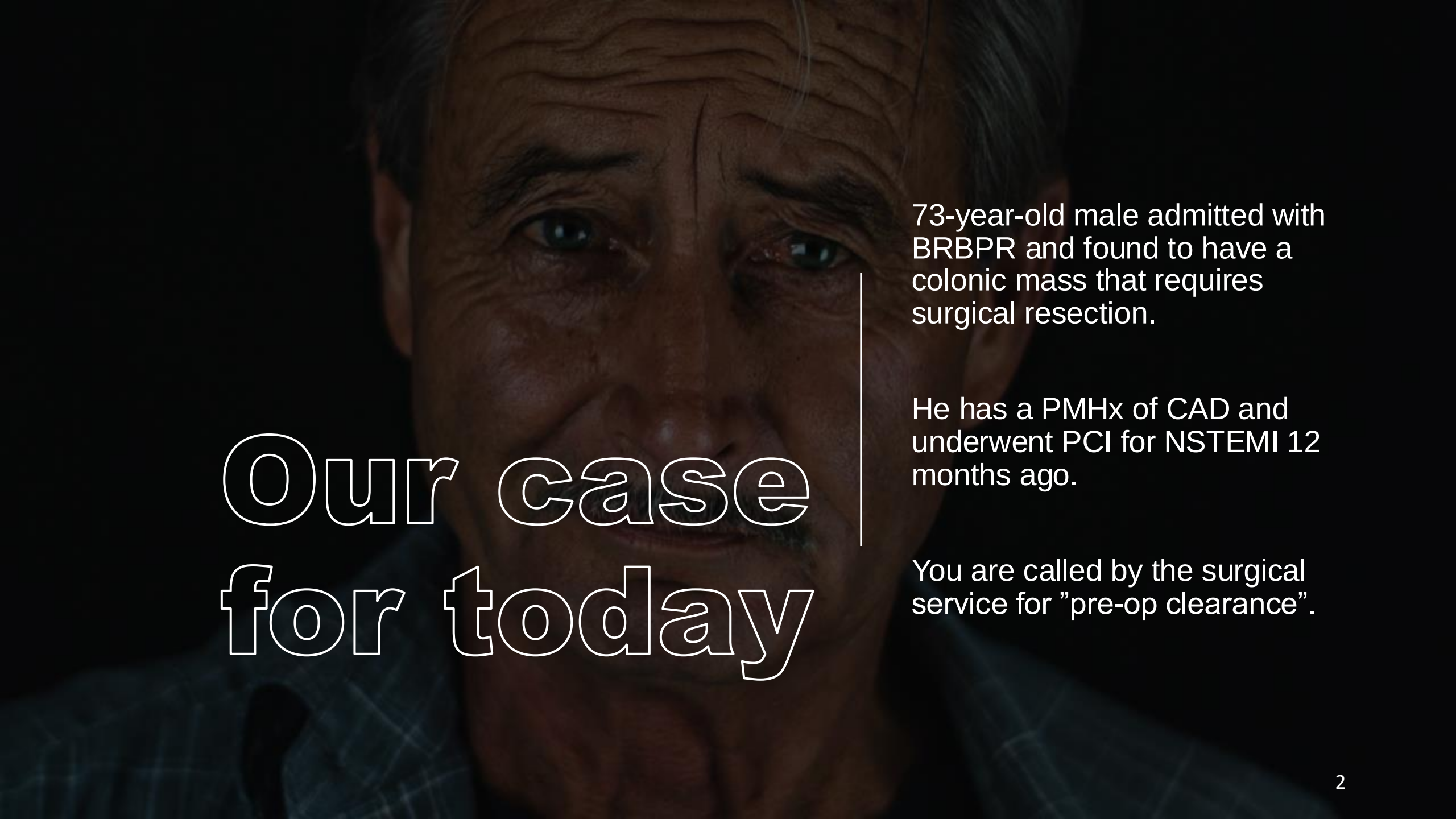
PERIOPERATIVE CARDIAC EVALUATION

Niteesh K. Choudhry, MD, PhD



Our case for today

73-year-old male admitted with BRBPR and found to have a colonic mass that requires surgical resection.

He has a PMHx of CAD and underwent PCI for NSTEMI 12 months ago.

You are called by the surgical service for ”pre-op clearance”.

GOALS:

1. Assess risk of cardiac morbidity/mortality → IF LOW, PROCEED TO THE OR; IF NOT LOW, WILL TESTING HELP?

2. Determine if other perioperative "optimization" is required → SHOULD I START A BETA-BLOCKER OR ANOTHER DRUG??

3. Manage other conditions (e.g., periop pulmonary assessment, anticoagulation, diabetes) → we will not discuss in detail today


HOW DO YOU ASSESS CARDIAC RISK?

THERE ARE NUMEROUS CARDIAC RISK ASSESSMENT SCALES

RCRI: REVISED [GOLDMAN] CARDIAC RISK INDEX

- history of heart disease
- history of compensated or prior heart failure
- history of cerebrovascular disease
- diabetes mellitus (on insulin)
- renal insufficiency (Cr > 2)
- high risk surgeries: intrathoracic, intraabdominal, or supra-inguinal vascular

PREDICTS CORONARY EVENTS AND DEATH
LOW RISK = 0 OR 1

SOURCE: Lee et al. Circ 1999; 100: 1043; Gupta et al. Circ 2011; 124: 381; J Am Coll Cardio 2019; 73: 3067

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PREDICTS CORONARY EVENTS AND DEATH
LOW RISK = 0 OR 1

MICA [MI or Cardiac Arrest]- NSQIP

- type of surgery
- dependent functional status (totally independent, partially dependent, totally dependent)
- abnormal creatinine (Cr ≥ 1.5)
- ASA class
- age

HIGHER ACCURACY THAN RCRI BUT MORE COMPLICATED

SOURCE: Lee et al. Circ 1999; 100: 1043; Gupta et al. Circ 2011; 124: 381; J Am Coll Cardio 2019; 73: 3067

THERE ARE NUMEROUS CARDIAC RISK ASSESSMENT SCALES

RCRI: REVISED [GOLDMAN] CARDIAC RISK INDEX	MICA [MI or Cardiac Arrest]- NSQIP	CVRI*: Cardiovascular Risk Index
• history of heart disease • history of compensated or prior heart failure • history of cerebrovascular disease • diabetes mellitus (on insulin) • renal insufficiency (Cr > 2) • high risk surgeries: intrathoracic, intraabdominal, or supra-inguinal vascular	• type of surgery • dependent functional status (totally independent, partially dependent, totally dependent) • abnormal creatinine (Cr ≥ 1.5) • ASA class • age	• age ≥ 75 • history of heart disease • angina or dyspnea • hemoglobin < 12 • vascular surgery • emergency surgery
PREDICTS CORONARY EVENTS AND DEATH LOW RISK = 0 OR 1	HIGHER ACCURACY THAN RCRI BUT MORE COMPLICATED	HIGHER ACCURACY THAN RCRI; EASY TO USE; SOME EXTERNAL VALIDATION

SOURCE: Lee et al. Circ 1999; 100: 1043; Gupta et al. Circ 2011; 124: 381; J Am Coll Cardio 2019; 73: 3067
*also called the American University of Beirut (AUB)-HAS2 Cardiovascular Risk Index

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LOW RISK = 0 OR 1

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HIGHER ACCURACY THAN RCRI

CVRI*: Cardiovascular Risk Index

- age ≥ 75
- history of heart disease
- angina or dyspnea
- hemoglobin < 12
- vascular surgery
- emergency surgery

HIGHER ACCURACY THAN RCRI; EASY TO USE; SOME EXTERNAL VALIDATION

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THE APPROACH

LOW CARDIAC RISK

(≤ 1%)

No further testing

THE APPROACH

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(≤ 1%)

No further testing

NOT LOW CARDIAC RISK

(> 1%)

Gather more information

(functional capacity; BNP)

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He has a PMHx of CAD and underwent PCI for NSTEMI 12 months ago.

You are called by the surgical service for ”pre-op clearance”.

RCRI = 2 (or more)

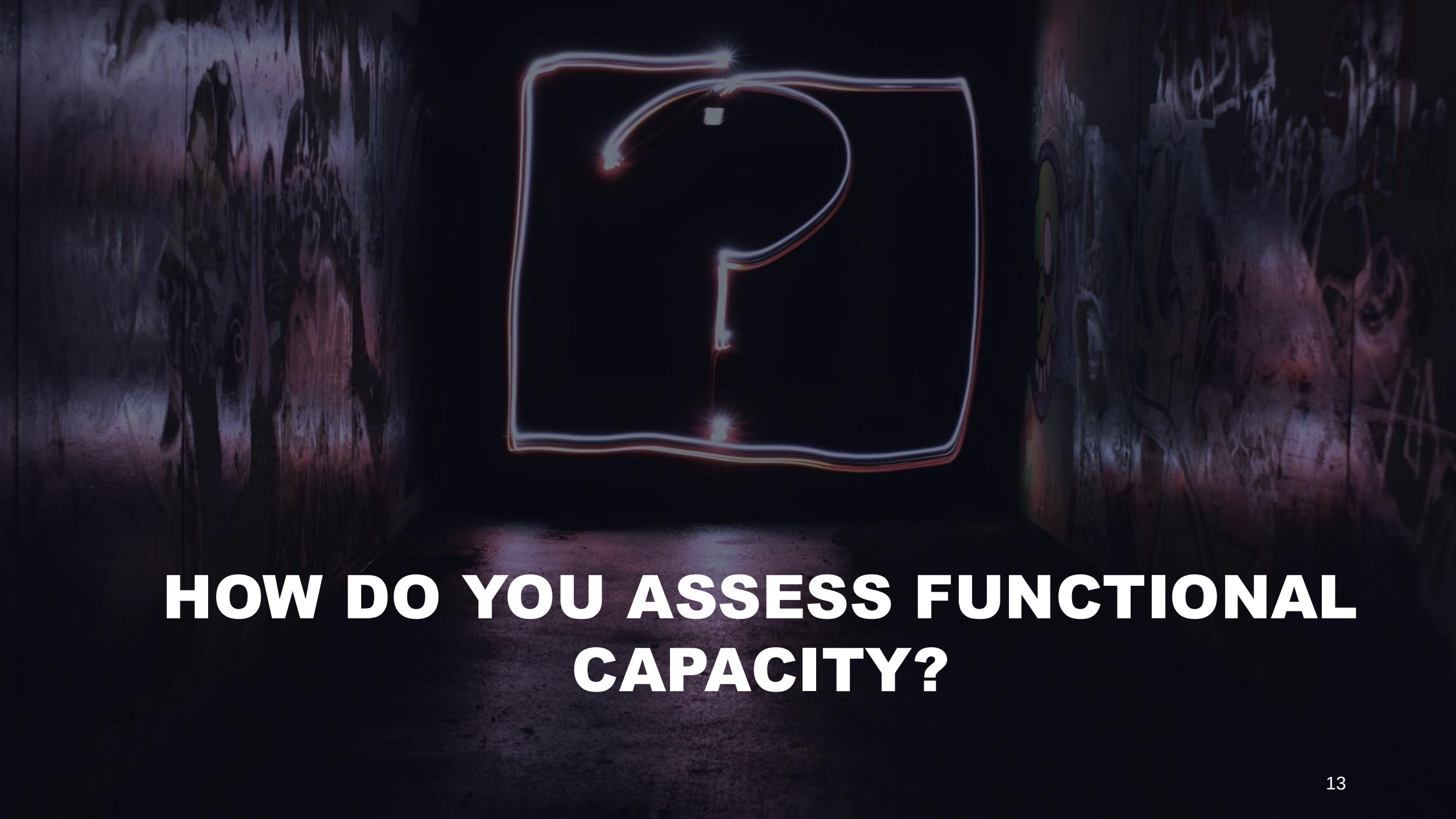
THE APPROACH

LOW RISK
(≤ 1%)

No further testing

NOT LOW RISK
(> 1%)

Gather more information
(functional capacity; BNP)

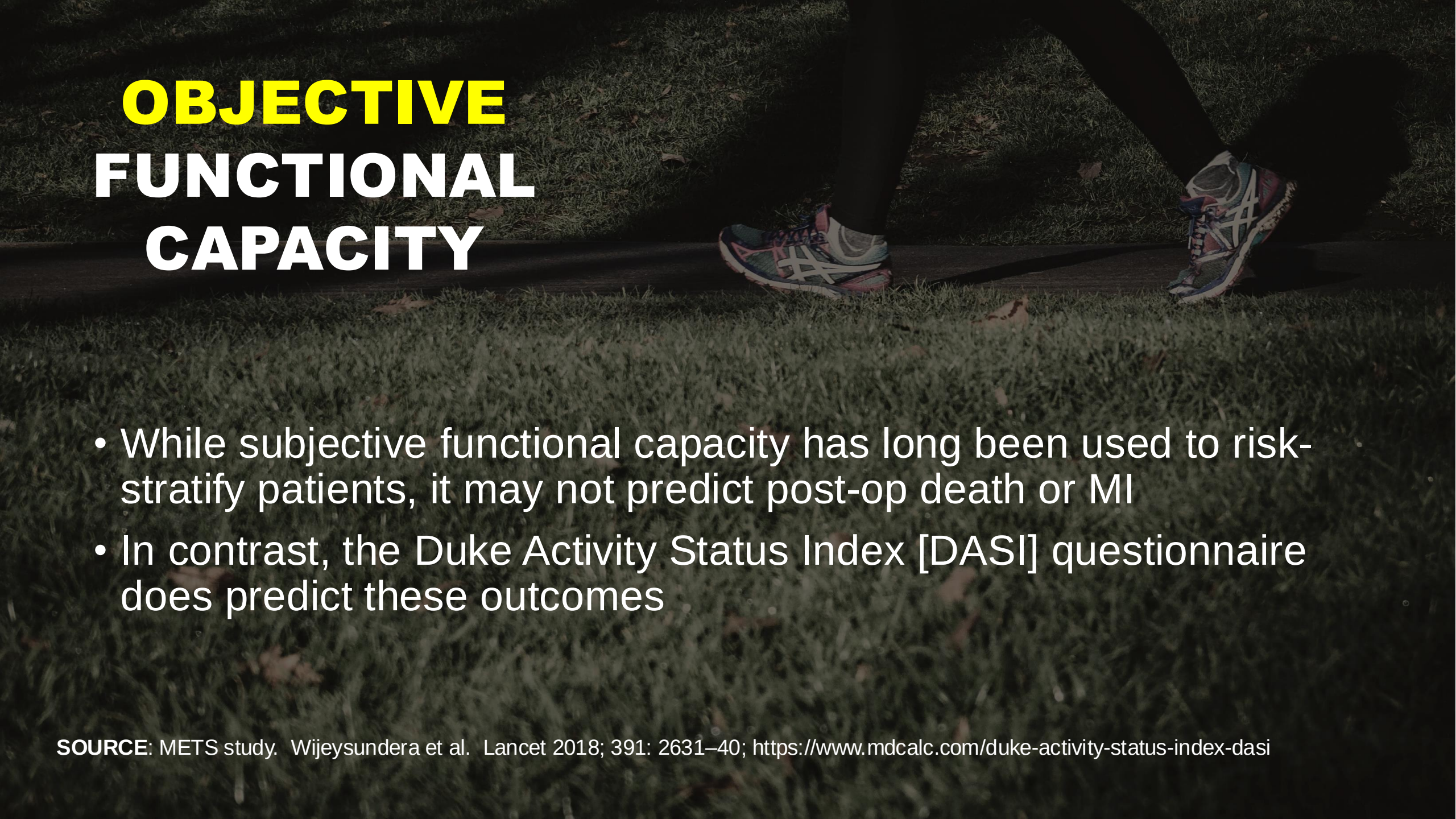


HOW DO YOU ASSESS FUNCTIONAL CAPACITY?

SUBJECTIVE FUNCTIONAL CAPACITY

	Can you...
1 MET	Take care of yourself?
	Eat, dress, or use the toilet?
	Walk indoors around the house?
	Walk a block or 2 on level ground at 2 to 3 mph (3.2 to 4.8 kph)?
4 METs	Do light work around the house like dusting or washing dishes?

	Can you...
4 METs	Climb a flight of stairs or walk up a hill?
	Walk on level ground at 4 mph (6.4 kph)?
	Run a short distance?
	Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?
	Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?
Greater than 10 METs	Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?



OBJECTIVE FUNCTIONAL CAPACITY

- While subjective functional capacity has long been used to risk-stratify patients, it may not predict post-op death or MI
- In contrast, the Duke Activity Status Index [DASI] questionnaire does predict these outcomes

SOURCE: METS study. Wijeysundera et al. Lancet 2018; 391: 2631–40; https://www.mdcalc.com/duke-activity-status-index-dasi

DUKE ACTIVITY STATUS INDEX QUESTIONNAIRE

Activity	Weight
Can you...	
1. Take care of yourself, that is, eating, dressing, bathing or using the toilet?	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 a hill?	5.50
5. Run a short distance?	8.00
6. Do light work around the house like dusting or washing dishes?	2.70
7. Do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?	3.50
8. Do heavy work around the house like scrubbing floors, or lifting or moving heavy furniture?	8.00
9. Do yardwork like raking leaves, weeding or pushing a power mower?	4.50
10. Have sexual relations?	5.25
11. Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	6.00
12. Participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?	7.50

- **Total DASI score: _____**
- **METs [(DASI score × 0.43) + 9.6] / 3.5: _____**

DASI of 11 ~ 4 METS

SOURCE: Hlatky MA, et al. Am J Cardiol 1989; 64: 651.

BNP

- Also appears to predict death or myocardial injury
  - 30d risk of death or MI for patients with NT BNP > 300 c.f. was 21.8% compared with 4.9% for those < 300

- Canadian Cardiovascular Society recommends enhanced post-operative **monitoring** if BNP is high pre-op

SOURCE: JACC 2014; 63: 170-190; Canadian Journal of Cardiology 2017; 33: 17-32

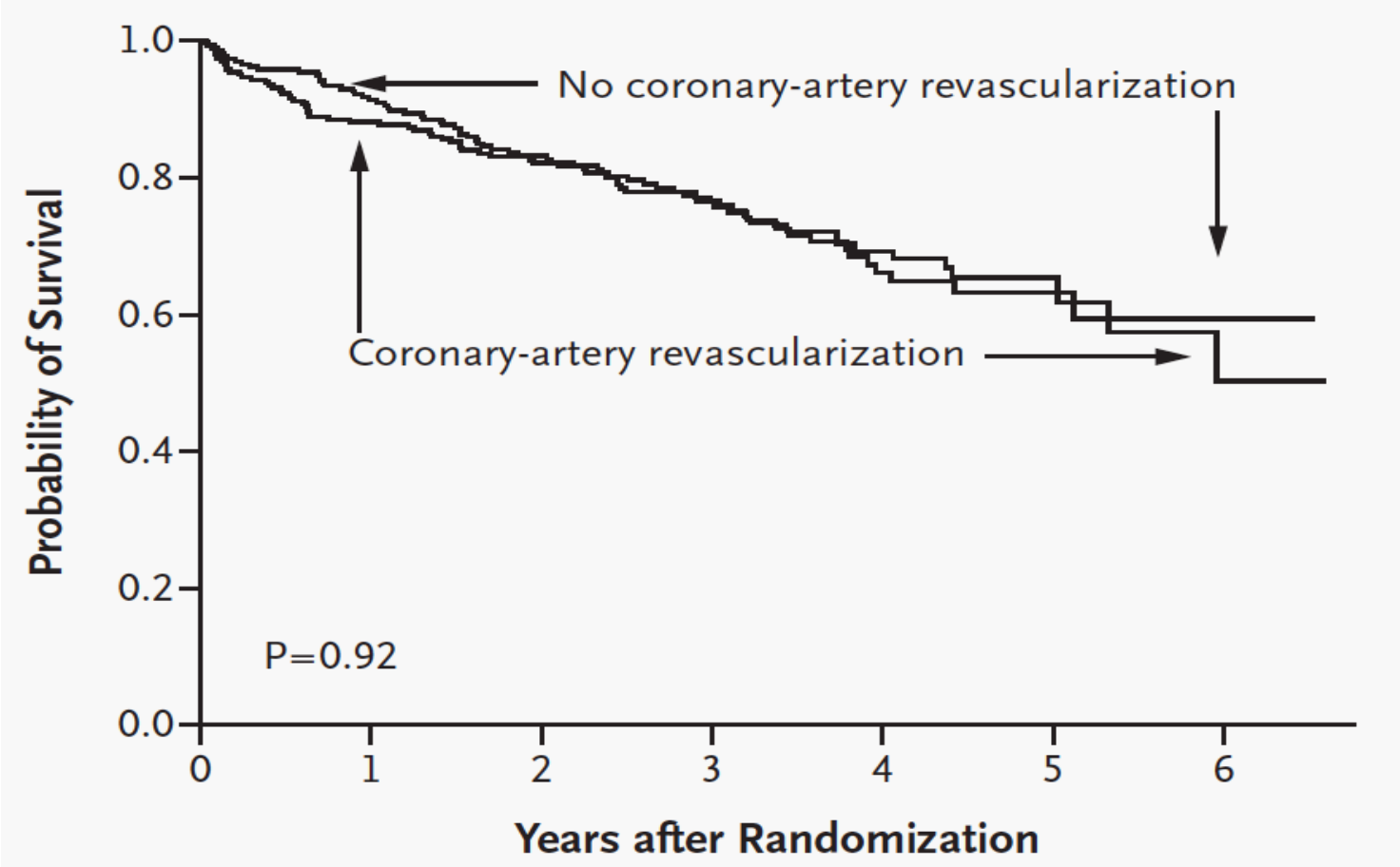
WHY DON’T WE JUST DO A STRESS TEST TO BETTER RISK STRATIFY?

STRESS TESTS FOR NON-LOW RISK PATIENTS

	No. of Patients	All-Cause Death (%)	p Value	Cardiovascular Death (%)	p Value	MI (%)	Cardiovascular Death or MI (%)	Odds Ratio (95% CI)	p Value
All patients	1,476	51 (3.5)		27 (1.8)		39 (2.6)	48 (3.3)		
Cardiac risk factors			0.002		<0.001				<0.001
0	354	6 (1.7)		1 (0.3)		0 (0)	1 (0.3)	1	
1 or 2	770	23 (3.0)		8 (1.0)		13 (1.7)	17 (2.2)	8.0 (1.1, 161)	
≥3	352	22 (6.3)		18 (5.1)		26 (7.4)	30 (8.5)	33 (4.8, ∞)	
Patients with 1 or 2 cardiac risk factors			0.14		0.29				0.62
Allocated to testing	386	15 (3.9)		6 (1.6)		7 (1.8)	9 (2.3)	1	
Allocated to no testing	384	8 (2.1)		2 (0.5)		5 (1.3)	7 (1.8)	0.78 (0.28, 2.1)	
Patients with 1 or 2 cardiac risk factors allocated to testing			<0.001		<0.001				<0.001
No ischemia	287	6 (2.1)		0 (0)		0 (0)	0 (0)	1	
1–4 ischemic segments	65	3 (4.6)		2 (3.1)		4 (6.2)	4 (6.2)	42 (2.2, ∞)*	
≥5 ischemic segments	34	6 (17.7)		4 (11.8)		3 (8.8)	5 (14.7)	107 (5.8, ∞)*	

SOURCE: Poldermans et al JACC 2006; 48: 964-9

LACK OF BENEFIT OF PRE-OP STRESS TESTING IS CONSISTENT WITH THE LACK OF BENEFIT OF PRE-OP REVASCULARIZATION



SOURCE: CARP TRIAL. N Engl J Med. 2004;35:2795

THE APPROACH

LOW RISK
(≤ 1%)

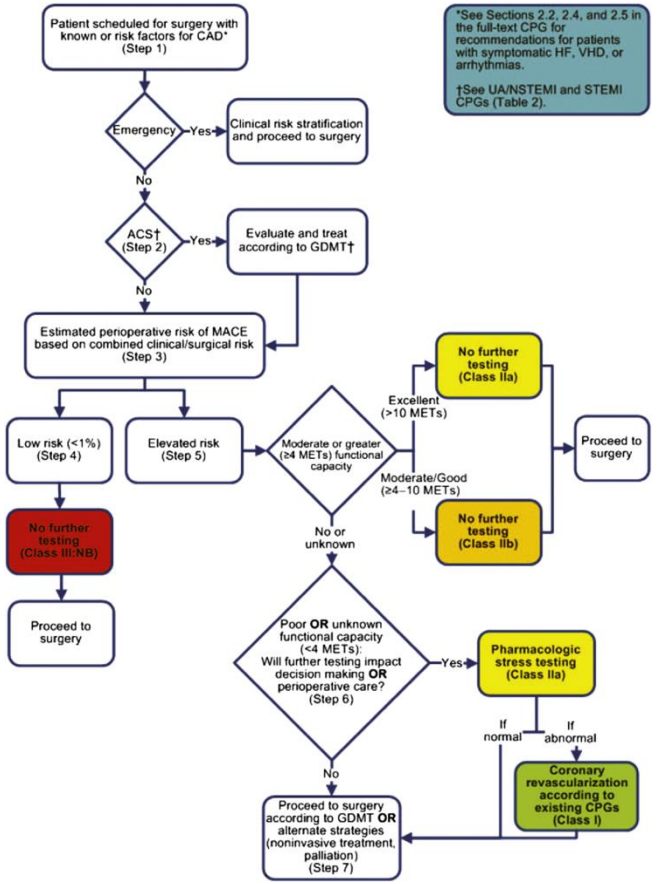
No further testing

NOT LOW RISK
(> 1%)

Gather more information

(functional capacity; BNP)

ACC/AHA PRE-OP GUIDELINES



SOURCE: JACC 2014 December

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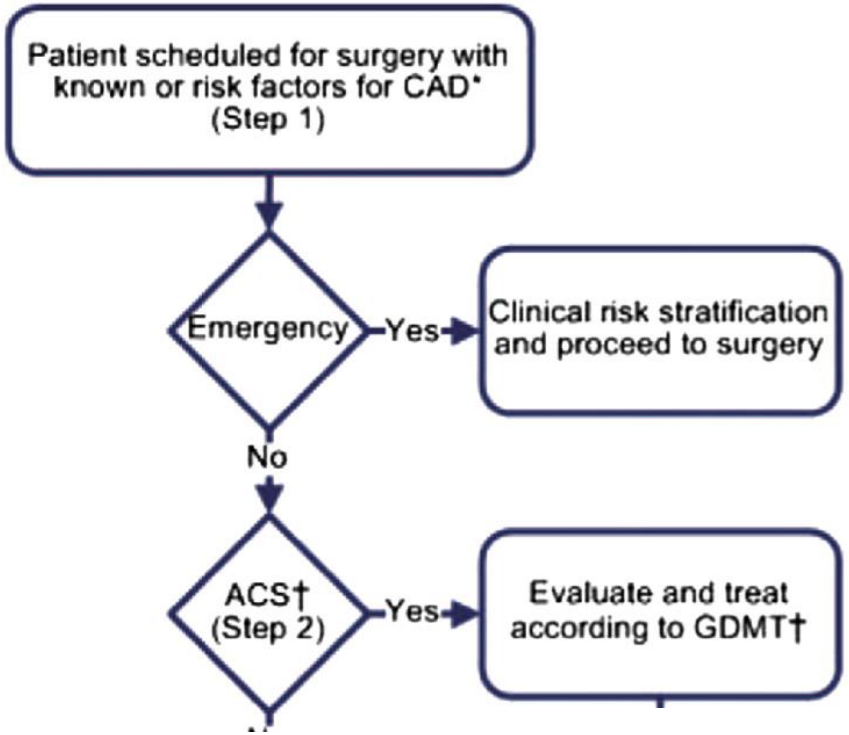
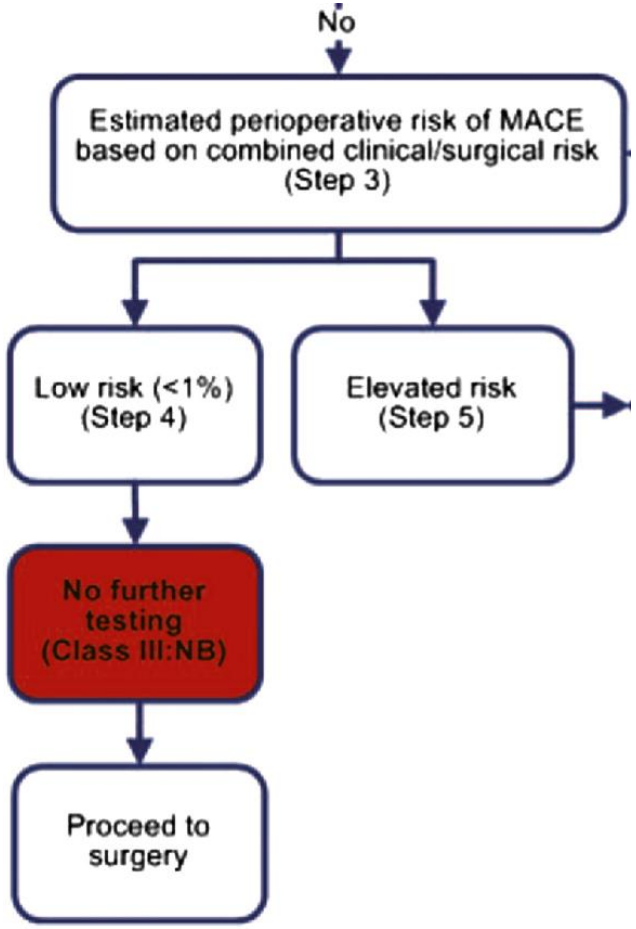


*See Sections 2.2, 2.4, and 2.5 in the full-text CPG for recommendations for patients with symptomatic HF, VHD, or arrhythmias.

†See UA/NSTEMI and STEMI CPGs (Table 2).

SOURCE: JACC 2014 December

ACC/AHA PRE-OP GUIDELINES



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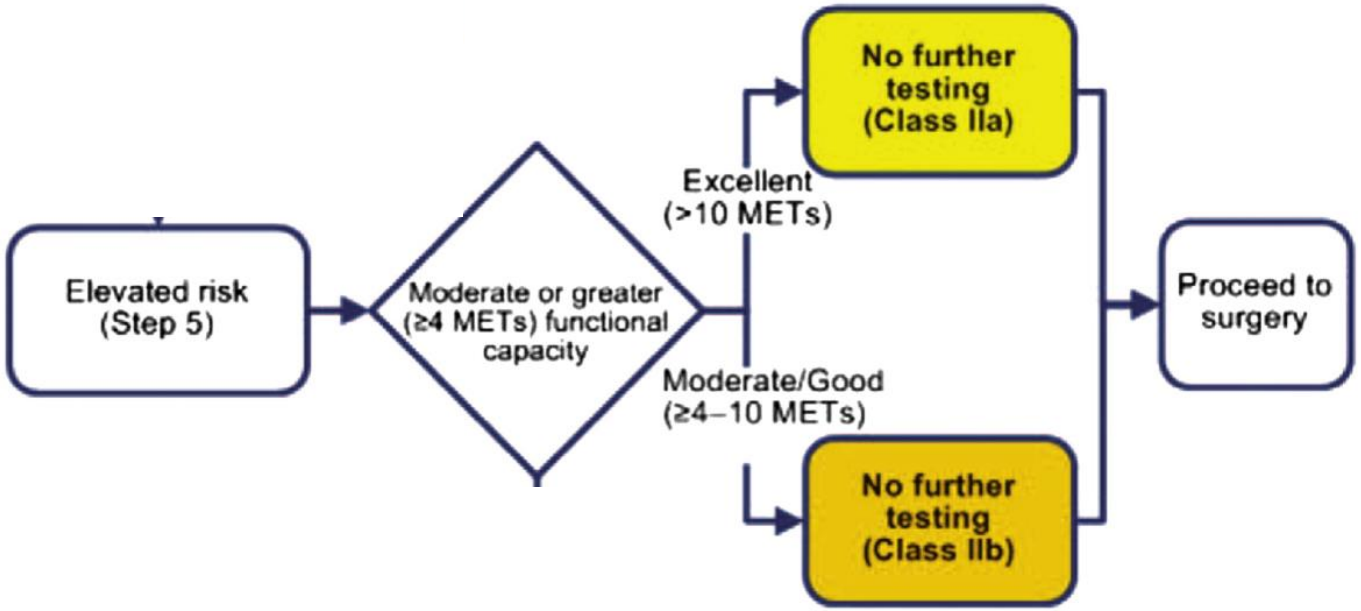

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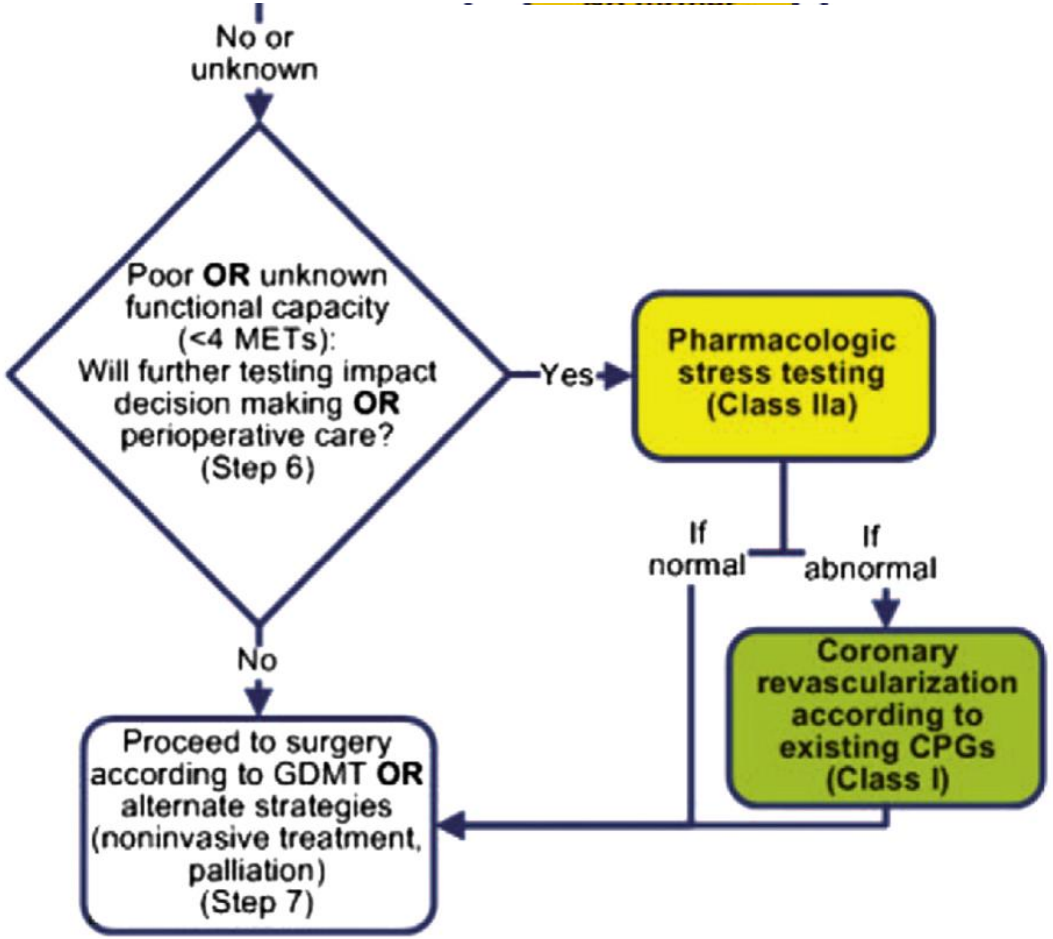

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Peri-operative beta-blockers

POISE TRIAL

- 8351 patients with or at risk of atherosclerotic disease undergoing non-cardiac surgery
- Randomized to metoprolol succinate extended-release 100mg or placebo started 2-4 hours before surgery and continued for 30 days (i.e. BIG DOSE STARTED JUST BEFORE THE OR)

	Metoprolol group (n=4174)	Placebo group (n=4177)	Hazard ratio	p value
Cardiovascular death, non-fatal myocardial infarction, or non-fatal cardiac arrest*	244 (5·8%)	290 (6·9%)	0·84 (0·70–0·99)	0·0399
Cardiovascular death	75 (1·8%)	58 (1·4%)	1·30 (0·92–1·83)	0·1368
Non-fatal myocardial infarction	152 (3·6%)	215 (5·1%)	0·70 (0·57–0·86)	0·0008
Non-fatal cardiac arrest	21 (0·5%)	19 (0·5%)	1·11 (0·60–2·06)	0·7436
Total mortality	129 (3·1%)	97 (2·3%)	1·33 (1·03–1·74)	0·0317
Myocardial infarction	176 (4·2%)	239 (5·7%)	0·73 (0·60–0·89)	0·0017
Cardiac revascularisation†	11 (0·3%)	27 (0·6%)	0·41 (0·20–0·82)	0·0123
Stroke	41 (1·0%)	19 (0·5%)	2·17 (1·26–3·74)	0·0053
Non-fatal stroke	27 (0·6%)	14 (0·3%)	1·94 (1·01–3·69)	0·0450
Congestive heart failure†	132 (3·2%)	116 (2·8%)	1·14 (0·89–1·46)	0·3005
New clinically significant atrial fibrillation†	91 (2·2%)	120 (2·9%)	0·76 (0·58–0·99)	0·0435
Clinically significant hypotension†	625 (15·0%)	404 (9·7%)	1·55 (1·38–1·74)	<0·0001
Clinically significant bradycardia†	277 (6·6%)	101 (2·4%)	2·74 (2·19–3·43)	<0·0001
Non-cardiovascular death	54 (1·3%)	39 (0·9%)	1·39 (0·92–2·10)	0·1169

SOURCE: Lancet 2008: 371:1839 -1847

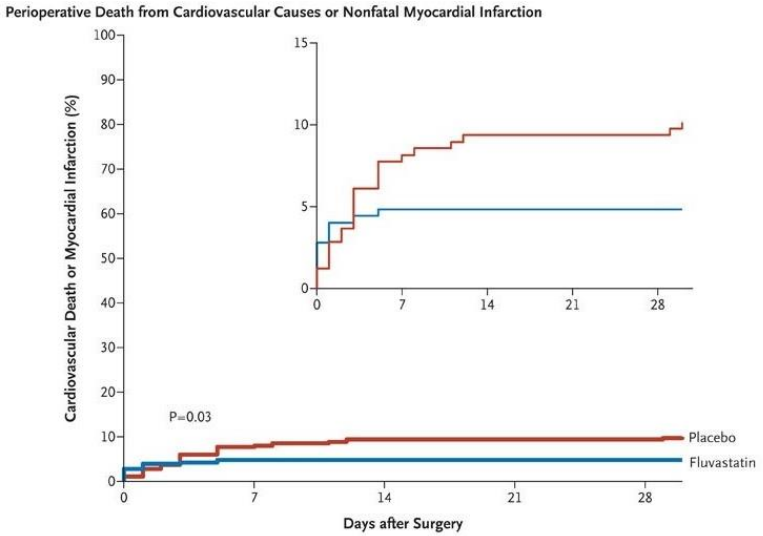
ACC/AHA Guidelines

- **Class 1**: Should be continued for patients who have been on beta-blockers chronically
- **Class 2a**: Management of beta-blockers after surgery should be guided by clinical circumstances, regardless of when the agent was started
- **Class 2b**: May be reasonable for patients with intermediate/high risk ischemia on pre-op stress testing or with multiple risk factors; should ideally be begun more than 1 day before surgery
- **Class 3**: Should NOT be started on the day of surgery

Are there drugs to reduce peri-operative events?

MAYBE:

STATINS



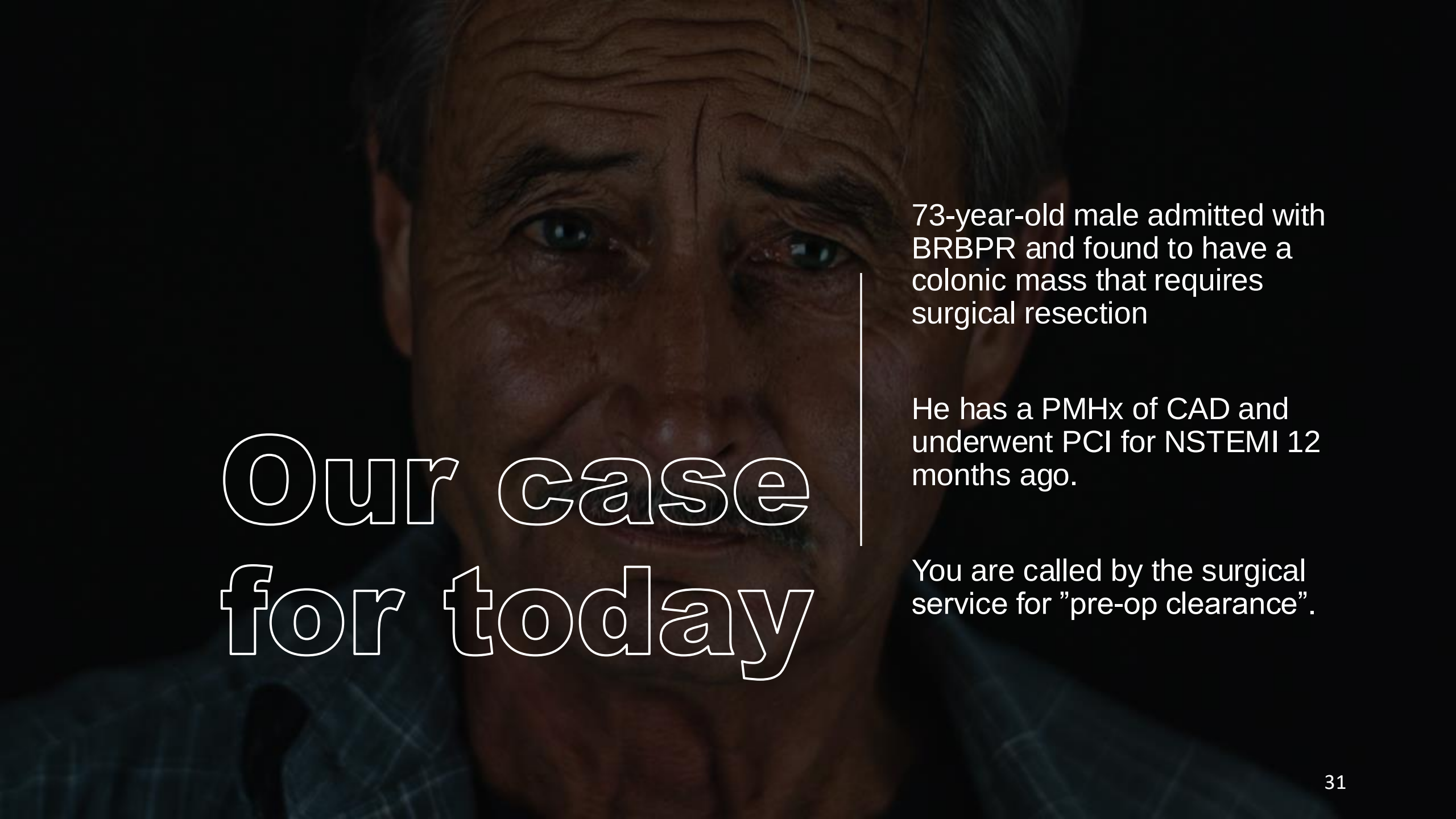
- Subsequently, atorvastatin loading in statin naïve patients prior to non-cardiac surgery did not reduce MACE
- High-dose statin loading prior to CABG for patients already on statins did not reduce MACE

NO:

ASPIRIN, CLONIDINE

- Aspirin v. placebo: no CV benefit but increased risk of bleeding (4.6% v. 3.8%)
- Clonidine v. placebo: no CV benefit but increased risk of hypotension and non-fatal cardiac arrest.

SOURCE: NEJM 2009; 361: 980; AHJ 2017; 184: 88. EHJ 2023; 44: 2322' NEJM April 2014; 370: 1494.



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