Cardiac Risk Evaluation and Managemet

Perioperative Guidelines

- 2014 ACC/AHA Guideline
- 2014 European Society of Cardiology/European Society of Anesthesiology
- 2017 Canadian Cardiovascular Society (CCS)

American College of Cardiology /AHA guidelines 2014

The first step of the algorithm is to determine the urgency of the surgery.

The ACC/AHA guidelines defined urgency as the need to have surgery within the following time frames:

- **Emergent < 6 hours;**
- **Urgent 6-24 hours;**
- **Time sensitive 1-6 weeks;**
- **Elective 1 year or more.**

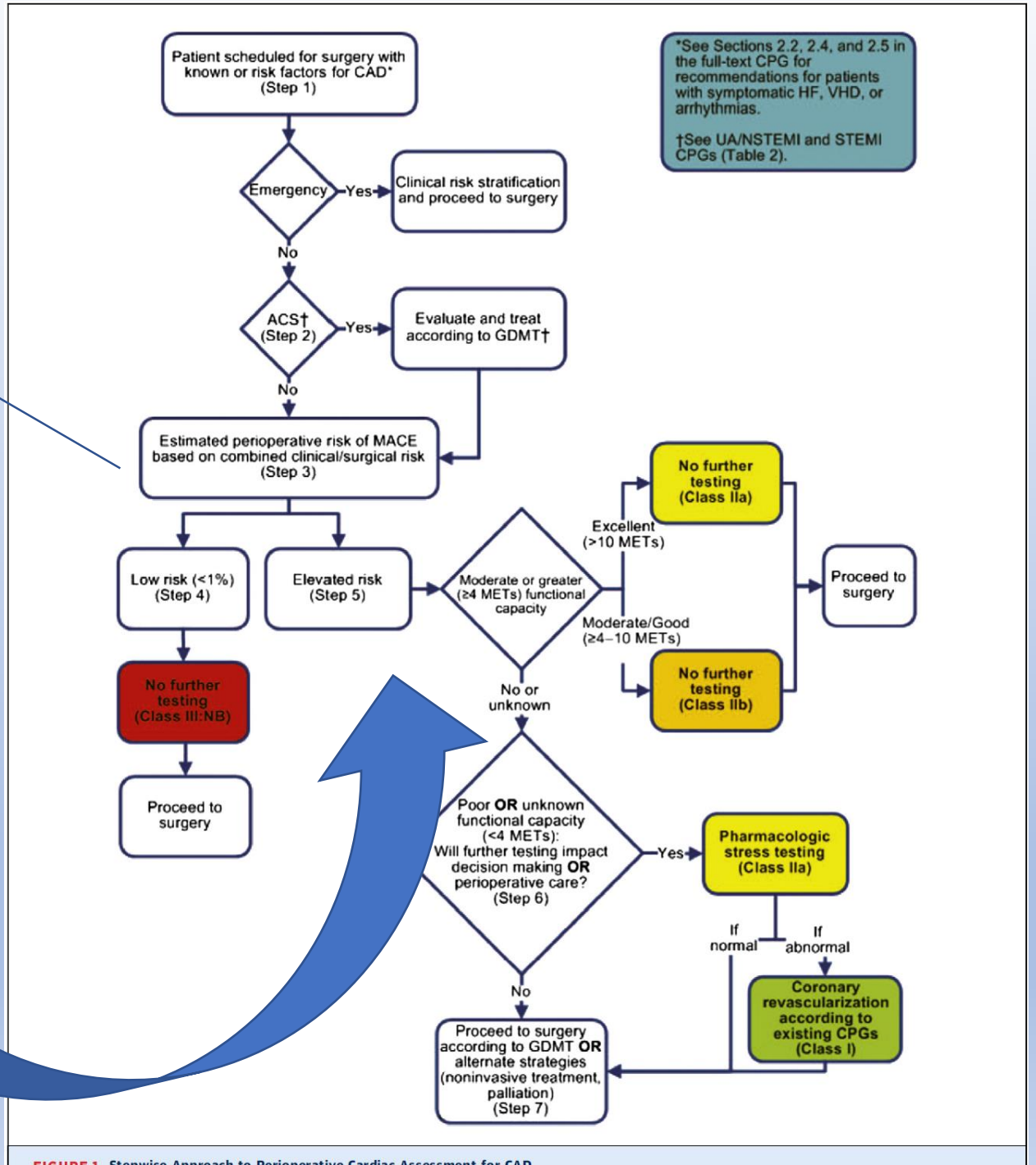
ACC/AHA 2014 Algorithm

Risk of MACE > 1%

- **RCRI ≥ 1**
- **NSQIP**

Next STEP

- **Functional Status**
- **METS < 4**



METS

- "Too subjective"

Table 3. Measures of Functional Capacity

<4 METs

- Eat, dress, and use the toilet
- Walk indoors around the house
- Walk 1 or 2 blocks slowly (2–3 mph)
- Do light work around the house

≥4 METs

- Walk 4 mph or faster on level ground
- Climb a flight of stairs
- Walk up a hill
- Run a short distance
- Do heavy work around the house
- Golf
- Doubles tennis

MET = metabolic equivalent.

Assessment of functional capacity before major non-cardiac surgery: an international, prospective cohort study

Duminda N Wijeysundera, Rupert M Pearse, Mark A Shulman, Tom E F Abbott, Elizabeth Torres, Althea Ambosta, Bernard L Croal, John T Granton, Kevin E Thorpe, Michael P W Grocott, Catherine Farrington, Paul S Myles, Brian H Cuthbertson, on behalf of the METS study investigators

Summary

Background Functional capacity is an important component of risk assessment for major surgery. Doctors' clinical subjective assessment of patients' functional capacity has uncertain accuracy. We did a study to compare preoperative subjective assessment with alternative markers of fitness (cardiopulmonary exercise testing [CPET], scores on the Duke Activity Status Index [DASI] questionnaire, and serum N-terminal pro-B-type natriuretic peptide [NT pro-BNP] concentrations) for predicting death or complications after major elective non-cardiac surgery.

Interpretation Subjectively assessed functional capacity should not be used for preoperative risk evaluation. Clinicians could instead consider a measure such as DASI for cardiac risk assessment.

Lancet 2018; 391: 2631–40

DASI

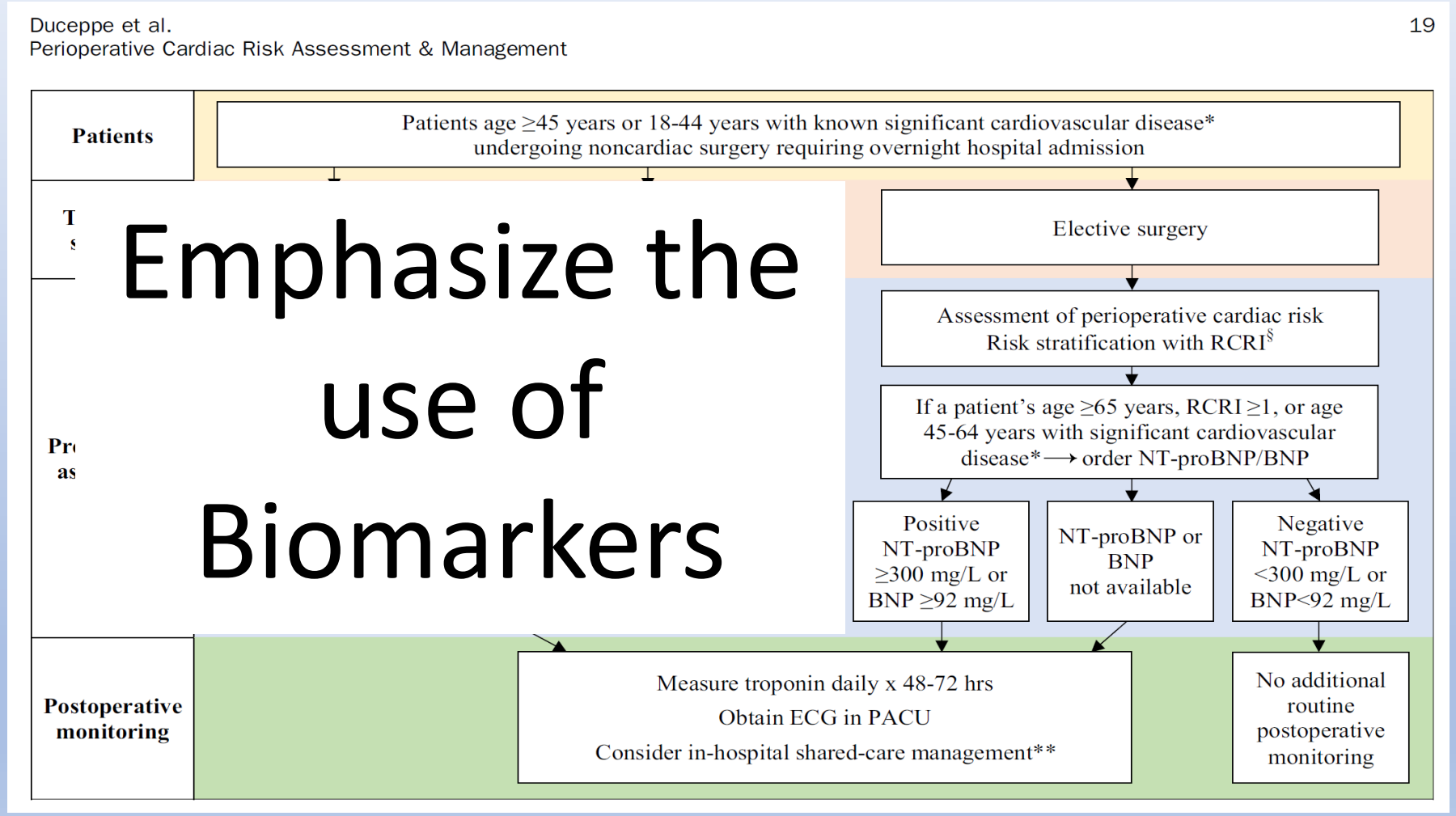
Figure 8. Duke Activity Status Index

Item	Activity	Yes	No
1	Can you take care of yourself (eating, dressing, bathing, or using the toilet)?	2.75	0
2	Can you walk indoors, such as around your house?	1.75	0
3	Can you walk a block or 2 on level ground?	2.75	0
4	Can you climb a flight of stairs or walk up a hill?	5.5	0
5	Can you run a short distance?	8	0
6	Can you do light work around the house like dusting or washing dishes?	2.7	0
7	Can you do moderate work around the house like vacuuming, sweeping, floors, or carrying in groceries?	3.5	0
8	Can you do heavy work around the house like scrubbing floors or lifting and moving heavy furniture?	8	0
9	Can you do yard work like raking leaves, weeding, or pushing a power mower?	4.5	0
10	Can you have sexual relations?	5.25	0
11	Can you participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	6	0
12	Can you participate in strenuous sports like swimming, singles, tennis, football, basketball, or skiing?	7.5	0

Duke Activity Status Index = SUM (values for all 12 questions).
Hlatky et al. *Am J Cardiol*, 1989.[21]

To convert the DASI to METs, divide the sum value of all 12 questions of the DASI by 3.5.

Canadian Cardiovascular Society



Emphasize the use of Biomarkers

Can J Cardiol. 2017 Jan;33(1):17-32.
Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Noncardiac Surgery.

Canadian Cardiovascular Society

Table 3. Risk of death or myocardial infarction at 30 days after noncardiac surgery, based upon a patient's preoperative NT-proBNP or BNP result

Test result	Risk estimate, %	95% CI for the risk estimate
NT-proBNP $<$ 300 ng/L or BNP $<$ 92 mg/L	4.9	3.9%-6.1%
NT-proBNP value $\geq$ 300 ng/L or BNP $\geq$ 92 mg/L	21.8	19.0%-24.8%

BNP, brain natriuretic peptide; CI, confidence interval; NT-proBNP, N-terminal pro-brain natriuretic peptide.

Preoperative Cardiac Risk Calculators

- Revised Cardia
- National Surge
- Myocardial Inf
- Reconstructed
- Vascular Surge
- American Univ
  (AUB-POCES C

RCRI

- Published 1999
- Not as predictive vascular surgery patients
- Uncertain influence of IDDM
- Better measures renal function that serum creatinine

Comparison of 4 Cardiac Risk Calculators in Predicting Postoperative Cardiac Complications After Noncardiac Operations

Steven L. Cohn, MD[a,b,*], and Nerea Fernandez Ros, MD, PhD[c]

The 2014 American College of Cardiology/American Heart Association Perioperative Guidelines suggest using the Revised Cardiac Risk Index, myocardial infarction or cardiac arrest, or American College of Surgeons—National Surgical Quality Improvement Program calculators for combined patient-surgical risk assessment. There are no published data comparing their performance. This study compared these risk calculators and a reconstructed Revised Cardiac Risk Index in predicting postoperative cardiac complications, both during hospitalization and 30 days after operation, in a patient cohort who underwent select surgical procedures in various risk categories. Cardiac complications occurred in 14 of 663 patients (2.1%), of which 11 occurred during hospitalization. Only 3 of 663 patients (0.45%) had a myocardial infarction or cardiac arrest. Because these calculators used different risk factors, different outcomes, and different durations of observation, a true direct comparison is not possible. We found that all 4 risk calculators performed well in the setting they were originally studied but were less accurate when applied in a different manner. In conclusion, all calculators were useful in defining low-risk patients in whom further cardiac testing was unnecessary, and the myocardial infarction or cardiac arrest may be the most reliable in selecting higher risk patients. **© 2017 Elsevier Inc. All rights reserved.** **(Am J Cardiol 2018;121:125–130)**

Risk Calculators

Table 1
Cardiac risk calculators

Revised Cardiac Risk Index[4] (MI/Cardiac Arrest, complete heart block, pulmonary edema **during admission**)	**MI or Cardiac Arrest Calculator (MICA)**[7] (MI/Cardiac Arrest **within 30 days** after surgery)	**ACS NSQIP Surgical Risk Calculator (ACS-SRC)**[8] (MI/Cardiac Arrest **within 30 days** after surgery)
High-risk surgery (3 categories)	**Type of surgery (21 categories)**	**Surgical procedure (CPT codes)**
Ischemic heart disease	**Age**	**Age group**
Congestive heart failure	**Functional status**	**Functional status**
Cerebrovascular disease	**ASA class**	**ASA class**
Renal insufficiency (Cr > 2 mg/dl)	**Renal insufficiency (Cr > 1.5 mg/dl)**	**Acute renal failure**
Diabetes treated with insulin		**Diabetes on oral meds or insulin**
		Dialysis
Reconstructed-RCRI[5] (MI/Cardiac Arrest, complete heart block, pulmonary edema **during admission**)		**Congestive heart failure** (<30 days)
High-risk surgery (3 categories)		**Dyspnea**
Ischemic heart disease		**Smoker (within past year)**
Congestive heart failure		**Severe COPD**
Cerebrovascular disease		**Ventilator dependent**
Renal insufficiency (GFR < 30 cc/min)		**Sepsis (within 48 hours)**
		Disseminated cancer
		Hypertension requiring meds
		Wound class
		Sex
		Steroid use (chronic)
		Ascites (within 30 days)
		BMI class

ACS-SRC = American College of Surgeons surgical risk calculator; ASA = American Society of Anesthesiology; BMI = body mass index; COPD = chronic obstructive pulmonary disease; GFR = glomerular filtration rate; MI = myocardial infarction; MICA = myocardial infarction or cardiac arrest; RCRI = Revised Cardiac Risk Index; R-RCRI = Reconstructed Revised Cardiac Risk Index.

Am J Cardiol 2018;121:125–130

A New Index for Pre-Operative Cardiovascular Evaluation

Habib A. Dakik, MD,[a] Omar Chehab, MD,[a] Mahmoud Eldirani, MD,[a] Eman Sbeity, MD,[b] Cynthia Karam, MD,[c] Ossama Abou Hassan, MD,[a] Mayyas Msheik, MD,[c] Hussein Hassan, BS,[a] Ahmad Msheik, MD,[a] Chris Kaspar, MD,[a] Maha Makki, MS,[d] Hani Tamim, PhD[d]

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ABSTRACT

BACKGROUND Currently used indices for pre-operative cardiovascular evaluation are either powerful, but complex, or simple, but with weak discriminatory power.

OBJECTIVES This study sought to prospectively derive and validate a simple powerful index that can stratify the cardiovascular risk of patients undergoing noncardiac surgery.

METHODS The derivation cohort consisted of 3,284 prospectively enrolled adult patients undergoing noncardiac surgery at the American University of Beirut Medical Center. The validation cohort consisted of 1,167,414 patients registered in the American College of Surgeons National Surgical Quality Improvement Program database. The primary outcome measure was death, myocardial infarction, or stroke at 30 days after surgery.

RESULTS The primary outcome occurred in 38 patients (1.2%) in the derivation cohort. Multivariate logistic regression analysis in the derivation cohort identified 6 data elements to be included in the prediction model: age ≥75 years, history of heart disease, symptoms of angina or dyspnea, hemoglobin <12 mg/dl, vascular surgery, and emergency surgery. Each patient was assigned a Cardiovascular Risk Index (CVRI) of 0, 1, 2, 3, and >3 based on the number of data elements present. The incidence of the primary outcome increased steadily across the CVRI groups in both the derivation (0%, 0.5%, 2.0%, 5.6%, and 15.7%, respectively; $p < 0.0001$) and validation (0.3%, 1.6%, 5.6%, 11.0%, and 17.5%, respectively; $p < 0.0001$) cohorts. The discriminatory power of the new CVRI was further confirmed by constructing a receiver-operating characteristic curve that had an area under the curve of 0.90 in the derivation cohort and 0.82 in the validation dataset.

CONCLUSIONS This study reports a new index for pre-operative cardiovascular evaluation which has a strong discriminatory power that can effectively stratify patients into low- (CVRI 0 to 1), intermediate- (CVRI 2 to 3), and high-risk (CVRI >3) groups. This has important implications for the efficient triage and management of patients scheduled for noncardiac surgery. (J Am Coll Cardiol 2019;73:3067–78) © 2019 by the American College of Cardiology Foundation.

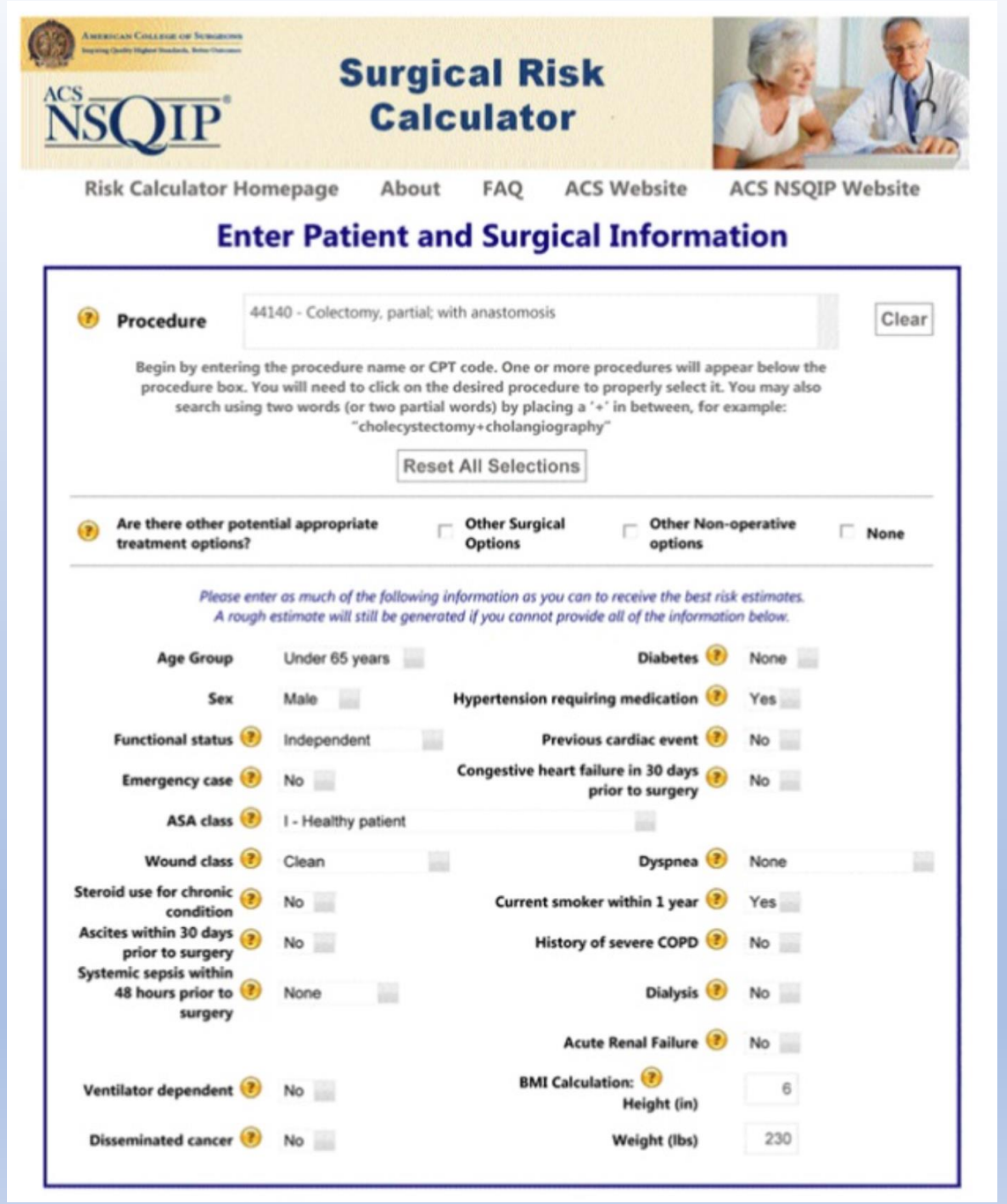
AUB-POCES study
American University of Beirut–Pre-Operative Cardiovascular Evaluation Study

The American University of Beirut Pre-Operative Cardiovascular Evaluation Study prospectively derived and validated a new preoperative cardiovascular risk index, referred to as **CVRI**.

Six risk factors were identified in multivariate analysis:

- age ≥75 years,
- hemoglobin <12 mg/dL,
- history of heart disease,
- symptoms of angina or dyspnea,
- **vascular surgery, and**
- **emergency surgery**

NSQIP Online
- Periodic changes



Cardiac Risk

Cardiac	Risk Scoring System
RCRI	https://www.mdcalc.com/revised-cardiac-risk-index-pre-operative-risk
NSQIP	Http://riskcalculator.facs.org/RiskCalculator/PatientInfo.jsp
Gupta MICA	http://www.surgicalriskcalculator.com/miorcardiacarrest
VSGNE	https://qxmd.com/vascular-study-group-new-england-decision-support-tools

Gupta MICA

- Type of surgery
- Dependent functional status
- Abnormal creatinine, > 1.5 mg/dL
- ASA Class
- Age

Preoperative Cardiac Risk Calculators

- RCRI still standard but perhaps would use another calculator for vascular surgery:
  - Can use MICA, NSQIP, VSGNE CRI, AUB-POCES CRI
  - Note the RCRI indicators:
    - Insulin requiring DM (development several antidiabetic medications since 1999)
    - Creatinine > 2.0 (Perhaps eGFR or eCr Cl is more precise)
- Expect online calculators to become the standard
  - Value of being surgery specific, however
  - Most are not validated
  - NSQIP is adjusted periodically

Other Preoperative Risk Calculators

Pulmonary Complications

- Gupta Pneumonia
- Gupta Respiratory Failure
- ARISCAT Respiratory Failure
- STOPBANG Extended

Perioperative Pulmonary Risk Calculators

Gupta Pneumonia Risk	**http://www.surgicalriskcalculator.com/postoperative-pneumonia-risk-calculator**
Gupta Respiratory Failure Risk	http://www.surgicalriskcalculator.com/prf-risk-calculator
Ariscat Postoperative Pulmonary Complications	https://www.mdcalc.com/ariscat-score-postoperative-pulmonary-complications

Preoperative OSA/OHS Screening

Enhanced STOP-Bang questionnaire [1-3]

❑ Yes	❑ No	**Snoring?** Do you **snore loudly** (loud enough to be heard through closed doors, or your bed partner elbows you for snoring at night)?
❑ Yes	❑ No	**Tired?** Do you often feel **tired, fatigued, or sleepy** during the daytime (such as falling asleep during driving or talking to someone)?
❑ Yes	❑ No	**Observed?** Has anyone **observed** you **stop breathing** or **choking/gasping** during your sleep?
❑ Yes	❑ No	**Pressure?** Do you have or are being treated for **high blood pressure**?
❑ Yes	❑ No	**Body mass index more than 35 kg/m^2?**
❑ Yes	❑ No	**Age older than 50 years old?**
❑ Yes	❑ No	**Neck size large? (measured around Adam's apple)** For male, is your shirt collar 17 inches/43 cm or larger? For female, is your shirt collar 16 inches/41 cm or larger?
❑ Yes	❑ No	**Gender = Male?**

Scoring criteria:

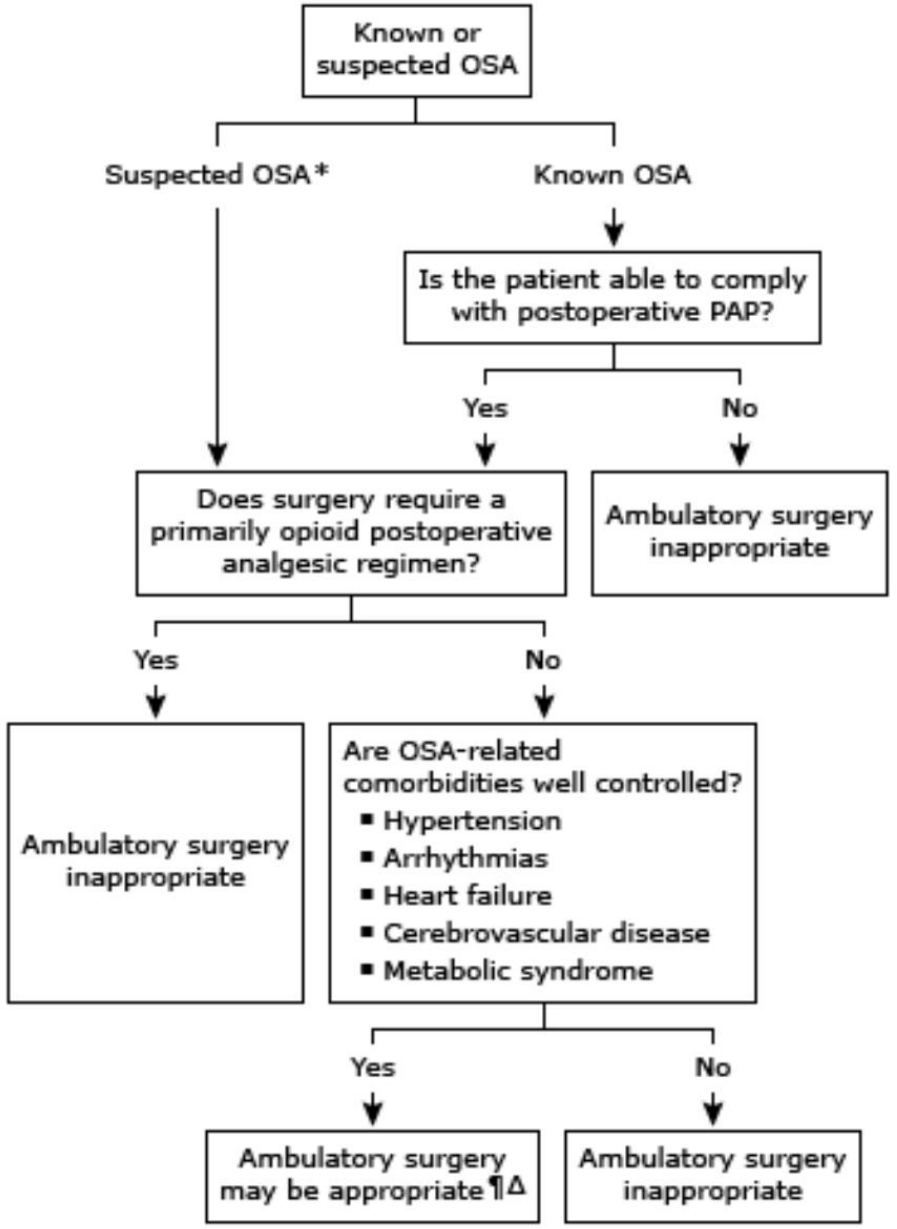
Low risk of OSA: Yes to 0 to 2 questions

Intermediate risk of OSA: Yes to 3 to 4 questions

High risk of OSA: Yes to 5 to 8 questions
or Yes to 2 or more of 4 STOP questions + male gender
or Yes to 2 or more of 4 STOP questions + BMI >35kg/m^2
or Yes to 2 or more of 4 STOP questions + neck circumference 17 inches/43 cm in male or 16 inches/41 cm in female

OSA/OHS Algorithm

Ambulatory versus inpatient surgery for patients with known OSA or suspected OSA



STOP-Bang questionnaire (enhanced)

STOP:
- Snoring loudly
- Tiredness during the day
- Observed stopped breathing or choking/gasping during sleep
- High blood pressure

Bang:
- BMI >35 kg/m^2
- Age >50 years
- Neck circumference ≥17 inches in males, ≥16 inches in females
- Gender male

Scoring:
- OSA low risk:
  - Yes to 0 to 2 questions
- OSA intermediate risk:
  - Yes to 3 or 4 questions
- OSA high risk:
  - Yes to ≥5 questions
  - OR Yes to ≥2 STOP + gender male
  - OR yes to ≥2 STOP + BMI >35 kg/m^2
  - OR yes to ≥2 STOP + neck circumference ≥17 inches in males, ≥16 inches in females

Frailty & Cognition: Perioperative Impact

Frailty

Frailty, the loss of resilience with increased vulnerability to stressors, is independently associated with

- greater risk for postoperative complications,
- increased length of hospital stay, and
- greater likelihood of being discharged being dependent for care.

Frailty Calculators

Radiologic Tools Frailty British J Anes 2019 Bentov

Frailty tool	Type	Time to administer	Tool components	Frailty definition	Advantages	Disadvantages
Fried frailty phenotype	observational	5-10 min	Weight loss, exhaustion, weakness, gait, low physical activity.	1–2 = pre-frail, 3 or more = frail	Extensively validated, predictive of outcomes, can be extracted from a health questionnaire.	Requires special equipment and patient participation.
Frailty index	self-reported	20-30 min	Accumulated symptoms, signs, diseases, and disabilities.	A dimensionless fraction with cut-off greater than ~0.25	validated, predictive.	Requires a long time to complete.
Modified frailty index	self-reported	10-15 min	List of co-morbidities and conditions.	Similar to frailty Index.	Shorter than frailty index.	Not as reliable/ predictive as frailty index.
FRAIL scale	self-reported	5-10 min	Fatigue, resistance, ambulation, illness and loss of weight.	1–2 = pre-frail, 3 or more = frail	Simple, no training needed to administer.	Needs to be further validated.
Risk analysis index	self-reported	5-10 min	Age/cancer, co-morbidities, residence, ADLs, cognitive decline	Composite score of 0 to 81, cut-off greater than 16–21	Simple, performed by clinical staff	most questions are part of standard nursing interviews
VESPA (short form)	self-reported	10 min	Gender, ADLs, functional status, charlson comorbidity index, surgical complexity.	A dimensionless fraction with cut-off greater than ~0.25	Simple, performed by physician assistants	modest sensitivity for postoperative complications.
Edmonton frailty scale	observational/ self-reported	10-15 min	Cognition, hospitalisation, general health, independence, social support, medication, nutrition, mood, continence, timed up and go.	Composite score ≥ 8 out of 17 = frail	App available for tablet or phone.	Older adults may not be familiar or comfortable with tablet/phone.
Clinical frail scale	observational	< 5 min	Clinical descriptors and pictographs.	≥ 5 out of 9 = frail	Simple, accompanied by a visual chart.	Gestalt, unclear reliability.
ACS NSQIP	electronic health record	5-10 min	Demographics, symptoms, diseases, conditions.	Provides predicted 30 days mortality and complications	Based on very large database, highly predictive.	Limited to 30 days outcomes.

Fig 2. Commonly used clinical tools to assess frailty. Clinical modalities that are commonly used to assess frailty in the preoperative population. Tools are different in the type of data components that are collected and the definition of frailty, which leads to different time burdens to administer the tool. For a more comprehensive description, please see main article. ACS NSQIP, American College of Surgeons National Surgical Quality Improvement Program; ADL, activities of daily living; FRAIL, Fatigue, Resistance, Ambulation, Illnesses, and Loss of Weight; VESPA, Vulnerable Elders Surgical Pathways and Outcomes Assessment.

Impact of Frailty

mFrailty Index 11
NSQIP
2018 study

The American Journal of Surgery 218 (2019) 393–400

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Impact of frailty on outcomes in surgical patients: A systematic review and meta-analysis

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ABSTRACT

Importance: Age has historically been used to predict negative post-surgical outcomes. The concept of frailty was introduced to explain the discrepancies that exist between patients' chronological and physiological age. The efficacy of the modified frailty index (mFI) to predict surgical risk is not clear.
Objective: We sought to synthesize the current literature to quantify the impact of frailty as a prognostic indicator across all surgical specialties.
Data sources: Pubmed and Cochrane databases were screened from inception to 1 January 2018.
Study selection: Studies utilizing the modified Frailty Index (mFI) as a post-operative indicator of any type of surgery. The mFI was selected based on a preliminary search showing it to be the most commonly applied index in surgical cohorts.
Data extraction and synthesis: Articles were selected via a two-stage process undertaken by two reviewers (AP and DS). Statistical analysis was performed in Revman (Review manager V5.3). The random-effects model was used to calculate the Risk Ratios (RR).
Main outcome(s) and measure(s): The primary outcomes: post-operative complications, re-admission, re-operation, discharge to a skilled care facility, and mortality.
Results: This meta-analysis of 16 studies randomizes 683,487 patients, 444,885 frail, from gastrointestinal, vascular, orthopedic, urogenital, head and neck, emergency, neurological, oncological, cardiothoracic, as well as general surgery cohorts. Frail patients were more likely to experience complications (RR 1.48, 95%CI 1.35–1.61; $p < 0.001$), major complications (RR 2.03, 95%CI 1.26–3.29; $p = 0.004$), and wound complications (RR 1.52, 95%CI 1.47–1.57; $p < 0.001$). Furthermore, frail patients had higher risk of readmission (RR 1.61, 95%CI 1.44–1.80; $p < 0.001$) and discharge to skilled care (RR 2.15, 95%CI 1.92–2.40; $p < 0.001$). Notably, the risk of mortality was 4.19 times more likely in frail patients (95% CI 2.96–5.92; $p < 0.001$).
Conclusions: and Relevance: This study is the first to synthesize the evidence across multiple surgical specialties and demonstrates that the mFI is an underappreciated prognostic indicator that strongly correlates with the risk of post-surgical morbidity and mortality. This supports that formal incorporation of pre-operative frailty assessment improves surgical decision-making.

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Table 1
Examples of factors included in the geriatric preoperative assessment

Domain	Assessment	Follow-up/Implications of Low Scores
Cognition	Mini-Cog: clock draw and 3-item recall Montreal Cognitive Assessment	Delirium risk Decision-making potential Increased risk of nonhospital discharge Increased length of stay
Behavioral	Alcohol history Depression screening	Delirium risk Quality of life Decision making
Function	ADL Instruments ADL Timed up and go Walking speed	Increased risk of postoperative complications Increased mortality Delirium Preoperative exercise: prehabilitation opportunity
Polypharmacy	Medication list Screen for inappropriate medications	Delirium Readmission Morbidity/mortality
Nutrition	Albumin/prealbumin levels Mini–nutritional short form assessment	Preoperative nutrition supplements Increased risk of postoperative complications
Frailty	Phenotype: weight loss/grip strength/exhaustion/gait speed/low physical activity	Preoperative nutrition supplements Increased risk of postoperative complications Prehabilitation opportunity Treatment decisions

Abbreviation: ADL, activities of daily living.

Adapted from Sattar S, Alibhai SM, Wildiers H, et al. How to implement a geriatric assessment in your clinical practice. Oncologist 2014;19(10):1058–1059; and Feldman LS, Carli F. From preoperative assessment to preoperative optimization of frailty. JAMA Surg 2018;153(5):e180213; with permission.

Modified Frailty Index – 11 (NSQIP)

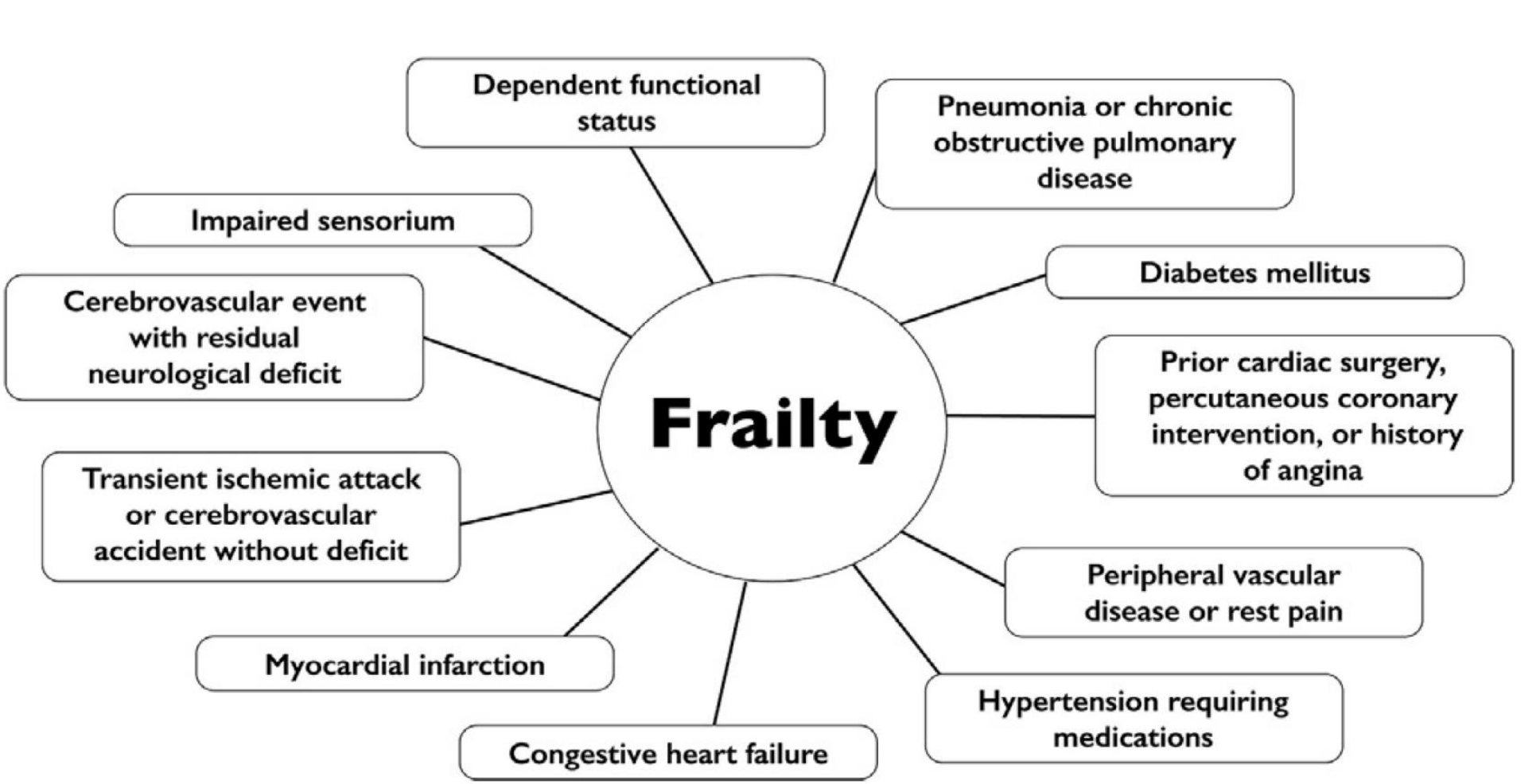

Fig. 1. The eleven mFI variables.

New 5-Factor Modified Frailty Index Using American College of Surgeons NSQIP Data

BACKGROUND: The modified frailty index (mFI-11) is a NSQIP-based 11-factor index that has been proven to adequately reflect frailty and predict mortality and morbidity. These 11 factors, made of 16 variables, map to the original 70-item Canada Study of Health and Aging Frailty Index. In past years, certain NSQIP variables have been removed from the database; as of 2015, only 5 of the original 11 factors remained. The predictive power and usefulness of these 5 factors in an index (mFI-5) have not been proven in past literature. The goal of our study was to compare the mFI-5 to the mFI-11 in terms of value and predictive ability for mortality, postoperative infection, and unplanned 30-day readmission.

STUDY DESIGN: The mFI was calculated by dividing the number of factors present for a patient by the number of available factors for which there were no missing data. Spearman's rho was used to assess correlation between the mFI-5 and mFI-11. Predictive models, using both unadjusted and adjusted logistic regressions, were created for each outcome for 9 surgical subspecialties using 2012 NSQIP data, the last year all mFI-11 variables existed.

RESULTS: Correlation between the mFI-5 and mFI-11 was above 0.9 across all surgical specialties except for cardiac and vascular surgery. Adjusted and unadjusted models showed similar c-statistics for mFI-5 and mFI-11, and strong predictive ability for mortality and postoperative complications.

CONCLUSIONS: The mFI-5 and the mFI-11 are equally effective predictors in all sub-specialties and the mFI-5 is a strong predictor of mortality and postoperative complications. It has credibility for future use to study frailty within the NSQIP database. It also has potential in other databases and for clinical use. (J Am Coll Surg 2018;226:173–182. © 2017 Published by Elsevier Inc. on behalf of the American College of Surgeons.)

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Modified Frailty Index (NSQIP)

mFI-11

1. Diabetes mellitus
2. Functional status (Not independent)
3. COPD or Pneumonia
4. CHF
5. Hypertension on medications
6. Myocardial Infarction
7. Prior Percutaneous Coronary Procedure or Angina
8. Peripheral Vascular Disease
9. Impaired Sensorium
10. TIA or CVA
11. Neurologic Deficit after prior CVA

mFI-5 (Changed in 2015)

1 DM (either IDDM, or NIDDM)

2 Partially or Totally dependent functional status

3 COPD or Pneumonia

4 Congestive Heart Failure within 30 days

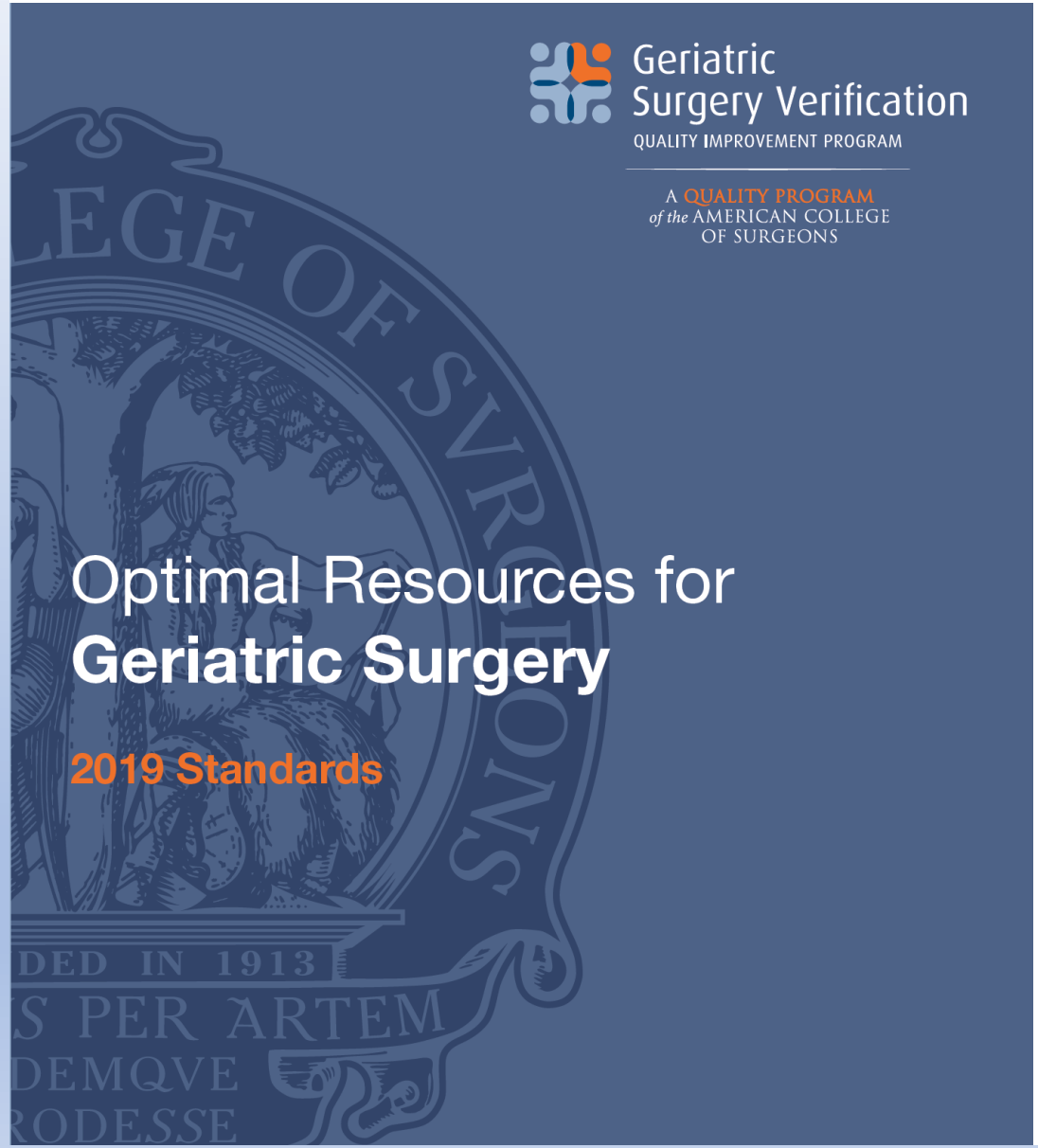
5 HTN requiring medication

Geriatric Surgery Quality Improvement Program

Patients with dementia were found to have a higher incidence of several postoperative complications:

- acute renal failure (OR 1.32, 95% CI 1.19–1.47),
- pneumonia (OR = 2.18, 95% CI 1.69–1.92),
- septicemia (OR = 1.8, 95% CI 1.69–1.92),
- stroke (OR = 1.51, 95% CI 1.43–1.6), and
- urinary tract infection (OR = 1.62, 95% CI 1.5–1.74).

5.6 Geriatric Vulnerability Screens



Definition and Requirements

Patients must be screened for the following high-risk characteristics to identify potential areas of vulnerability:

- Age ≥ 85 years
- Impaired cognition
- Delirium risk
- Impaired functional status
- Impaired mobility
- Malnutrition
- Difficulty swallowing
- Need for palliative care assessment

A positive screen in any category will designate the patient as "high risk."

In **elective** settings, the screening must be conducted prior to the operation to allow for time to address identified positive screens.

In **non-elective** settings, the screening must be conducted prior to the operation,* if possible, to flag areas of vulnerability that must be addressed within the 48-hour postoperative window, or as soon as is clinically appropriate.

**Often, the clinical situation will not allow for the completion of some or all preoperative vulnerability screens (for example, the patient cannot perform a mobility screen because they are immobilized due to a hip fracture). In these situations, information must be gathered from the patient, his or her family, or caregiver as appropriate.*

Geriatric Surgery Program Preop Assessment (ACS)

- Assess **cognitive** ability and capacity to understand anticipated surgery
- Screen for **depression**
- Identify risk factors for postoperative **delirium**
- Screen **for alcohol and substance abuse**/dependence
- Perform **preoperative cardiac evaluation** according to 2014 ACC Guideline
- Identify **risk factors for postoperative pulmonary** complications
- Document **functional** status and history of **falls**
- Determine **frailty** score
- Assess patient's **nutritional** status
- Take an accurate and detailed **medication history** and consider adjustments for **polypharmacy**
- Determine patient's **family** and **social support system**
- Order appropriate preoperative diagnostic tests focused on the elderly
- Determine patient's **treatment goals and expectations**

Geriatric American College of Surgeons

ASSESSING BASELINE AND CURRENT FUNCTIONAL STATUS IN AMBULATORY PATIENTS

Short Simple Screening Test for Functional Assessment[21,85]

Ask the patient the following four questions:

1. *Can you get out of bed or chair yourself?*
2. *Can you dress and bathe yourself?*
3. *Can you make your own meals?*
4. *Can you do your own shopping?*

Interpretation of Functional Screening Test

- If NO to any of these questions, more in-depth evaluation should be performed, including full screening of ADLs and IADLs.
- Deficits should be documented and may prompt perioperative interventions (for example, referral to occupational therapy and/or physical therapy) and proactive discharge planning.

NOTE: Patient's responses may not be reliable in the presence of cognitive impairment or dementia.

Document deficits in vision, hearing, or swallowing.

Inquire about history of falls ("*Have you fallen in the past year*?").

Evaluate the patient for limitations in gait and mobility and determine risk for falls.

ASSESSING GAIT AND MOBILITY IMPAIRMENT AND FALL RISK IN AMBULATORY PATIENTS

Timed Up and Go Test (TUGT)[86-88]

Patients should sit in a standard armchair with a line 10 feet in length in front of the chair. They should use standard footwear and walking aids and should not receive any assistance.

Have the patient perform the following commands:

1. Rise from the chair (if possible, without using the armrests)
2. Walk to the line on the floor (10 feet)
3. Turn
4. Return to the chair
5. Sit down again

Interpretation of TUGT

Any person demonstrating difficulty rising from the chair or requiring more than 15 seconds to complete the test is at high risk for falls. Consider preoperative referral to physical therapy for more detailed gait assessment.

Frailty Criteria

- Shrinkage (Weight Loss)
- Weakness
- Exhaustion
- Low Physical Activity
- Slowness

Preoperative frailty assessment

Frailty criteria	Assessment	Score	Points
Shrinkage	Ask the patient: Have you unintentionally lost ≥10 lbs in the past year? **Yes / No**	*If **Yes**, add 1 point*	
Weakness (grip strength)	1. Ask the patient to hold dynamometer in dominant hand with arms parallel to their body without squeezing arms against their body. 2. Adjust the handle to ensure that the middle phalanx rests on the inner handle. 3. Ask the patient to squeeze the handle and record. 4. Perform three trials, and obtain the average value. Record results below: Trial 1: _____ kg force Trial 2: _____ kg force Trial 3: _____ kg force **Average:** _____ kg force	Compare patient's average with the lowest 20th percentile by gender and BMI shown below: **Men** – **BMI** / **Kg force**: ≤24 / ≤29; 24.1 to 26 / ≤30; 26.1 to 28 / ≤31; >28 / ≤32 **Women** – **BMI** / **Kg force**: ≤23 / ≤17; 23.1 to 26 / ≤17.3; 26.1 to 29 / ≤18; >29 / ≤21 *Add 1 point* if the **average** falls within or below the above values	
Exhaustion	Ask the patient the following two questions: 1. How often in the last week did you feel that everything you did was an effort? _____ 2. How often in the last week did you feel that you could not get going? _____	**0**: Rarely or none of the time (<1 day) **1**: Some or a little of the time (1 to 2 days) **2**: Moderate amount of the time (3 to 4 days) **3**: Most of the time (>4 days) *Add 1 point* for a score of 2 or 3 for EITHER question	
Low physical activity	Ask the patient the following four questions: 1. Can you get out of bed or chair yourself? **Yes / No** 2. Can you dress and bathe yourself? **Yes / No** 3. Can you make your own meals? **Yes / No** 4. Can you do your own shopping? **Yes / No**	*Add 1 point* for any **No** answer	
Slowness	1. Ask the patient to stand up and walk toward the tape on the ground. 2. Using a stopwatch, record the time it takes for the patient to walk 15 feet. Record results below: Trial: _____ seconds	**Men** – **Height** / **Time**: ≤173 cm / ≥7 seconds; >173 cm / ≥6 seconds **Women** – **Height** / **Time**: ≤159 cm / ≥7 seconds; >159 cm / ≥6 seconds *Add 1 point* if the trial time falls higher than the above values	
Frailty score:			

Total the **number of points for each criterion** (the total should be 0 to 5) to determine the frailty score.

- 0 to 1: Not frail
- 2 to 3: Intermediate (pre-frail)
- 4 to 5: Frail

If the patient is in the intermediate frail or frail categories, please notify the surgeon.

BMI: body mass index.

Adapted from:

1. *Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001; 56:M146.*
2. *Frailty. In: Geriatrics Evaluation & Management Tools: Clinical Templates to Support Clinicians and Systems that are Caring for Older Adults, American Geriatrics Society, New York 2013.*

UpToDate®

ACS Geriatric Program: Cognition

COGNITIVE ASSESSMENT: MINI-COG

Mini-Cog: 3 Item Recall and Clock Draw[19]

1. GET THE PATIENT'S ATTENTION, THEN SAY:

"*I am going to say three words that I want you to remember now and later. The words are* **Banana** **Sunrise** **Chair**

Please say them for me now."

Give the patient 3 tries to repeat the words. If unable after 3 tries, go to next item.

2. SAY ALL THE FOLLOWING PHRASES IN THE ORDER INDICATED:

"*Please draw a clock in the space below. Start by drawing a large circle. Put all the numbers in the circle and set the hands to show 11:10 (10 past 11).*"

If subject has not finished clock drawing in 3 minutes, discontinue and ask for recall items.

3. SAY: "*What were the three words I asked you to remember?*"

ACS Geriatric Program: Cognition

Interpretation of the Mini-Cog

SCORING:

3 item recall (0-3 points):	1 point for each correct word
Clock draw (0 or 2 points):	0 points for abnormal clock 2 points for normal clock

A NORMAL CLOCK HAS ALL OF THE FOLLOWING ELEMENTS:

All numbers 1–12, each only once, are present in the correct order and direction (clockwise) inside the circle.

Two hands are present, one pointing to 11 and one pointing to 2.

ANY CLOCK MISSING ANY OF THESE ELEMENTS IS SCORED ABNORMAL.
REFUSAL TO DRAW A CLOCK IS SCORED ABNORMAL.

Total Score of 0, 1, or 2 suggests possible impairment.

Total Score of 3, 4, or 5 suggests no impairment.

If the patient has evidence of cognitive impairment on the Mini-Cog, consider a referral to a primary care physician, geriatrician, or mental health specialist.[20,21]

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Mini-Cog

- Cognitive impairment can be quickly assessed by several validated screening tools, one of which is the **Mini-Cog**, which consists of a

  three-item recall and

  clock drawing exercise.

- The Mini-Cog has low inter-observer variability and has been **validated in the geriatric surgery population**

Scoring the Mini-Cog©

The Mini-Cog© is scored in two parts: 1) 3-item recall, and 2) clock drawing. These are added together for a total score.

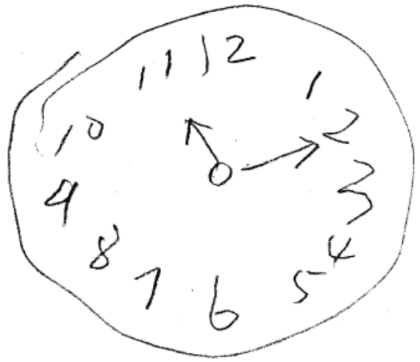
3-Item Recall Score:

1 point for each word recalled without cues, for a 3-item recall score of 1, 2, or 3.

Clock Drawing Score:

2 points for a normal clock or 0 (zero) points for an abnormal clock drawing. A normal clock must include all numbers (1-12), each only once, in the correct order and direction (clockwise). There must also be two hands present, one pointing to the 11 and one pointing to 2. Hand length is not scored in the Mini-Cog© algorithm.

Normal Clock



Abnormal Clock

(abnormal hands)

Abnormal Clock

(missing number)

Preoperative Screening Tools

- Cardiac
  - Revised Cardiac Risk Index (RCRI)
  - Reconstructed RCRI
  - National Surgical Quality Improvement Program (NSQIP)
  - Gupta Myocardial Infarction-Cardiac Arrest Index (MICA)
  - AUB-POCES (CVRI)
- Pulmonary
  - Gupta Pneumonia Risk Index
  - Gupta Respiratory Failure Index
  - ARISCAT (Respiratory Failure)
  - STOPBANG
- Frailty
  - Cognition
  - Functional Status
  - Nutritional status

Which of the following cardiac risk indices does the 2014 American College of Cardiology guideline recommend using?

A. Revised Cardiac Risk Index
B. Gupta Myocardial Infarction-Cardiac Arrest Index
C. NSQIP American College of Surgeons
D. Either A or B
E. Either A or C

According to the 2014 American College of Cardiology guideline on preoperative cardiac risk assessment, it is reasonable to consider preoperative stress testing if the patient has poor or unknown functional status and the risk of a major adverse cardiac event is:

A. > 1%
B. > 2%
C. > 3%
D. > 4%