

# Strategies to Reduce Cardiac Risk for Noncardiac Surgery

*Lee A. Fleisher, M.D.*

*Robert D. Dripps Professor and Chair*

*Department of Anesthesiology and Critical Care*

*Professor of Medicine*

# Scenarios-ARS

- Patient scheduled for colon resection for cancer
  - 65 year old diabetic hypertensive. Q waves on ECG
    - No further testing
    - Stress Test in all patients
    - Stress Test only in those with poor exercise capacity
    - Cardiopulmonary Exercise Testing

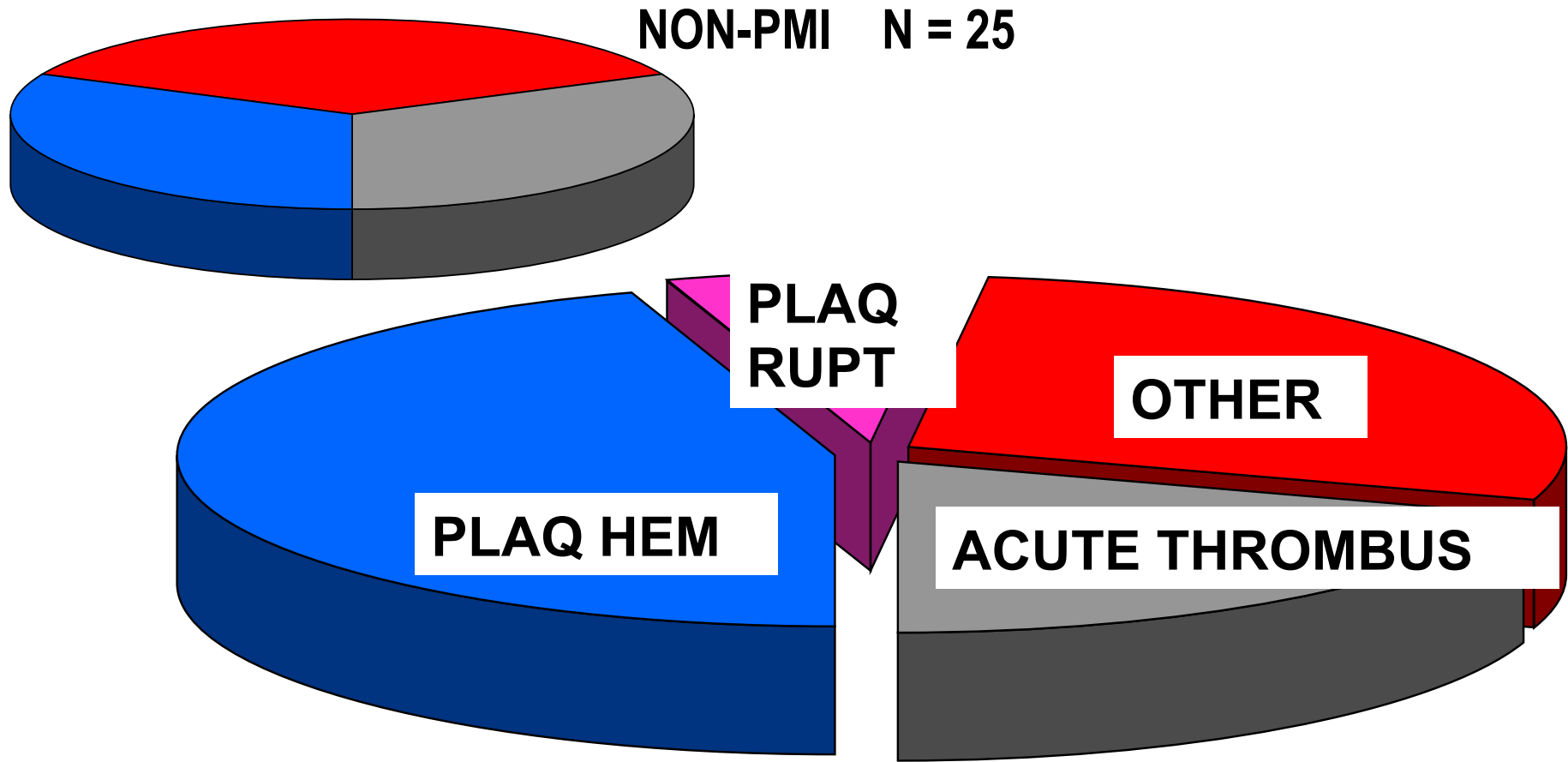
# Scenarios-ARS

- Patient scheduled for colon resection for cancer
  - 68 year old s/p DES stent placement 4 months ago on DAPT
    - Continue Dual anti-platelet therapy (DAPT)
    - Stop clopidogrel 10 days in advance, continue ASA
    - Stop clopidogrel 5 days in advance, continue ASA
    - Stop DAPT

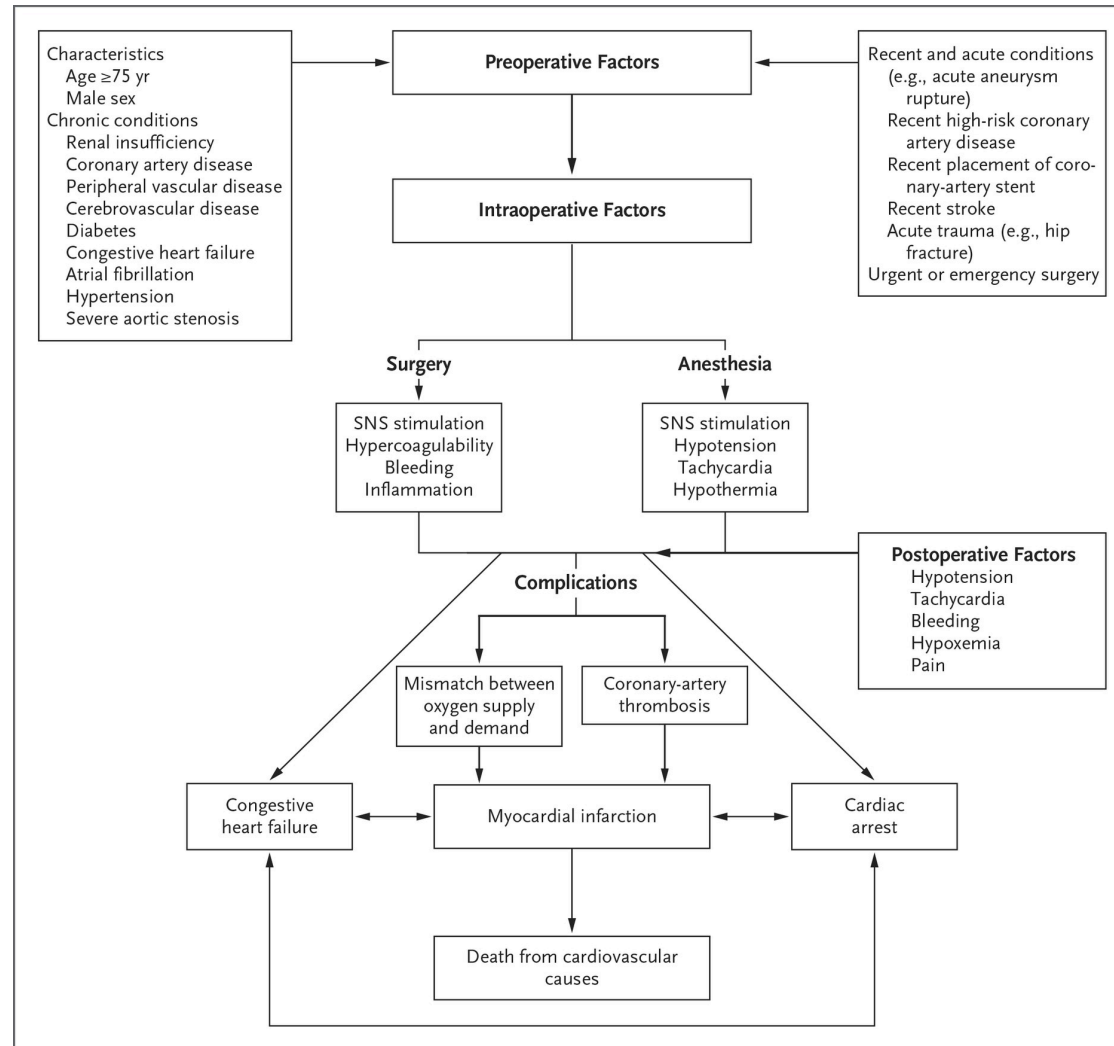
# Scenarios-ARS

- Patient scheduled for colon resection for cancer
  - 68 year old with stable ischemic heart disease
    - Routine troponin measurement
    - Routine ECG and troponin if changes
    - Troponin only if symptomatic
    - ECG if symptomatic and troponin if ECG changes present

# PATHOLOGY: FATAL PERIOPERATIVE MI



# Preoperative, Intraoperative, and Postoperative Factors Associated with Perioperative Cardiac Complications in Patients Undergoing Major Noncardiac Surgery.



# ACC/AHA Clinical Practice Guideline

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

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

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

*Endorsed by the Society of Hospital Medicine*

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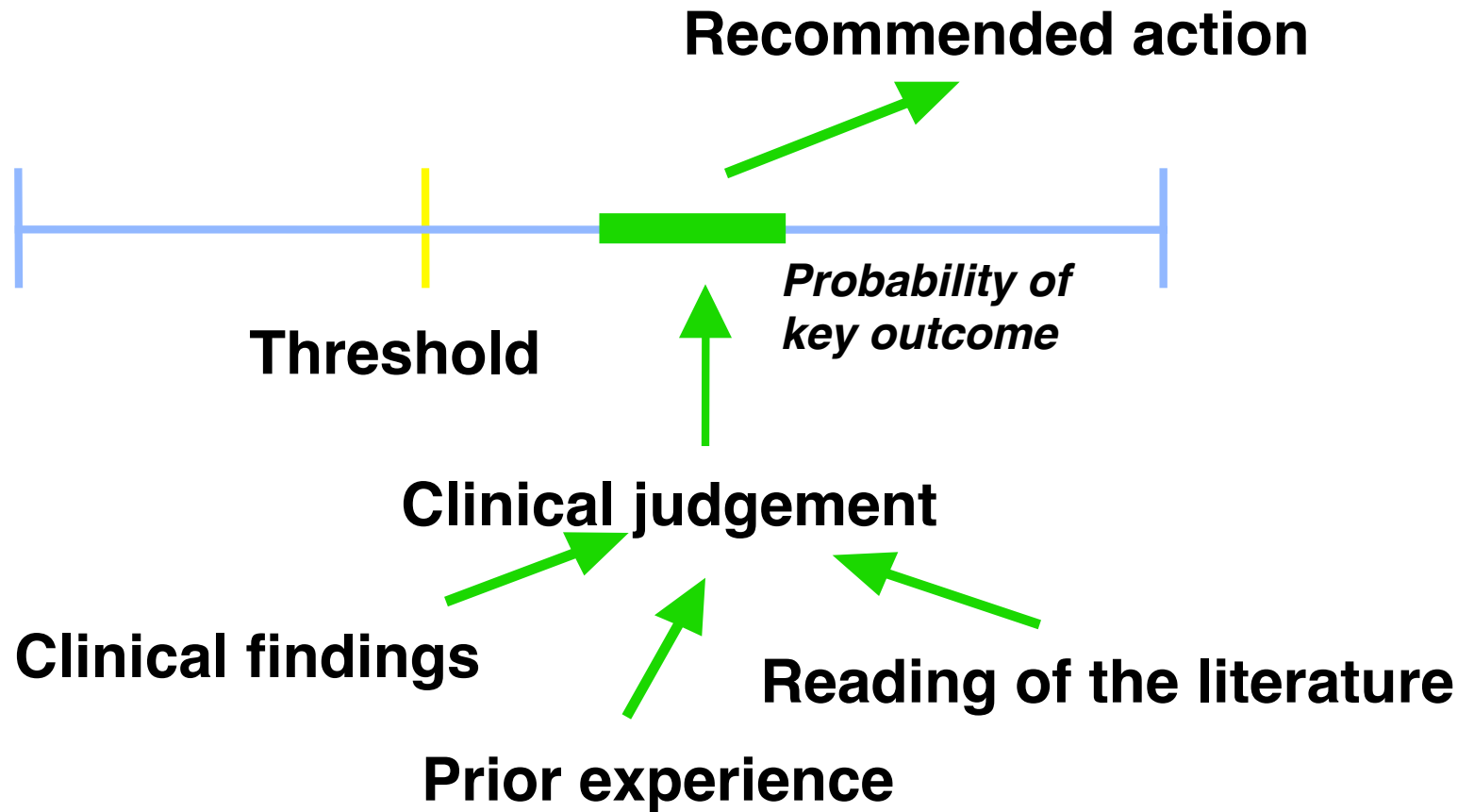
# Prominent Dutch Cardiovascular Researcher Fired for Scientific Misconduct

- the Committee's doubts about a proper procedure for written informed consent,
- the deviations from the protocol, and
- the inadequate source documentation and unreliable working procedure.
- The Integrity Committee also concluded that the conduct of the DECREASE IV and V study was in several respects negligent and scientifically incorrect





# Should we test?



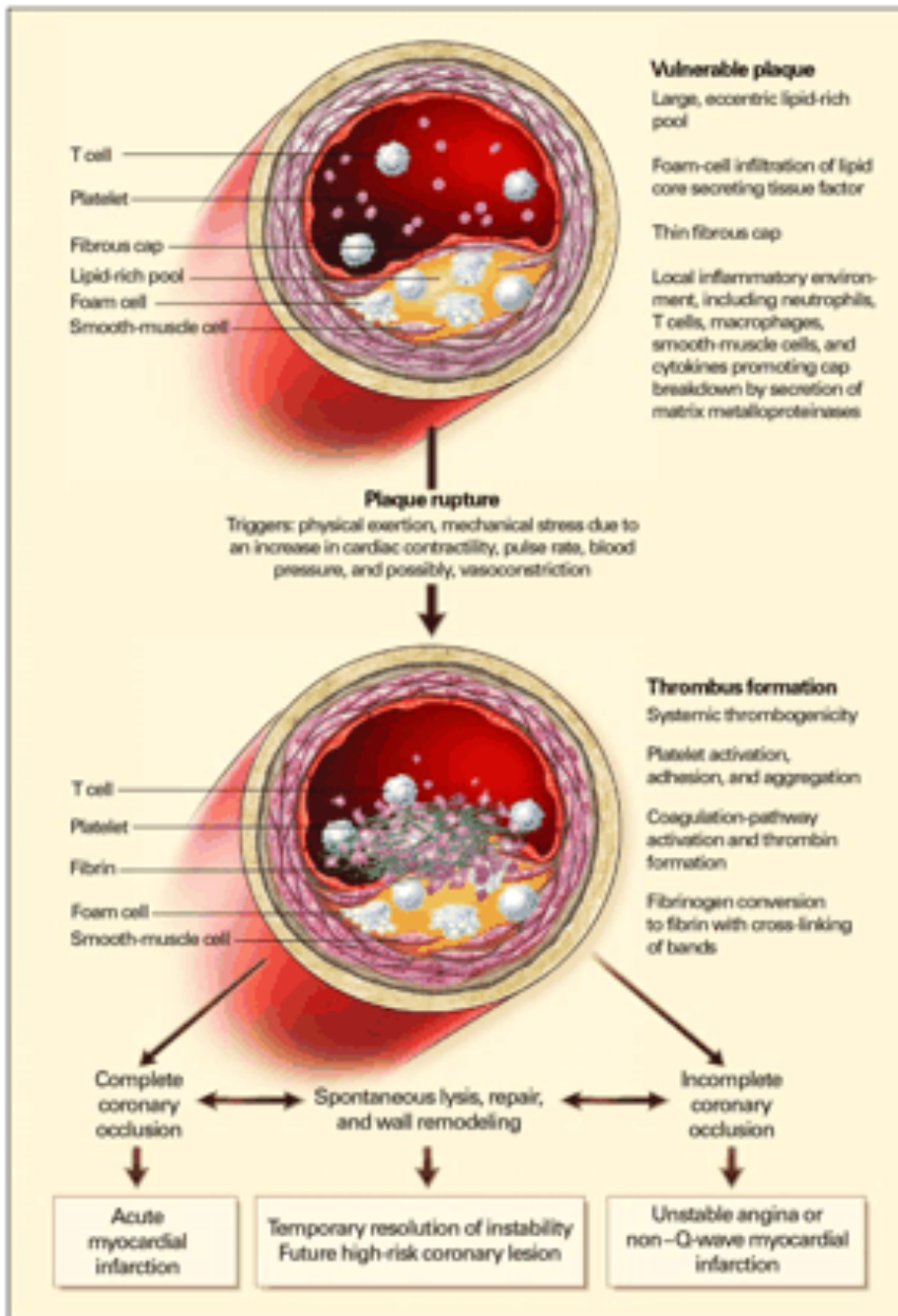
# Potential Interventions

- Delay case for unstable symptoms
- Coronary revascularization
- Medical optimization
- Perioperative medical care/involvement
- Modification of intraoperative monitors
- Modification of postoperative monitoring
- Modification of care location
- Palliative Care

# What should we worry about first?

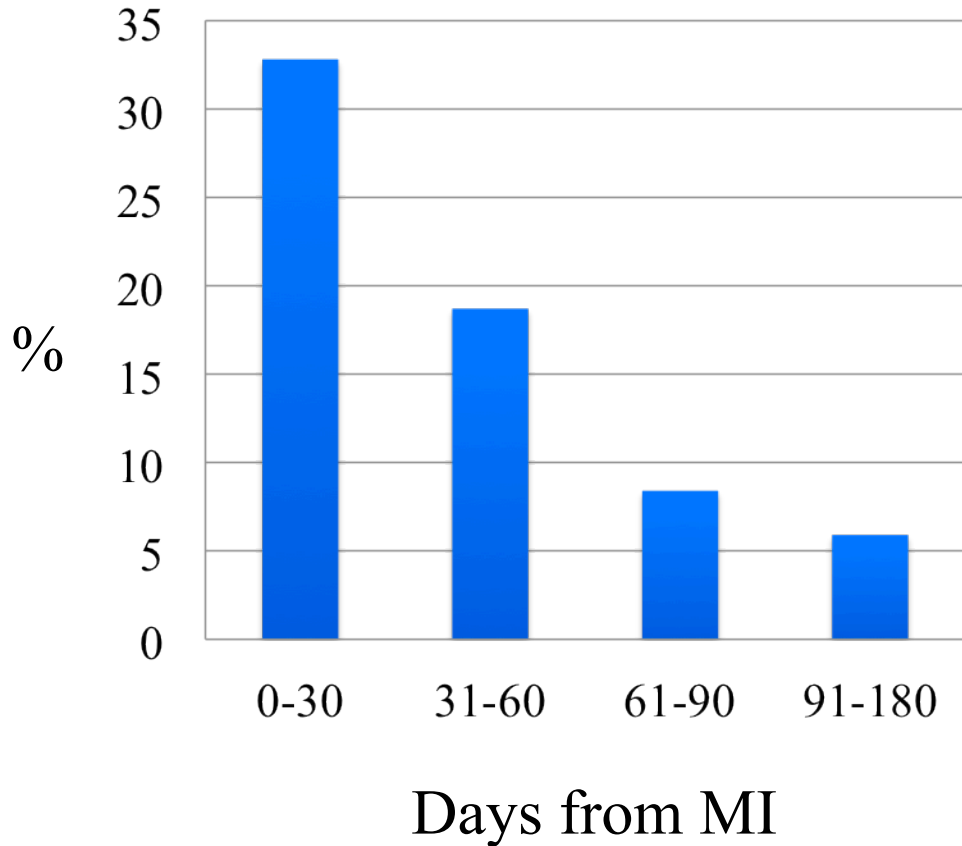
- Unstable angina is a hypercoagulable state
- Recent MI
- The perioperative period is a hypercoagulable state

—————> Myocardial infarction  
Death

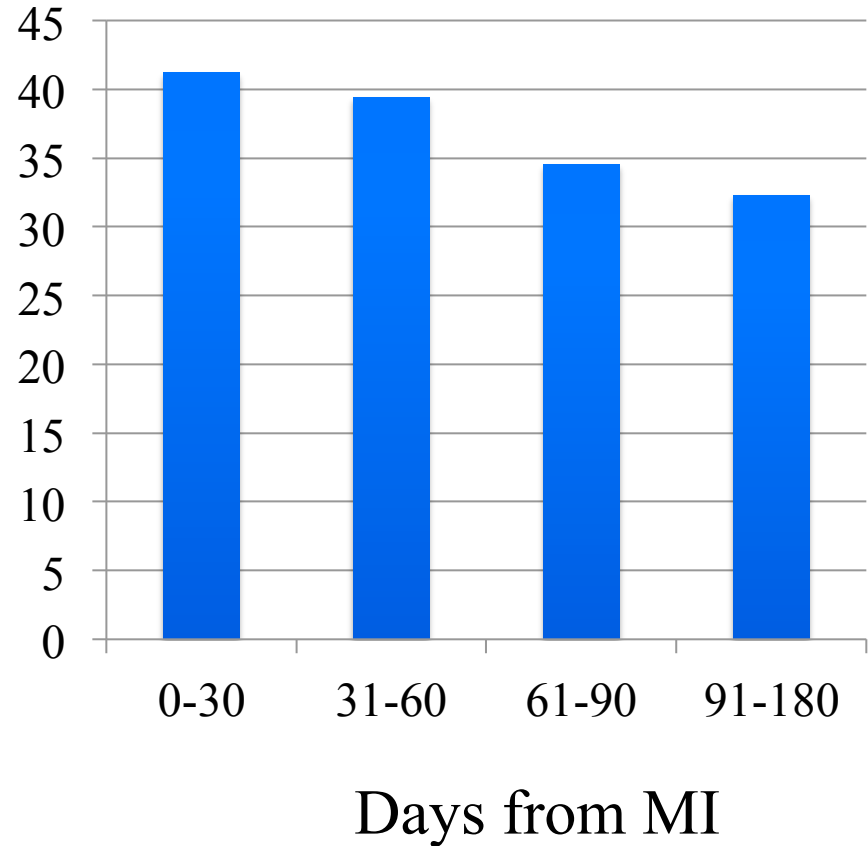


# Risk of reinfarction

## 30-day Postop MI



## 1-year Postop Mortality



# Surgical Risk Calculator



[Risk Calculator Homepage](#)

[About](#)

[FAQ](#)

[ACS Website](#)

[ACS NSQIP Website](#)

## Enter Patient and Surgical Information

Procedure

44140 - Colectomy, partial; with anastomosis

Clear

Begin by entering the procedure name or CPT code. You may also search using two words (or two partial words) by placing a '+' in between, for example: "cholecystectomy+cholangiography"

Reset All Selections

Please enter as much of the following information as you can to receive the best risk estimates.  
A rough estimate will still be generated if you cannot provide all of the information below.

Age Group	<input type="text" value="65-74 years"/>	Diabetes	<input type="text" value="None"/>
Sex	<input type="text" value="Male"/>	Hypertension requiring medication	<input type="text" value="Yes"/>
Functional status	<input type="text" value="Independent"/>	Previous cardiac event	<input type="text" value="No"/>
Emergency case	<input type="text" value="No"/>	Congestive heart failure in 30 days prior to surgery	<input type="text" value="No"/>
ASA class	<input type="text" value="II - Mild systemic disease"/>	Dyspnea	<input type="text" value="None"/>
Wound class	<input type="text" value="Clean/Contaminated"/>	Current smoker within 1 year	<input type="text" value="Yes"/>
Steroid use for chronic condition	<input type="text" value="No"/>	History of severe COPD	<input type="text" value="No"/>
Ascites within 30 days prior to surgery	<input type="text" value="No"/>	Dialysis	<input type="text" value="No"/>
Systemic sepsis within 48 hours prior to surgery	<input type="text" value="None"/>	Acute Renal Failure	<input type="text" value="No"/>
Ventilator dependent	<input type="text" value="No"/>	BMI Calculation:	Height (in) <input type="text" value="69"/>
Disseminated cancer	<input type="text" value="No"/>	Weight (lbs)	<input type="text" value="250"/>

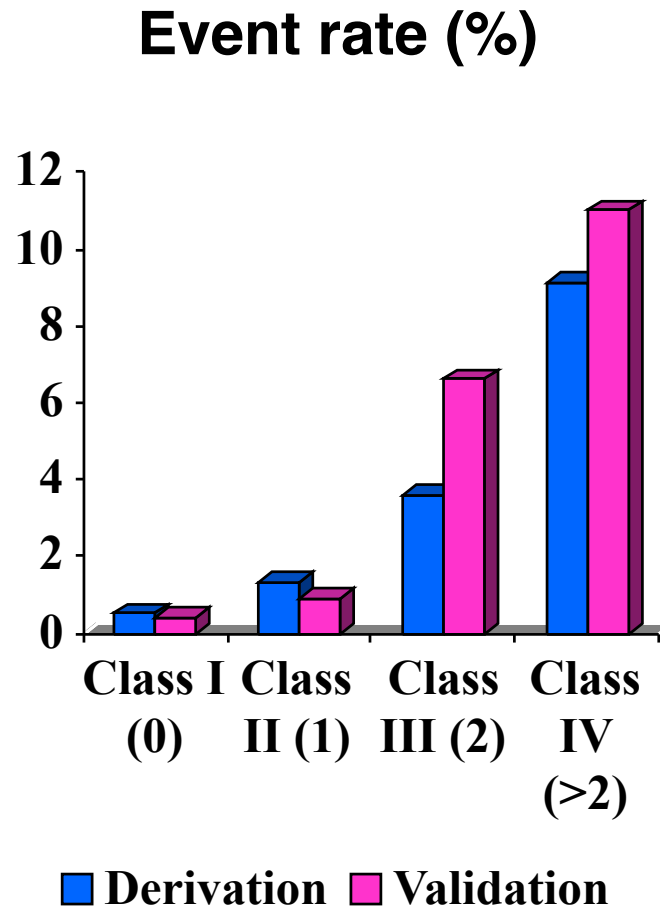
Back

Continue

Step 2 of 4



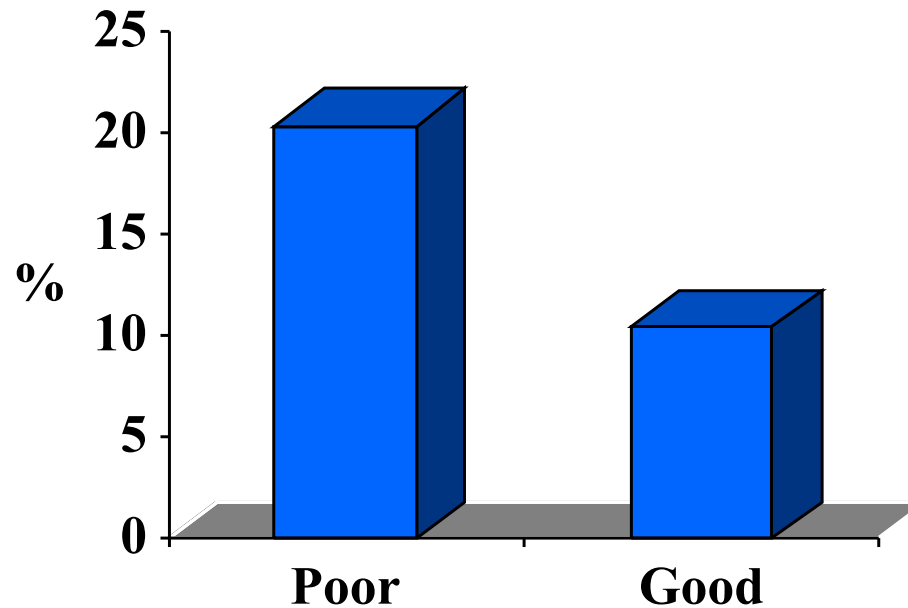
# Revised Cardiac Risk Index



- High risk surgery
  - intraperitoneal, intrathoracic or suprainguinal vascular procedures
- Ischemic heart disease
- H/O CHF
- H/O Cerebrovascular disease
- Insulin therapy for DM
- Preop Cr>2.0mg/dl

# Self-reported exercise capacity

## Perioperative complications



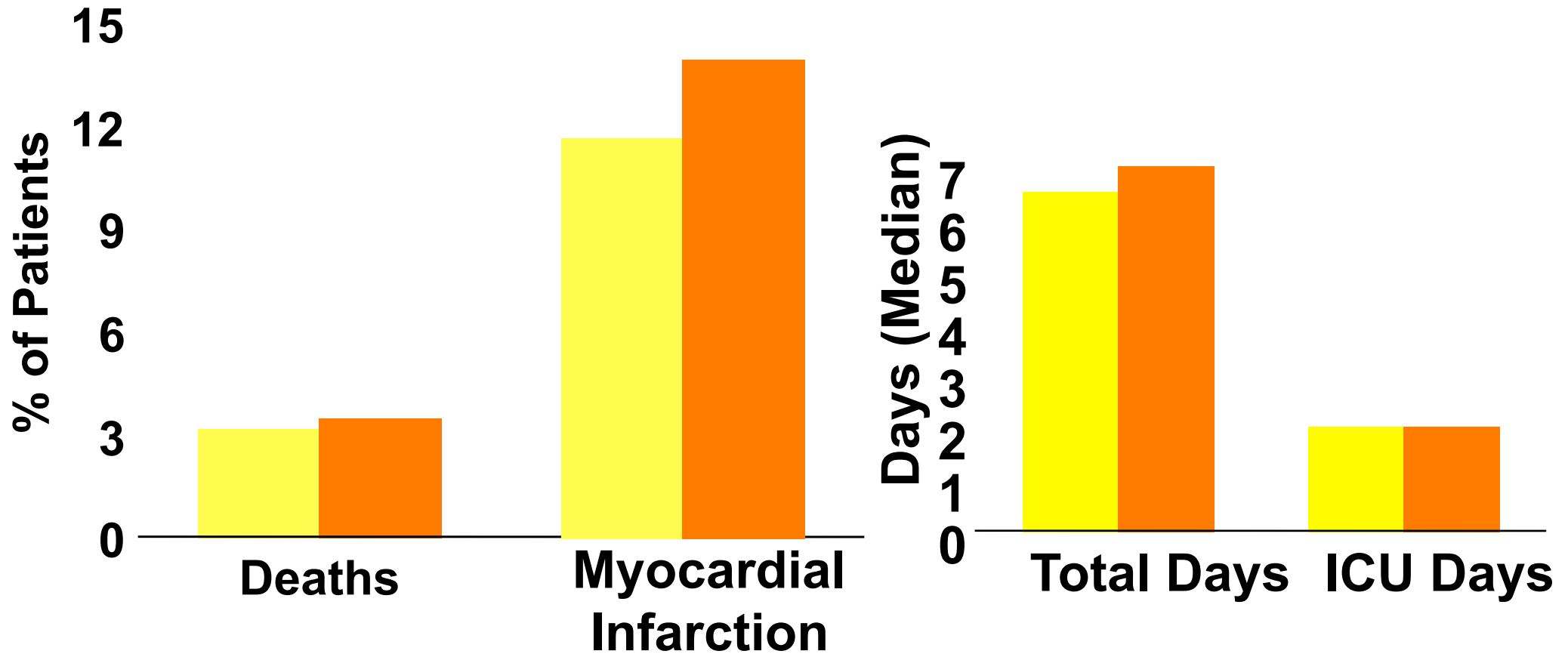
$P < 0.001$

- 600 ambulatory patients referred to medical consultation clinic
- Estimate number of blocks and flights of stairs
- Poor exercise capacity was defined as unable to walk 4 blocks or climb 2 flights of stairs

**Reilly et al. Arch Int Med 1999**

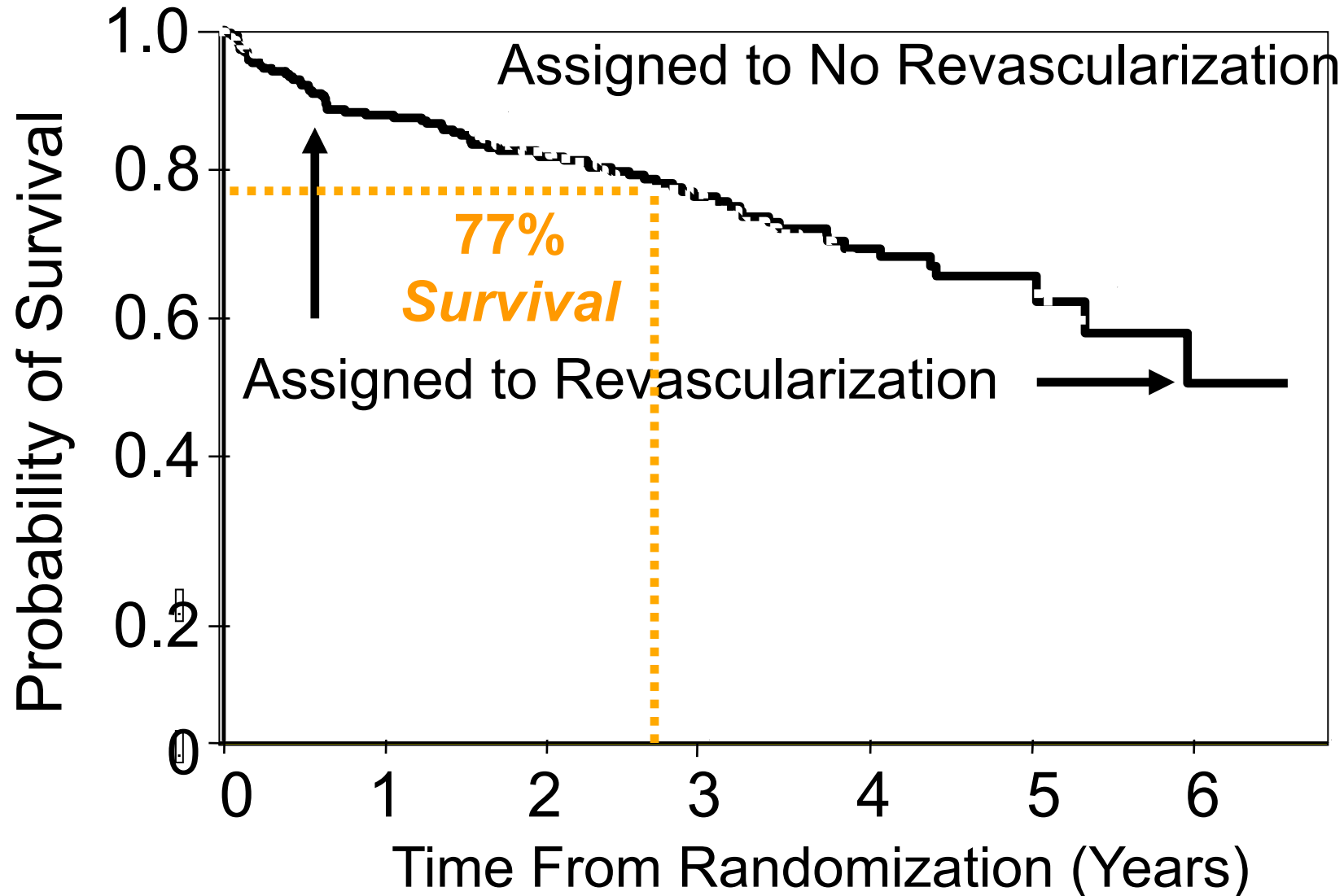
# Postoperative Cardiac Complications Within 30-Days Following Surgery

- Revascularization
- No Revascularization

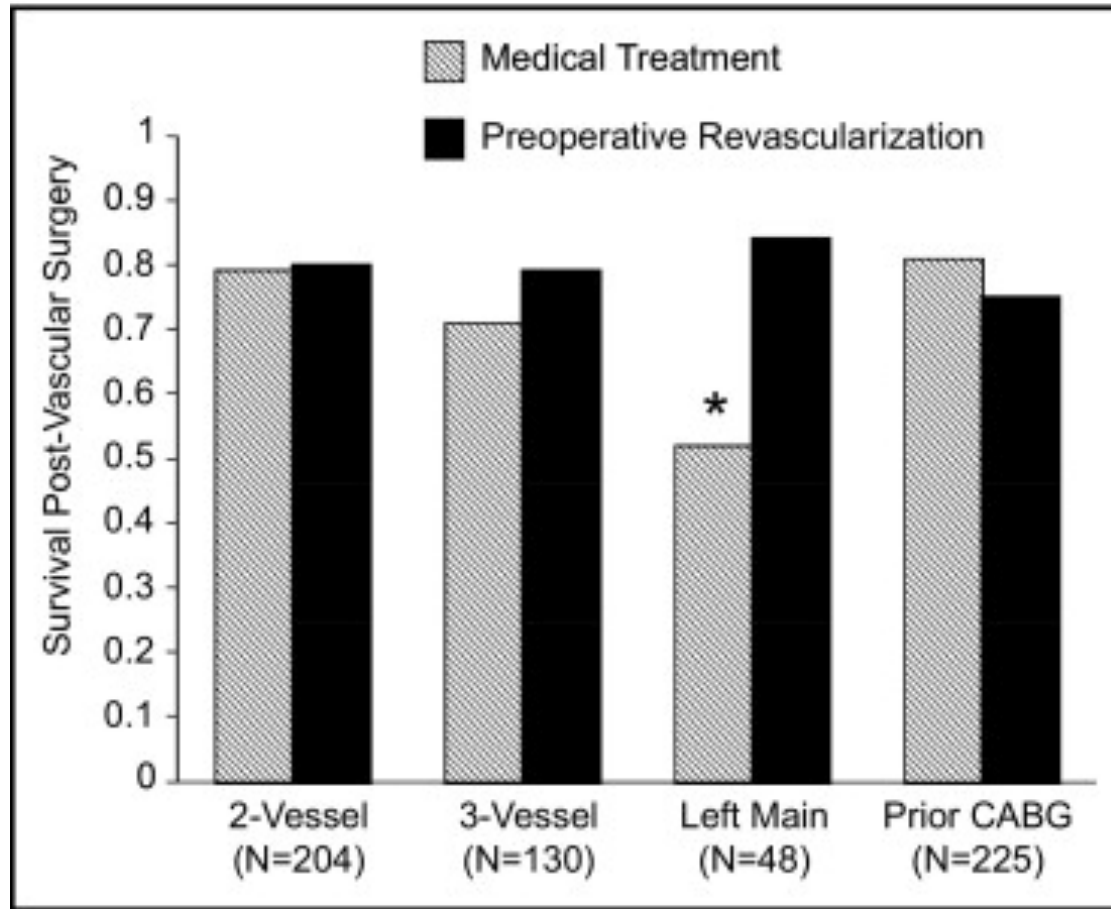




# Long-Term Survival

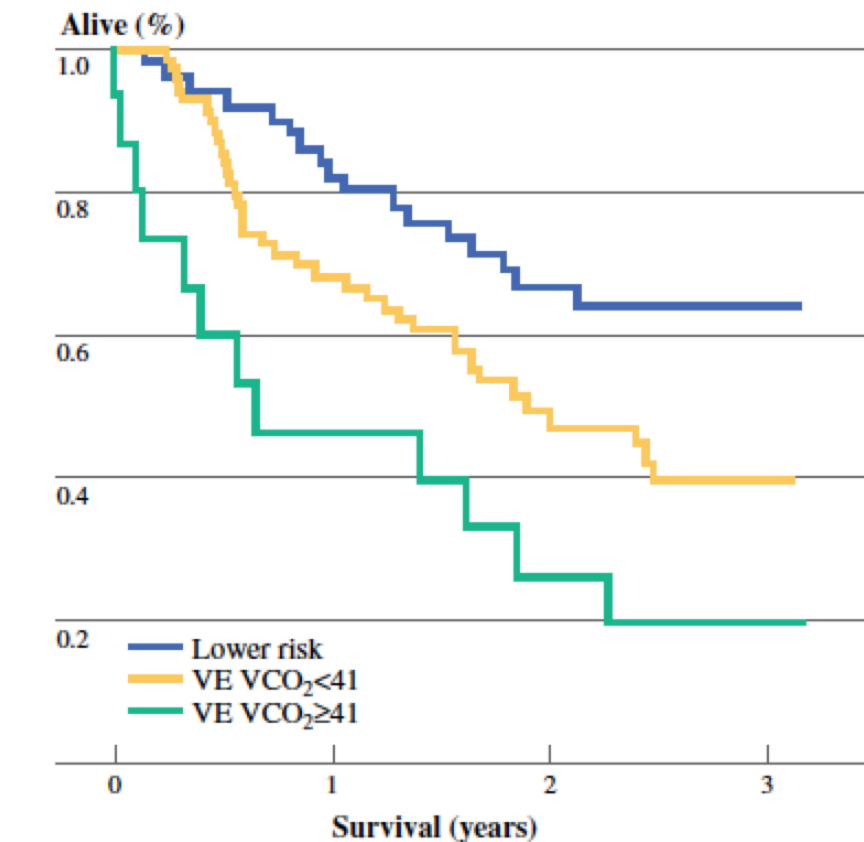


# Outcomes from CARP



# Cardiopulmonary Exercise Testing for Preoperative Risk Assessment before Pancreaticoduodenectomy for Cancer

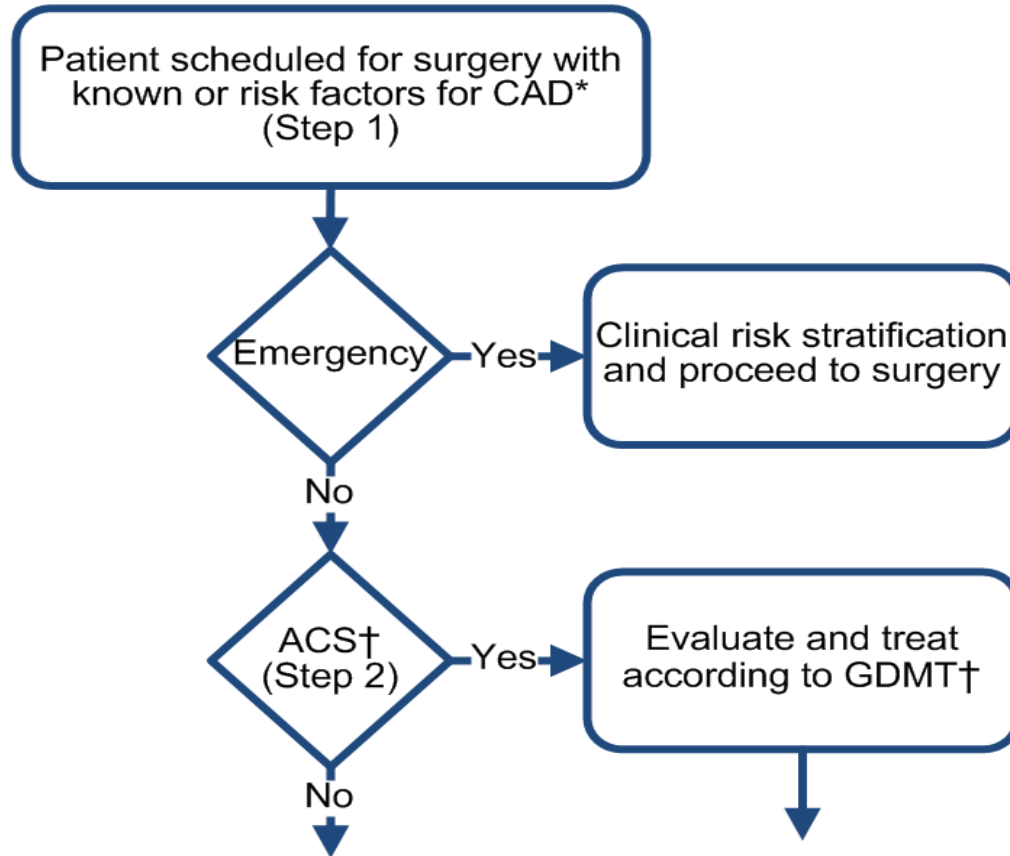
M. A. Junejo<sup>1</sup>, J. M. Mason<sup>3</sup>, A. J. Sheen<sup>1</sup>, A. Bryan<sup>2</sup>, J. Moore<sup>2</sup>, P. Foster<sup>2</sup>, D. Atkinson<sup>2</sup>, M. J. Parker<sup>2</sup>, and A. K. Siriwardena<sup>1</sup>



Number at risk

— Lower risk	50	41	27	16
— VE $VCO_2 < 41$	69	47	23	10
— VE $VCO_2 \geq 41$	15	7	4	2

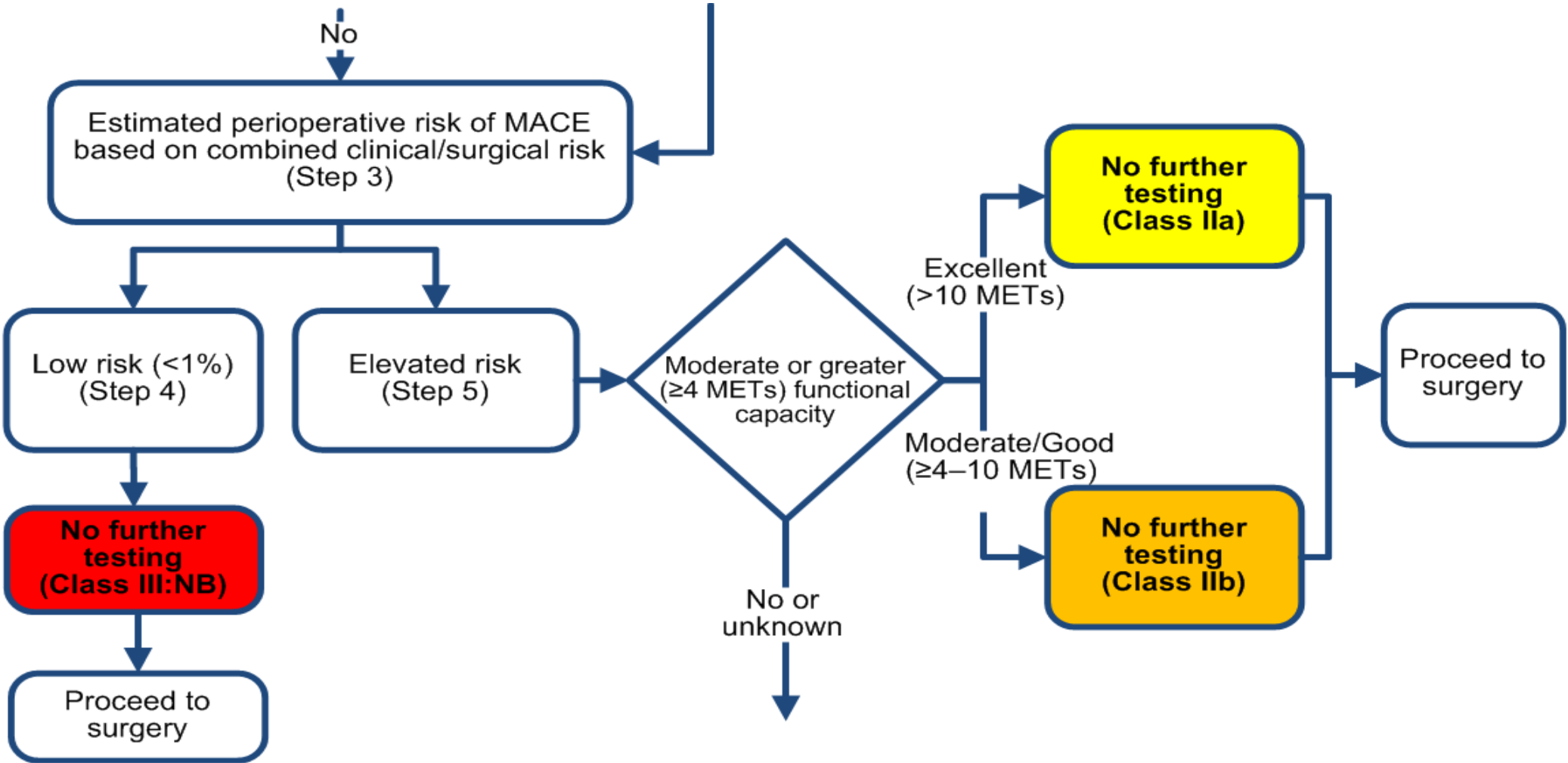
# Stepwise Approach to Perioperative Cardiac Assessment for CAD



Colors correspond to the Classes of Recommendations in Table 1.

Continued on the next slide.

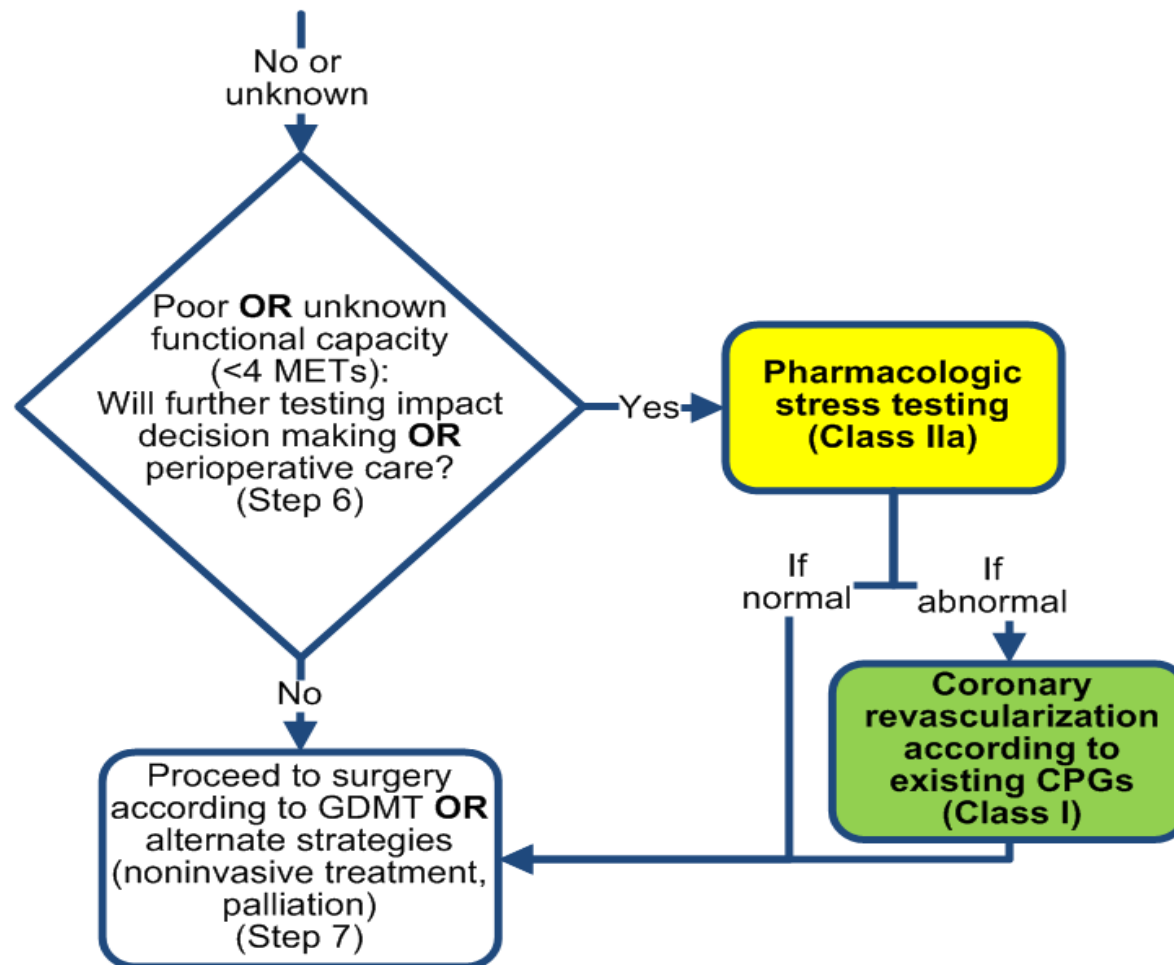
# Stepwise Approach to Perioperative Cardiac Assessment for CAD (cont'd)



Colors correspond to the Classes of Recommendations in Table 1.

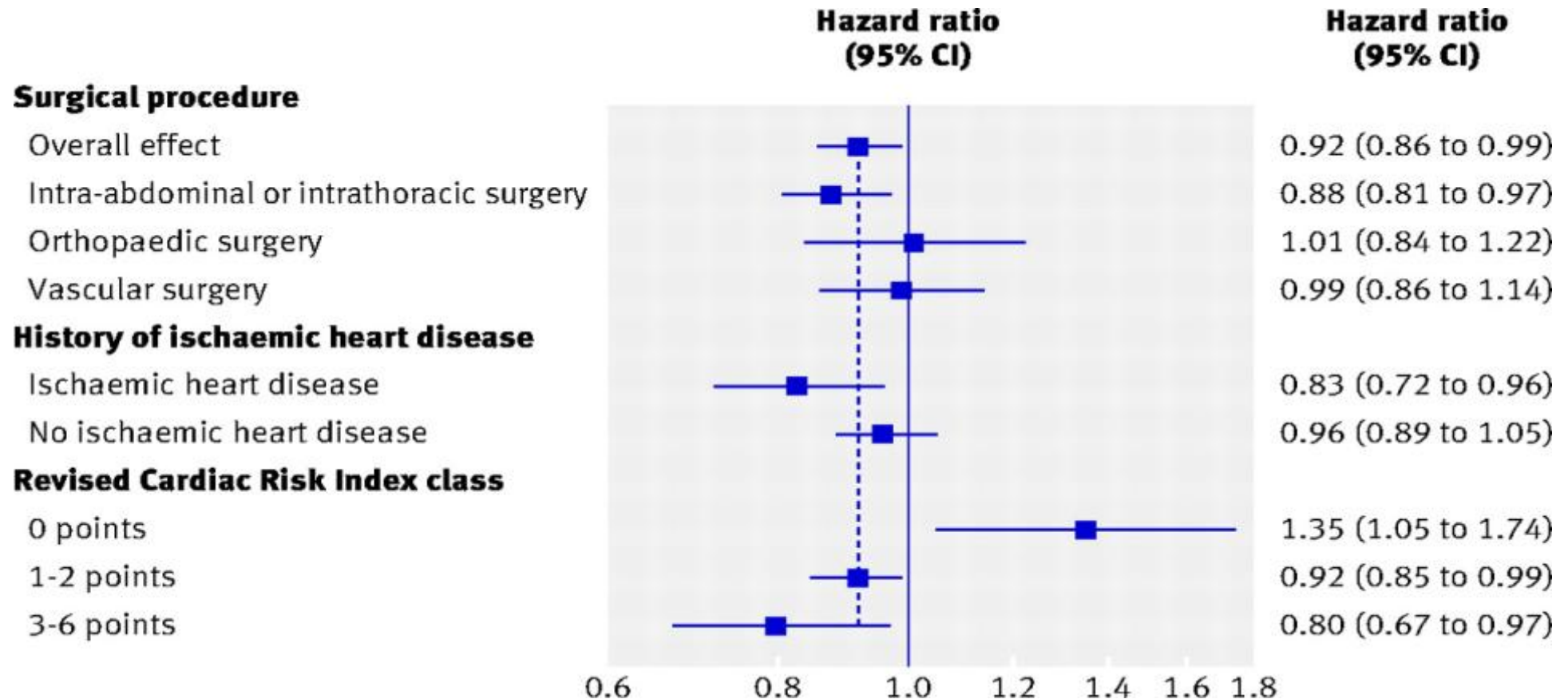
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# Stepwise Approach to Perioperative Cardiac Assessment for CAD (cont'd)



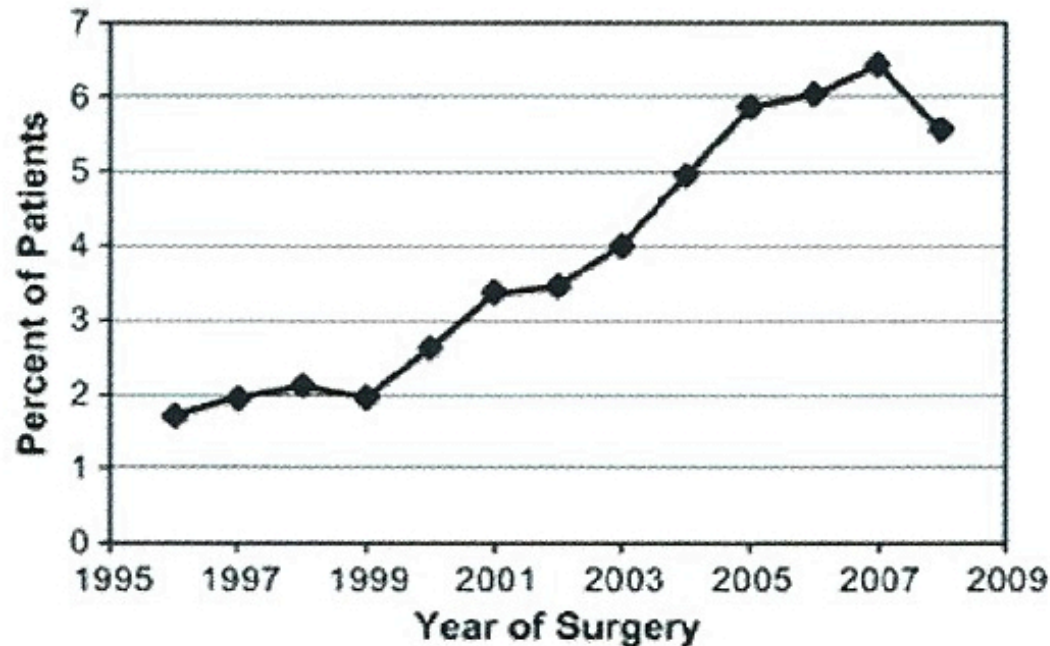
Colors correspond to the Classes of Recommendations in Table 1.

# Association of preoperative stress testing with one year survival in the subgroup analyses



# Overuse of Preoperative Cardiac Stress Testing in Medicare Patients Undergoing Elective Noncardiac Surgery

*Kristin M. Sheffield, PhD,\* Patricia S. McAdams, BA,\* Jaime Benarroch-Gampel, MD,\* James S. Goodwin, MD,† Casey A. Boyd, MD,\* Dong Zhang, PhD,† and Taylor S. Riall, MD, PhD\**



**FIGURE 1.** Use of preoperative cardiac stress testing in Medicare patients with no active cardiac conditions or clinical risk factors who underwent elective noncardiac, nonvascular surgical procedures, 1996 to 2008.



## Assessment of LV Function

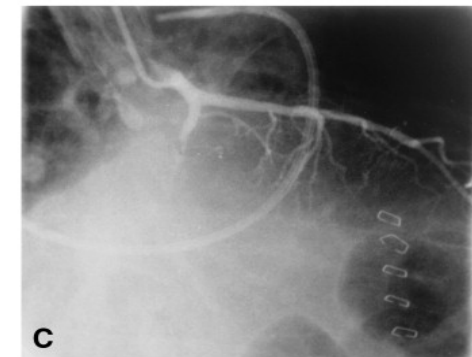
<b>Recommendations</b>	<b>COR</b>	<b>LOE</b>
It is reasonable for patients with dyspnea of unknown origin to undergo preoperative evaluation of LV function.	IIa	C
It is reasonable for patients with HF with worsening dyspnea or other change in clinical status to undergo preoperative evaluation of LV function.	IIa	C
Reassessment of LV function in clinically stable patients with previously documented LV dysfunction may be considered if there has been no assessment within a year.	IIb	C
Routine preoperative evaluation of LV function is not recommended.	III: No Benefit	B

## Noncardiac Surgery

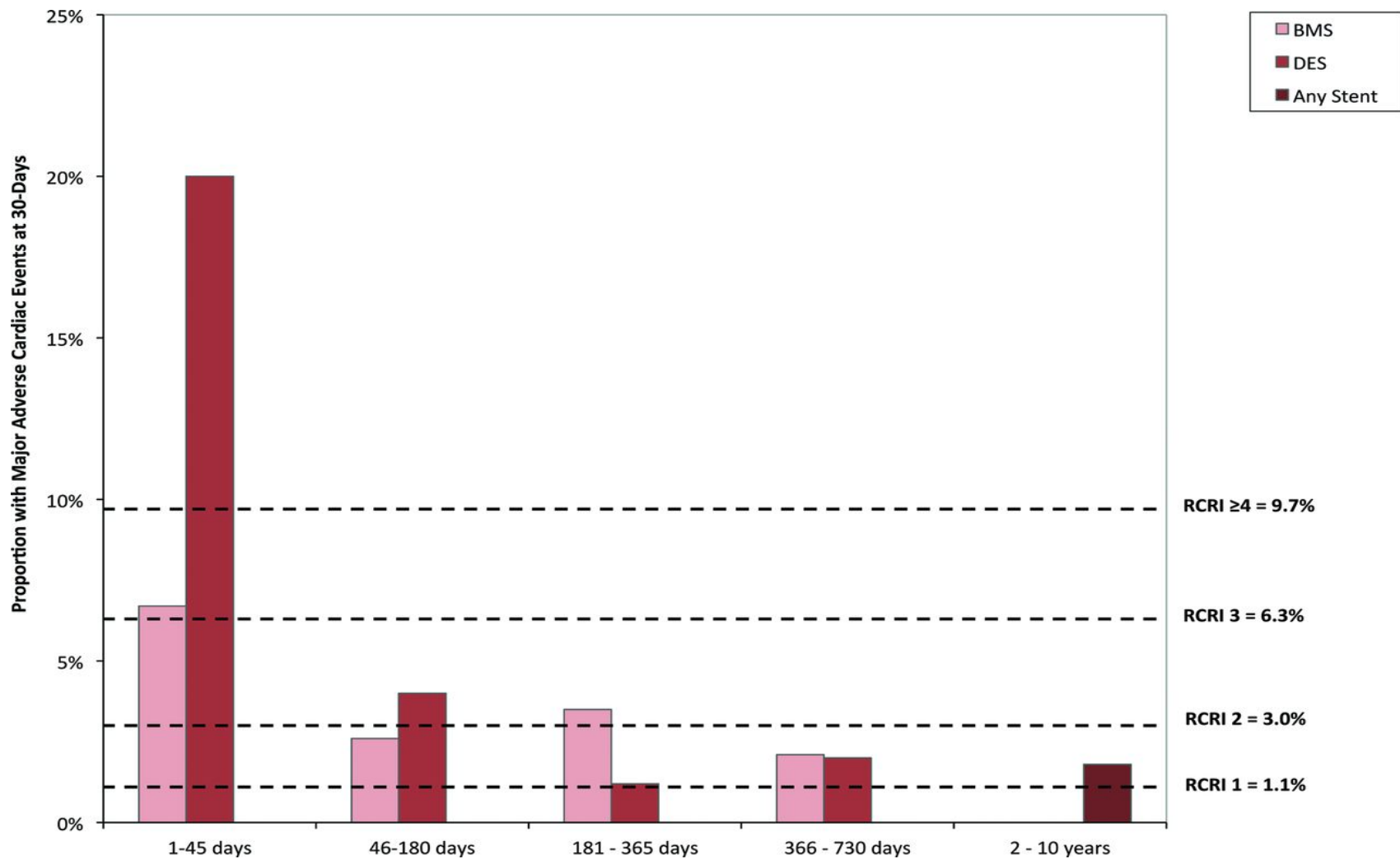
# Catastrophic Outcomes of Noncardiac Surgery Soon After Coronary Stenting

Grzegorz L. Kałuża, MD, PhD, Jane Joseph, Joseph R. Lee, MD, Michael E. Raizner, MD,  
Albert E. Raizner, MD, FACC

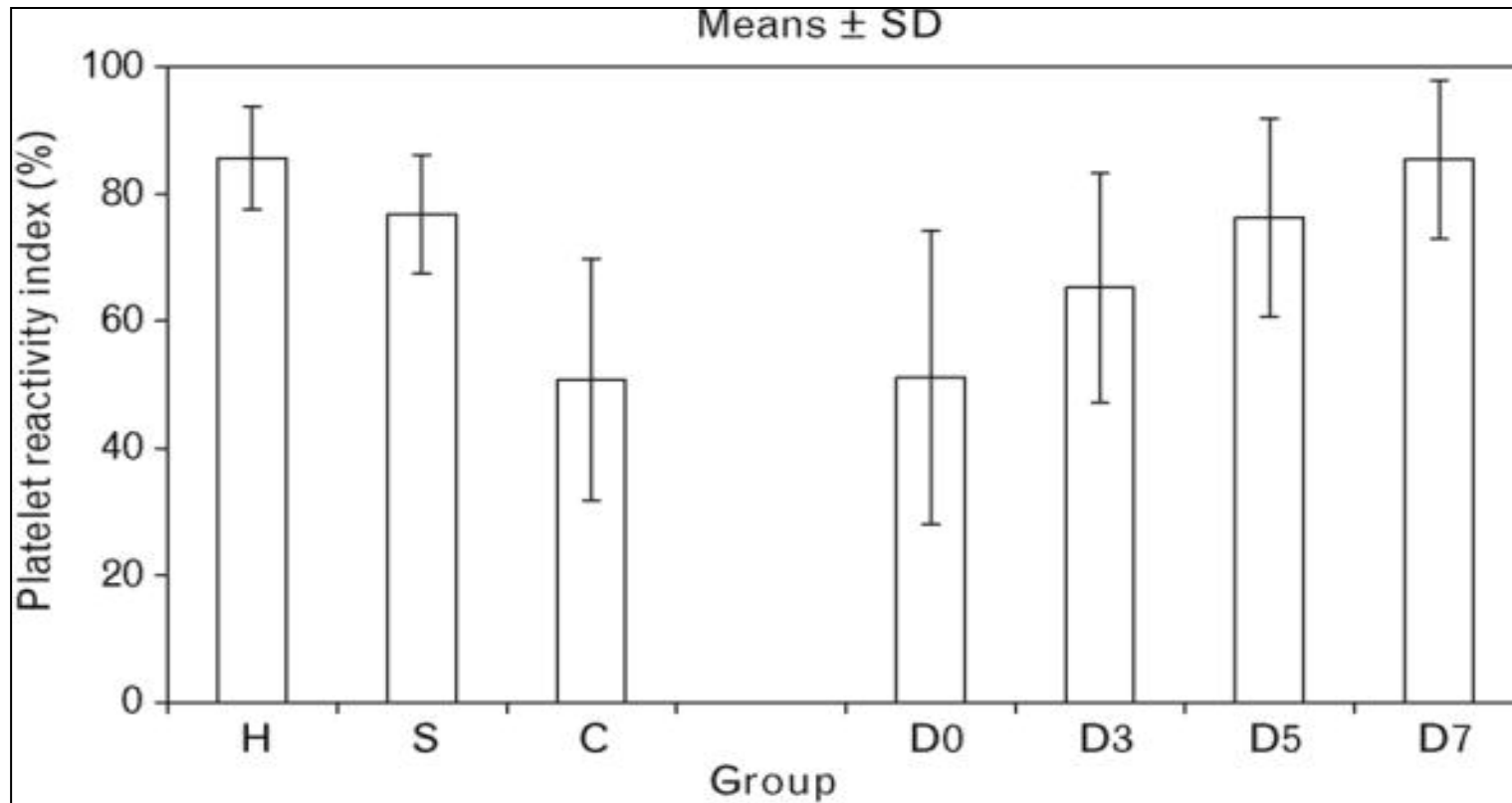
*Houston, Texas*



# Proportion of patients with major adverse cardiac events (death, readmission for acute coronary syndrome, coronary revascularization)

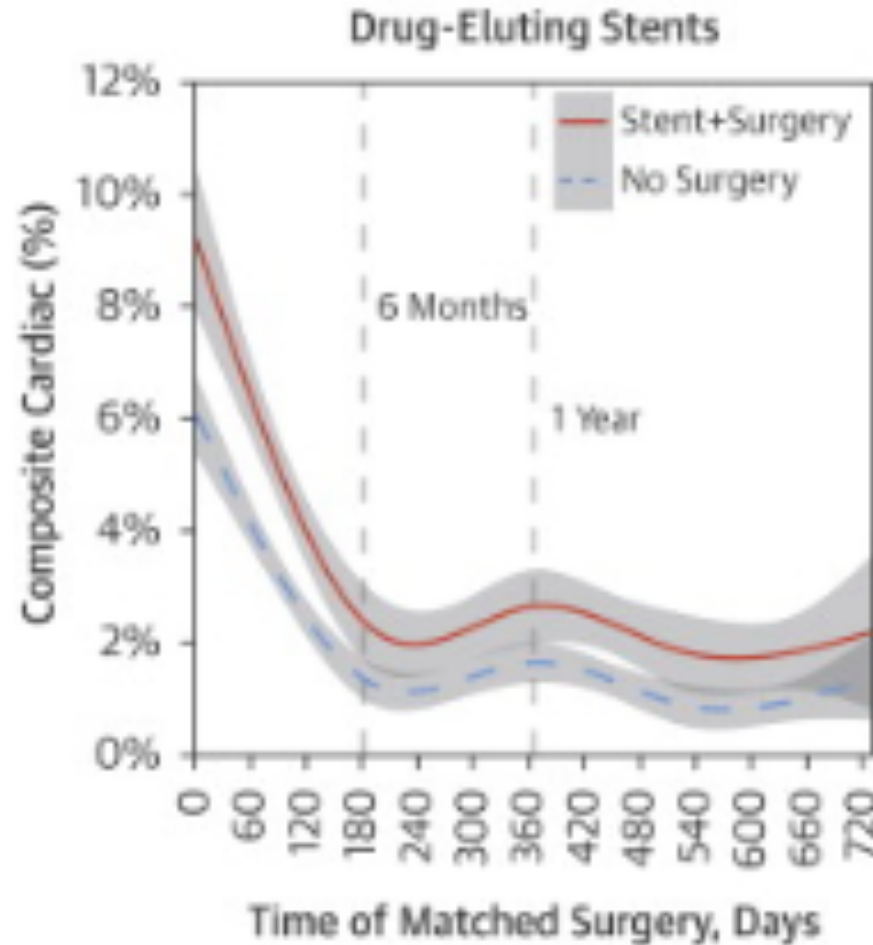


# Discontinuation of clopidogrel

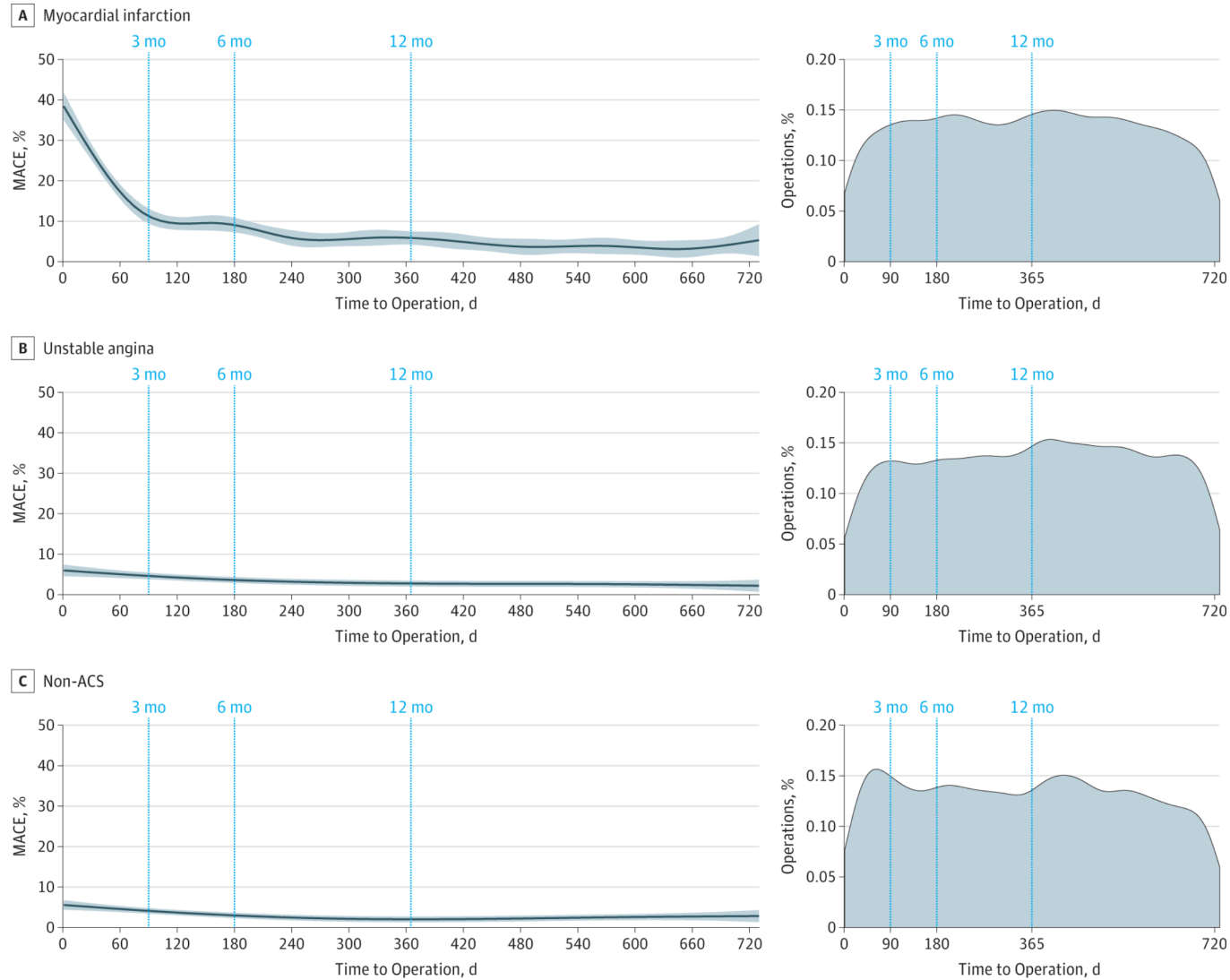


Mean  $\pm$  SD of platelet reactivity index (%) of the healthy volunteers and all patients' groups. H, healthy volunteers; S, surgical control group; C, cardiologic group; D0, 3, 5, 7, clopidogrel discontinuation group with the four time points (days 0, 3, 5, 7). For significance levels, see Table 2.

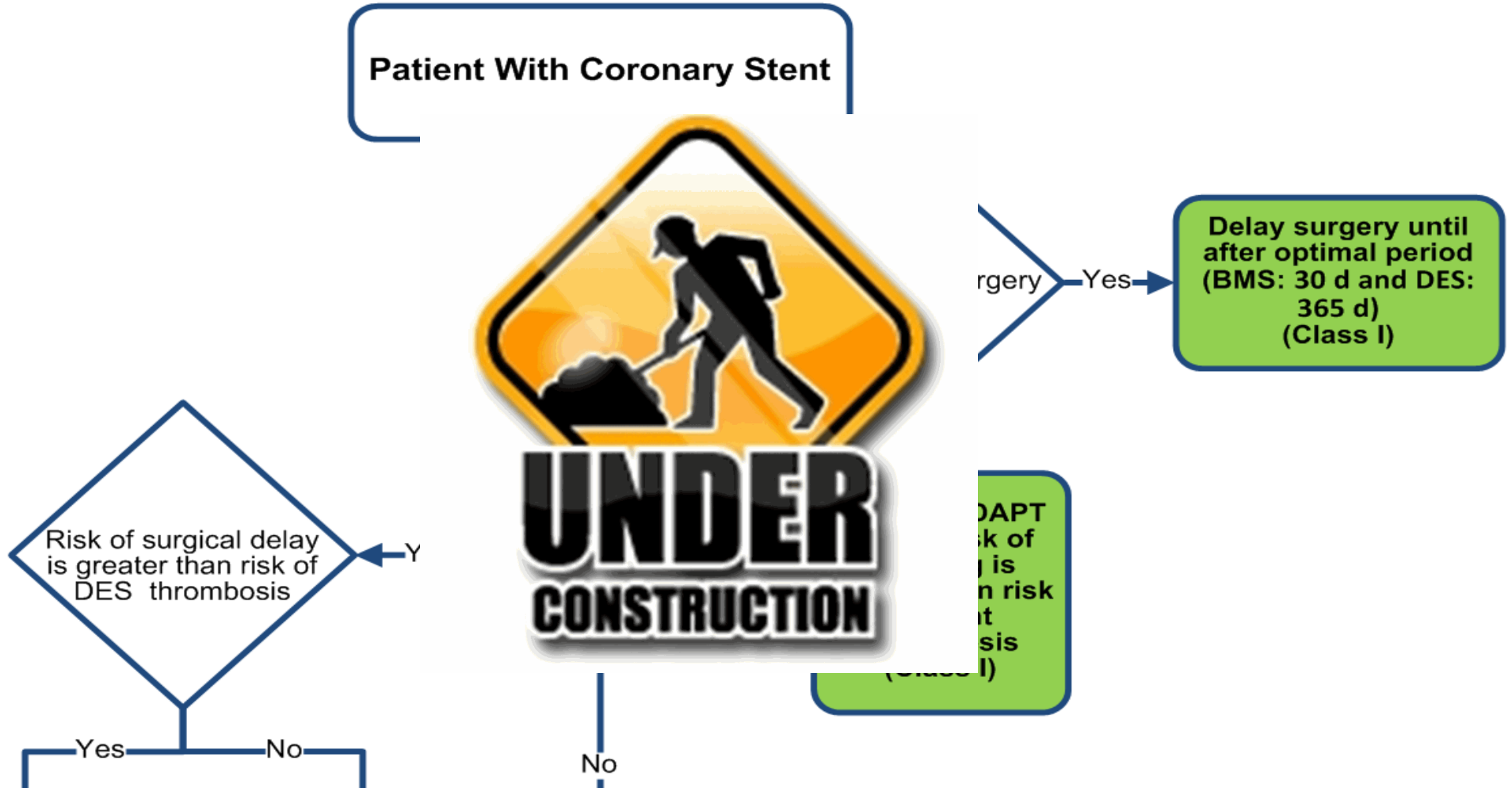
# The Incremental Risk of Noncardiac Surgery on Adverse Cardiac Events Following Coronary Stenting



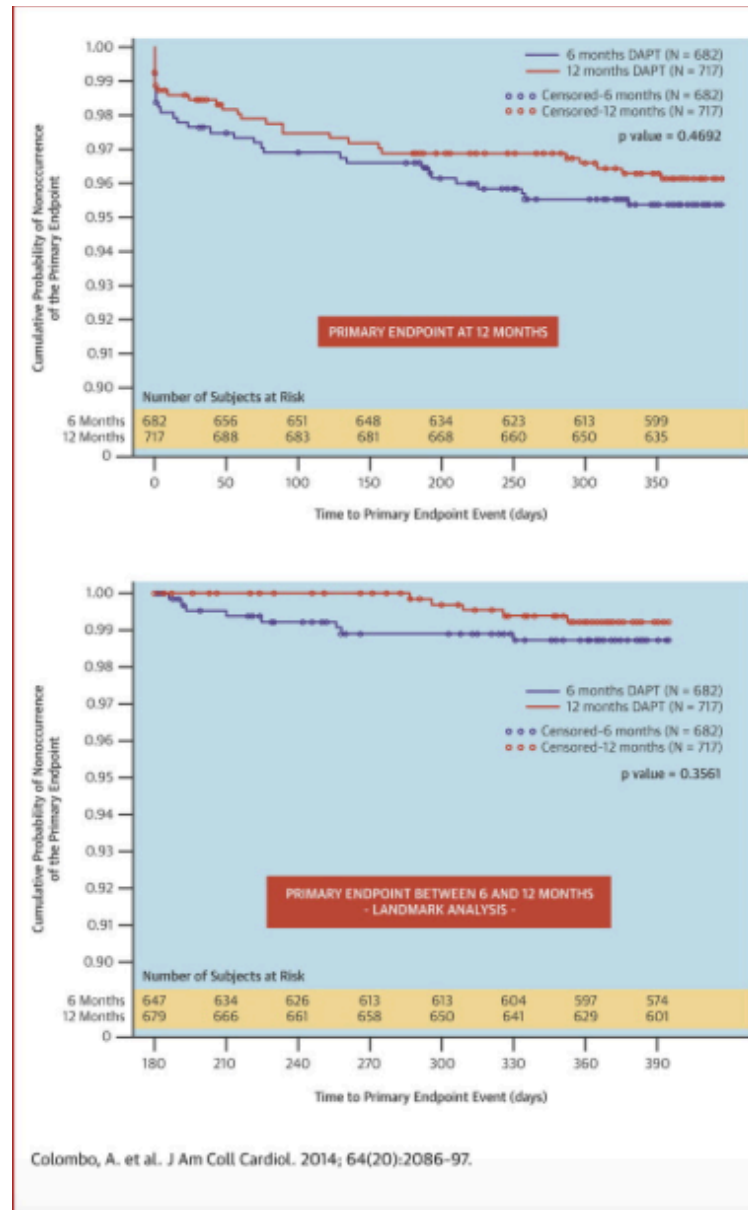
# Association of Coronary Stent Indication With Postoperative Outcomes Following Noncardiac Surgery



# Proposed Algorithm for Antiplatelet Management in Patients with PCI and Noncardiac Surgery

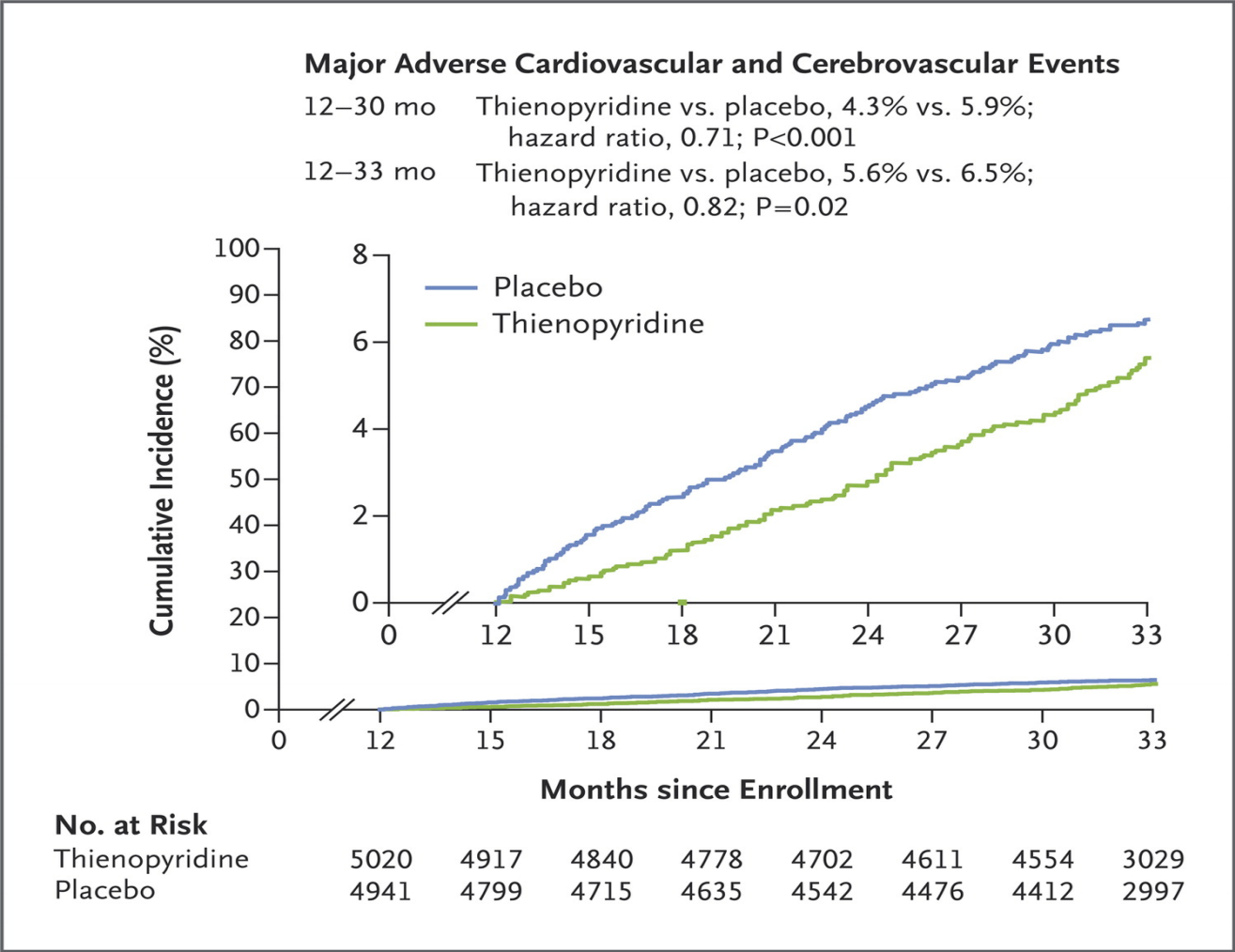


# Second-Generation Drug-Eluting Stent Implantation Followed by 6- Versus 12-Month Dual Antiplatelet Therapy : The SECURITY Randomized Clinical Trial

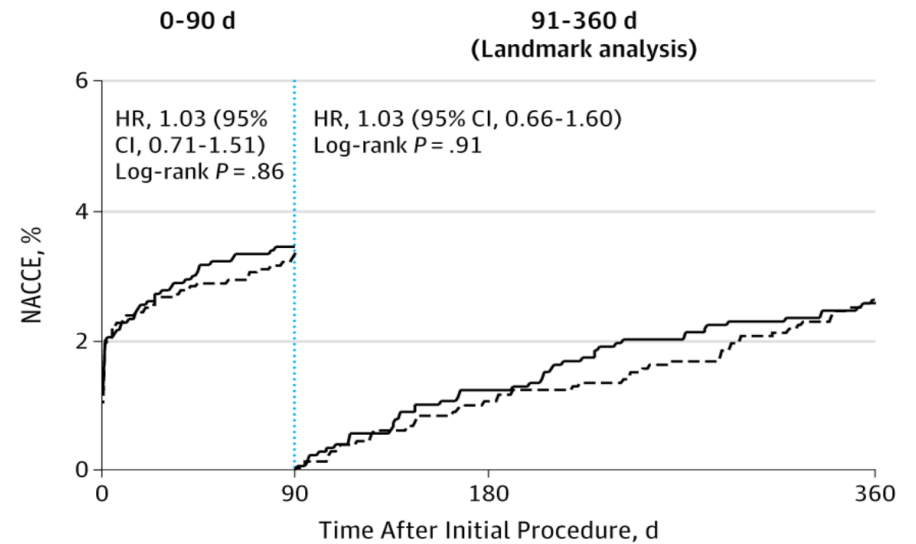
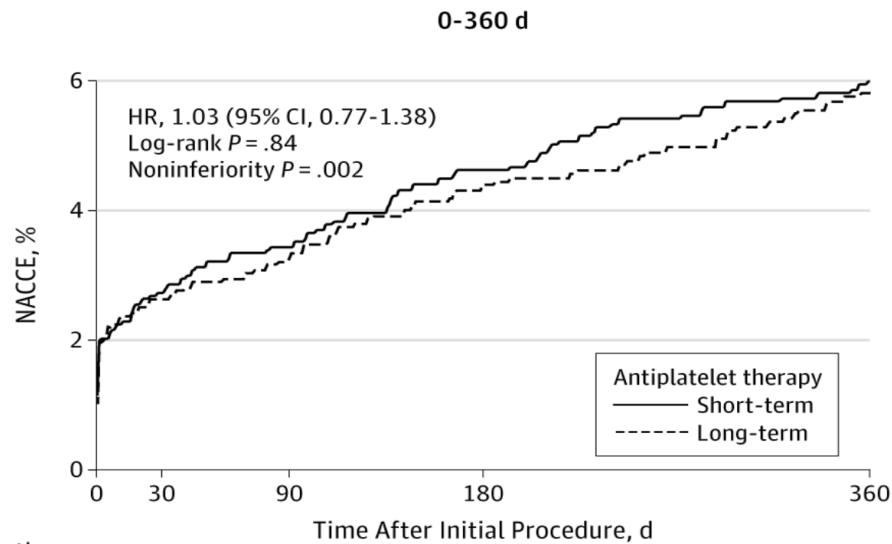




# Twelve or 30 Months of Dual Antiplatelet Therapy after Drug-Eluting Stents



# Three vs Twelve Months of Dual Antiplatelet Therapy After Zotarolimus-Eluting Stents: The OPTIMIZE Randomized Trial

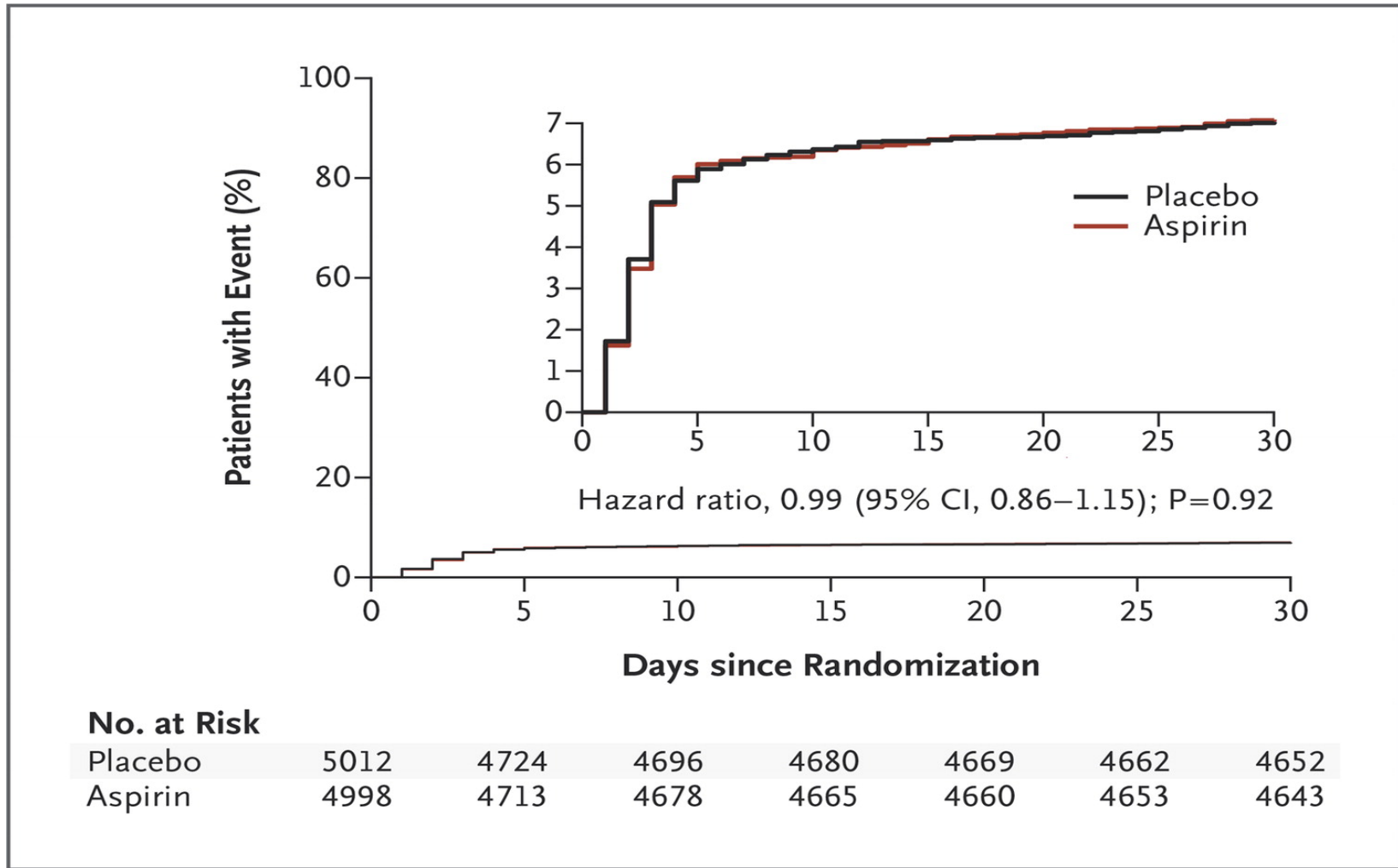


Short-term therapy		1504		1468		1384	
No. at risk	1563	1520	1504	1468	1384		
No. of events	18	25	11	18	21		
Long-term therapy		1497		1466		1381	
No. at risk	1556	1514	1497	1466	1381		
No. of events	16	25	11	16	22		

1504		1468		1384	
No. at risk	1563	1504	1468	1384	
No. of events	18	11	18	21	
1497		1466		1381	
No. at risk	1556	1497	1466	1381	
No. of events	16	11	16	22	

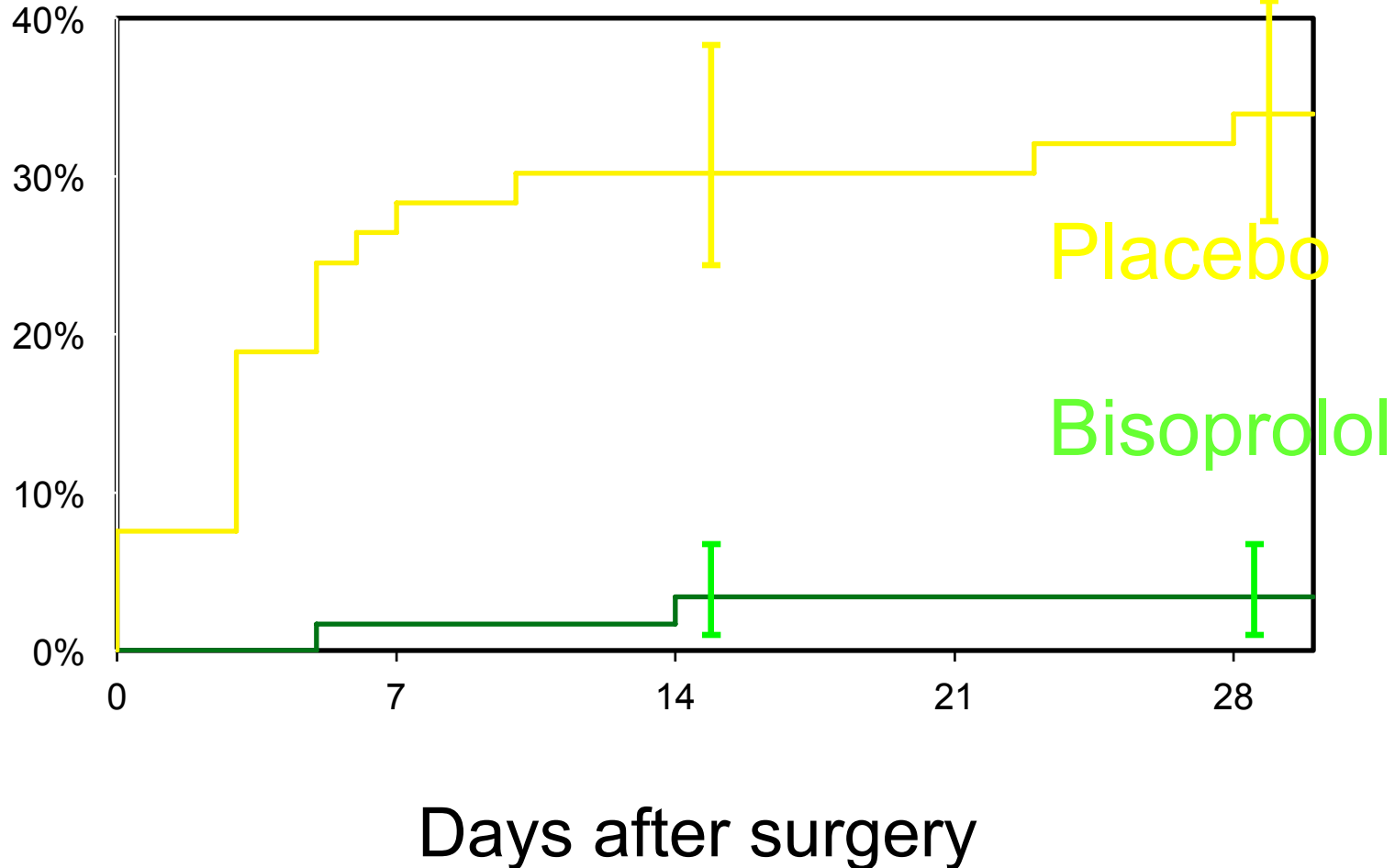
# POISE-11

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



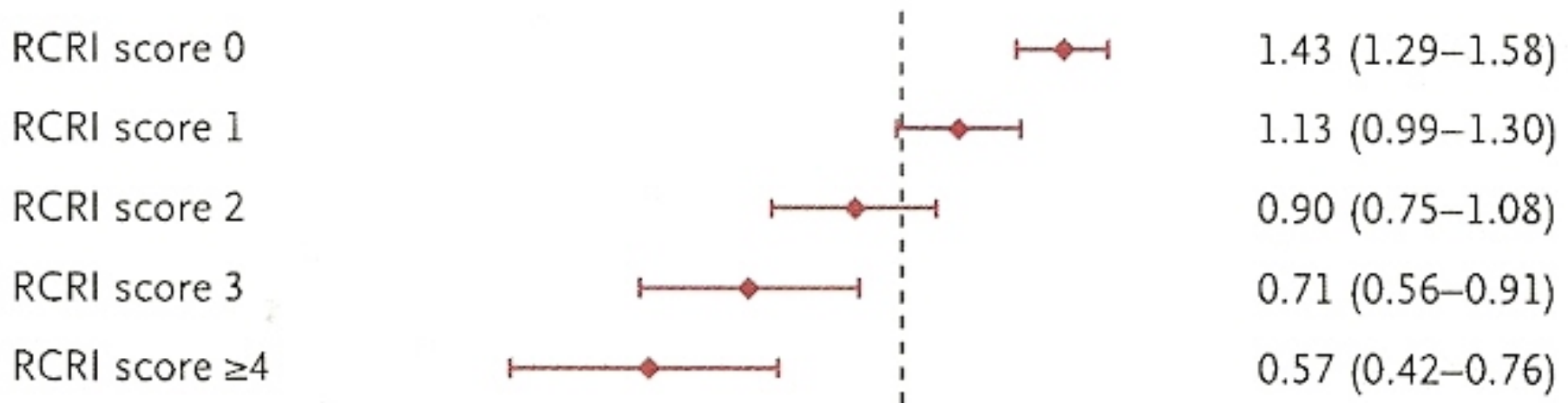
# Bisoprolol in high risk vascular patients

**P < 0.0001**

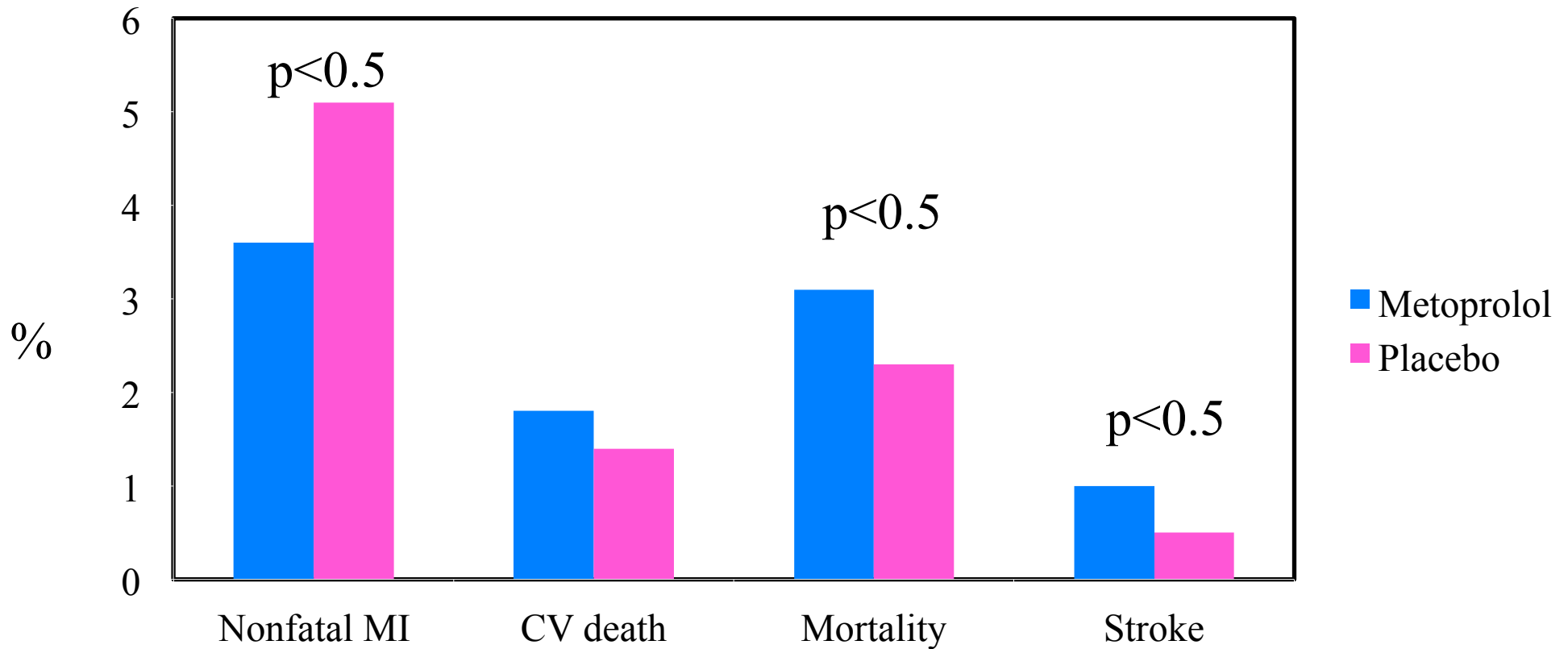


# Adjusted Odds Ratio for In-Hospital Death Associated with Perioperative Beta-Blocker Therapy

## Propensity-Matched Cohort



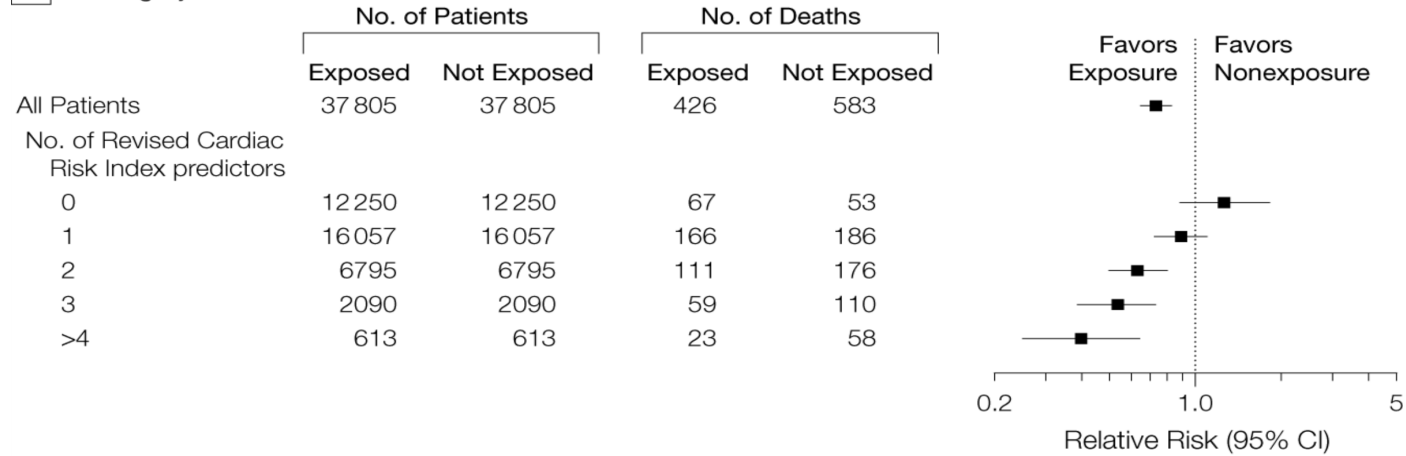
# POISE



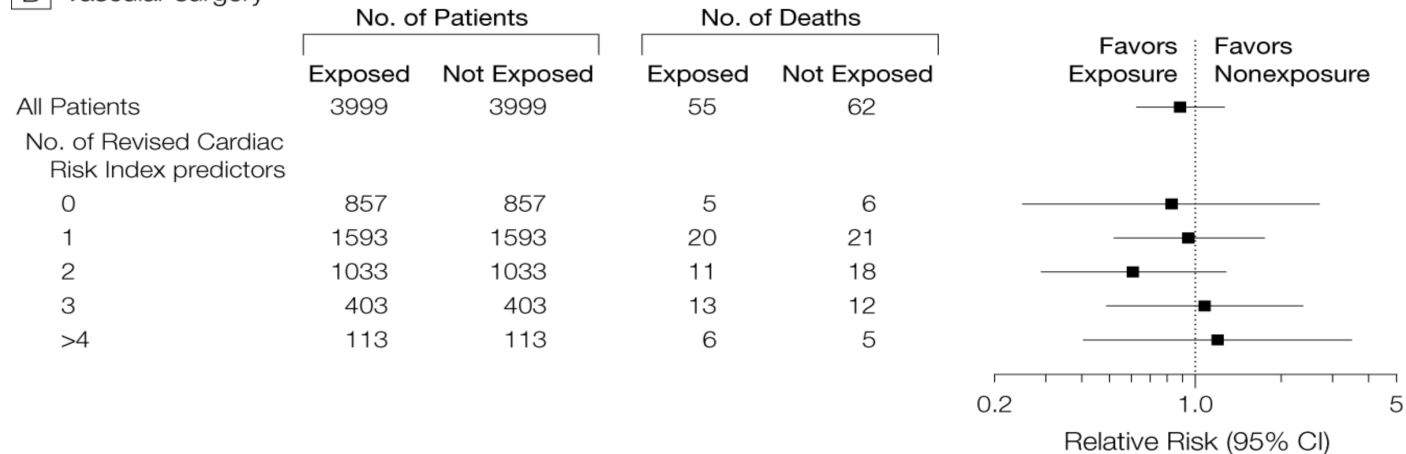
Devereaux, et al. Lancet 2008

# Association of Perioperative $\beta$ -Blockade With Mortality Following Major Noncardiac Surgery

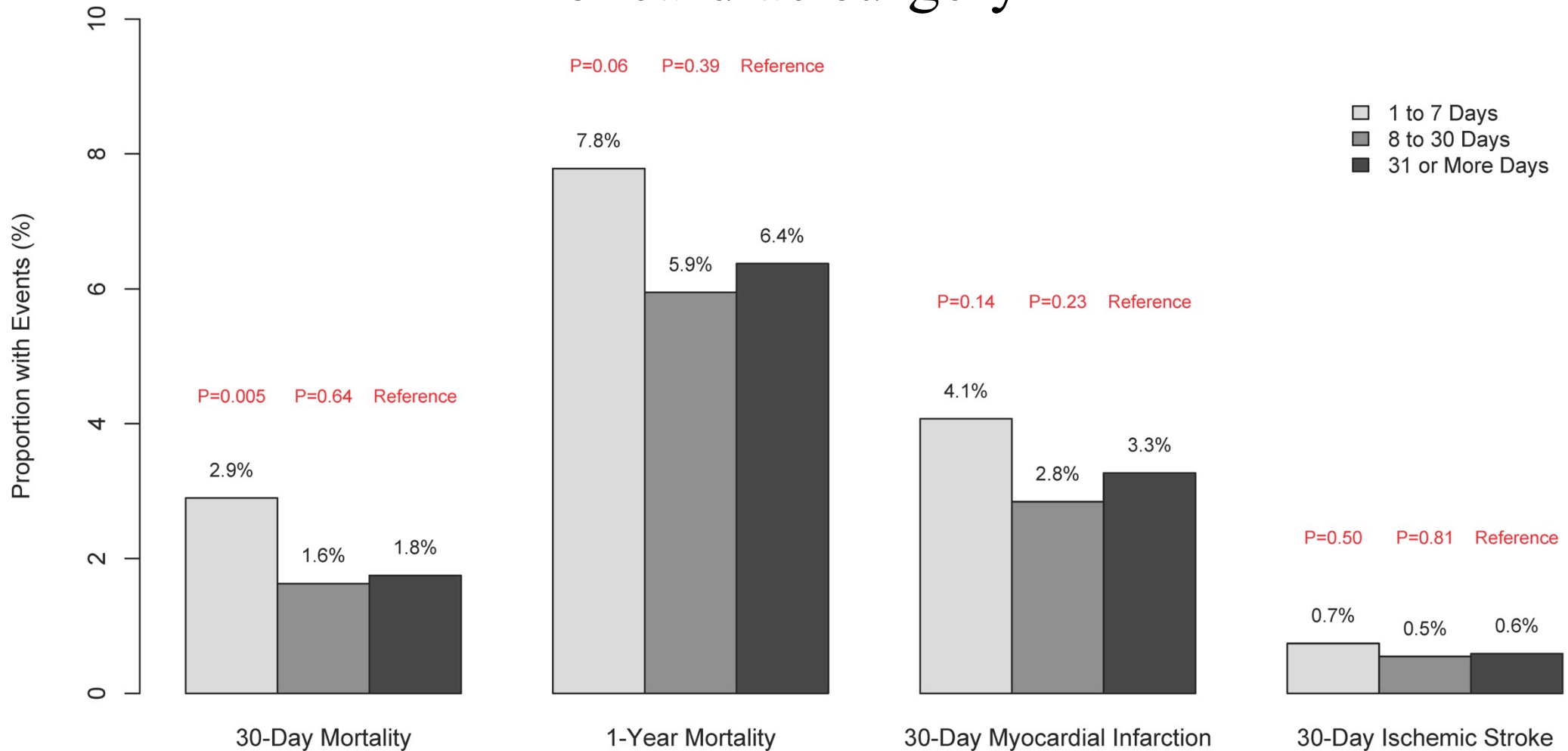
## A All surgery



## B Vascular surgery



# Administrative databases of 48,103 patients aged $\geq 66$ years who underwent major noncardiac surgery





# Perioperative Beta-Blocker Therapy

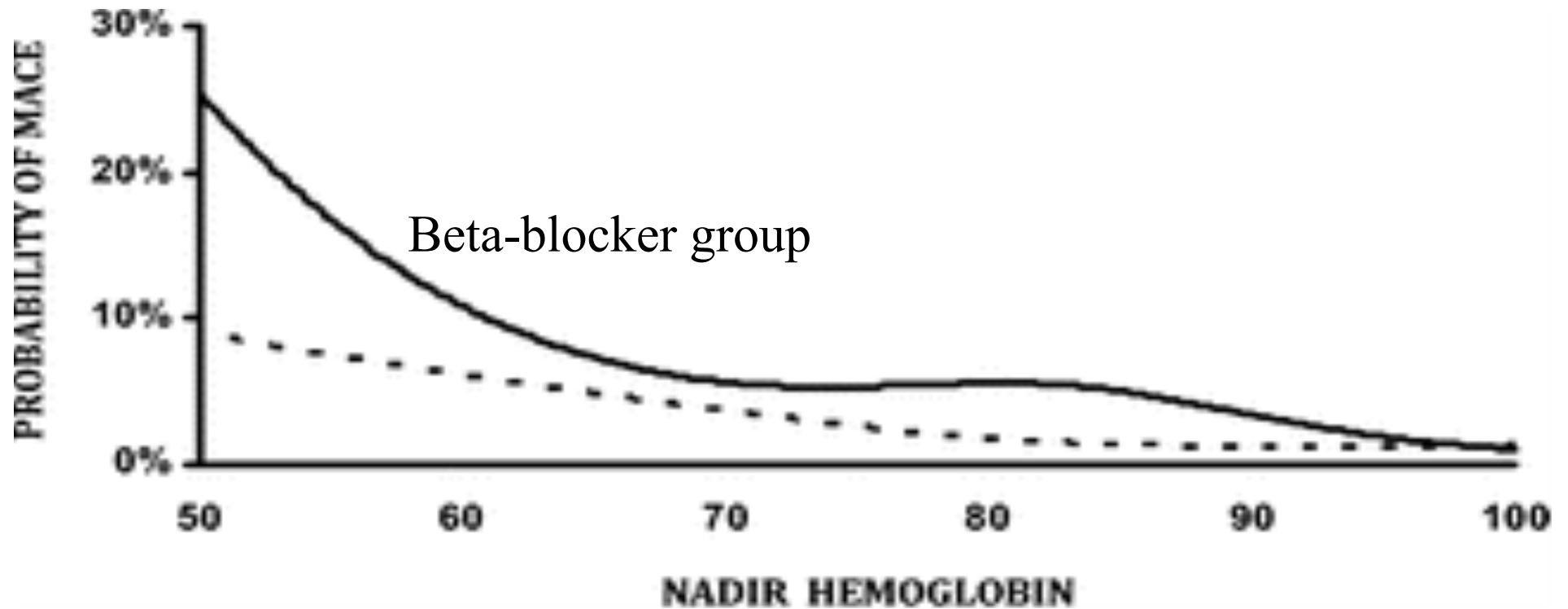
Recommendations	COR	LOE
Beta blockers should be continued in patients undergoing surgery who have been on beta blockers chronically.	I	B <sup>SR</sup>
It is reasonable for the management of beta blockers after surgery to be guided by clinical circumstances, independent of when the agent was started.	IIa	B <sup>SR</sup>
In patients with intermediate- or high-risk myocardial ischemia noted in preoperative risk stratification tests, it may be reasonable to begin perioperative beta blockers.	IIb	C <sup>SR</sup>
In patients with 3 or more RCRI risk factors (e.g., diabetes mellitus, HF, CAD, renal insufficiency, cerebrovascular accident), it may be reasonable to begin beta blockers before surgery.	IIb	B <sup>SR</sup>

See the ERC systematic review report, “Perioperative beta blockade in noncardiac surgery: a systematic review for the 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery” for the complete evidence review on perioperative beta-blocker therapy (8), and see Online Data Supplement 19 for more information about beta blockers ([http://jaccjacc.cardiosource.com/acc\\_documents/2014\\_Periop\\_GL\\_Data\\_Supplement\\_Tables.pdf](http://jaccjacc.cardiosource.com/acc_documents/2014_Periop_GL_Data_Supplement_Tables.pdf)). The tables in Data Supplement 19 were reproduced directly from the ERC’s systematic review for your convenience. These recommendations have been designated with a SR to emphasize the rigor of support from the ERC’s systematic review.

## Perioperative Beta-Blocker Therapy (cont'd)

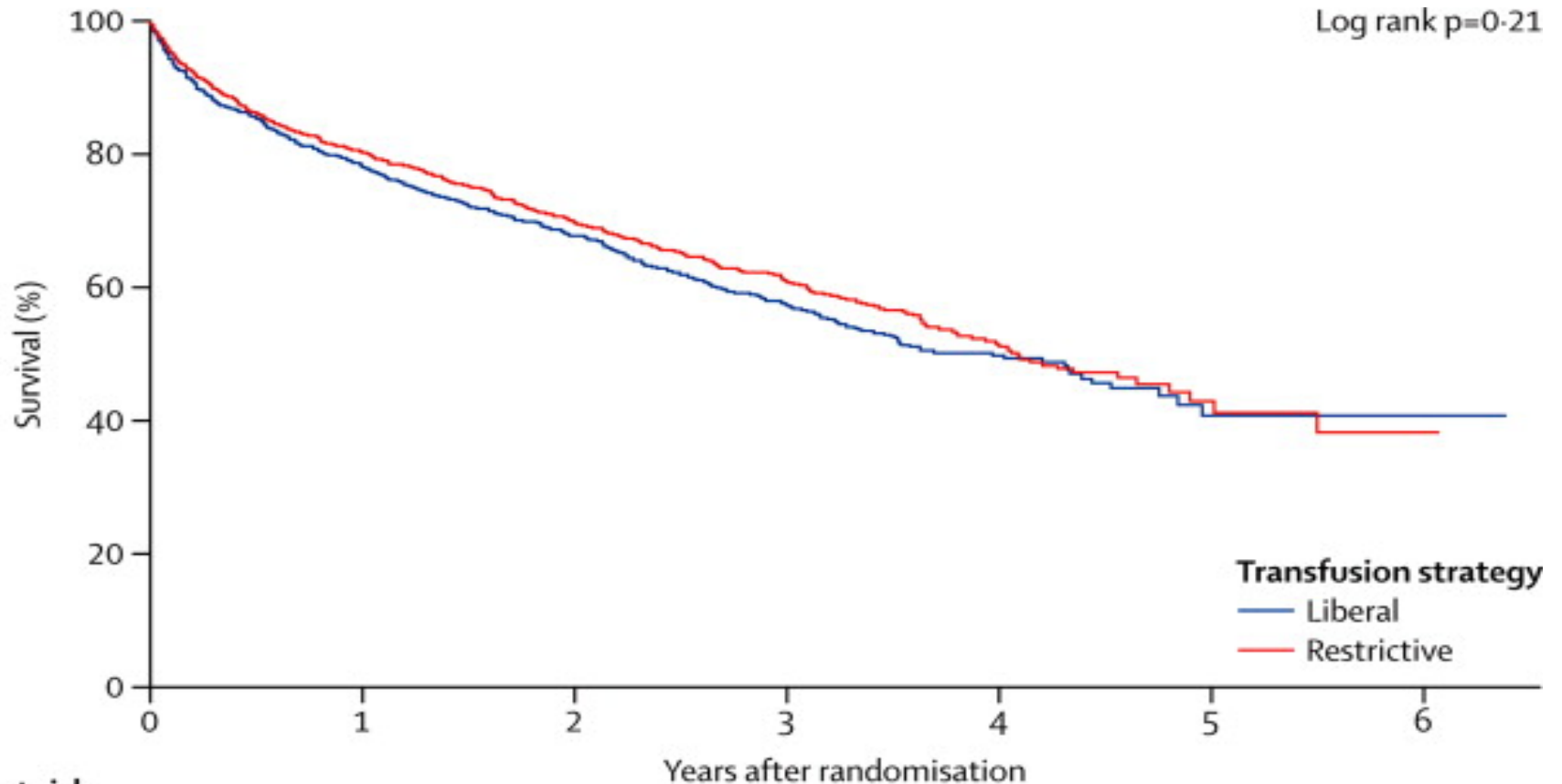
<b>Recommendations</b>	<b>COR</b>	<b>LOE</b>
In patients with a compelling long-term indication for beta-blocker therapy but no other RCRI risk factors, initiating beta blockers in the perioperative setting as an approach to reduce perioperative risk is of uncertain benefit.	IIb	B <sup>SR</sup>
In patients in whom beta-blocker therapy is initiated, it may be reasonable to begin perioperative beta blockers long enough in advance to assess safety and tolerability, preferably more than 1 day before surgery.	IIb	B <sup>SR</sup>
Beta-blocker therapy should not be started on the day of surgery.	III: Harm	B <sup>SR</sup>

See the ERC systematic review report, “Perioperative beta blockade in noncardiac surgery: a systematic review for the 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery” for the complete evidence review on perioperative beta-blocker therapy (8), and see Online Data Supplement 19 for more information about beta blockers ([http://jaccjacc.cardiosource.com/acc\\_documents/2014\\_Periop\\_GL\\_Data\\_Supplement\\_Tables.pdf](http://jaccjacc.cardiosource.com/acc_documents/2014_Periop_GL_Data_Supplement_Tables.pdf)). The tables in Data Supplement 19 were reproduced directly from the ERC’s systematic review for your convenience. These recommendations have been designated with a SR to emphasize the rigor of support from the ERC’s systematic review.



From: Acute Surgical Anemia Influences the Cardioprotective Effects of  $\beta$ -Blockade: A Single-center, Propensity-matched Cohort Study  
Anesthesiology. 2010;112(1):25-33. doi:10.1097/ALN.0b013e3181c5dd81

# Liberal versus restrictive blood transfusion strategy: 3-year survival and cause of death results from FOCUS

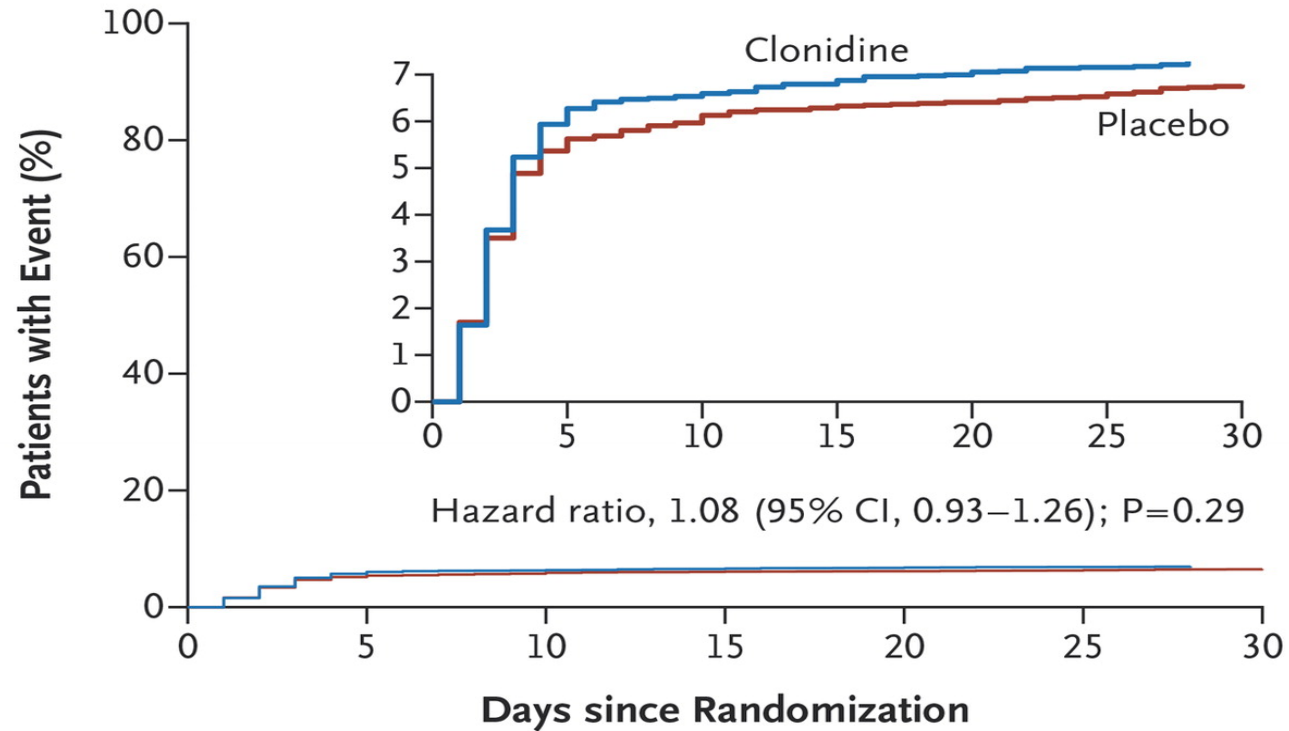


## Number at risk

	0	1	2	3	4	5	6						
Liberal	999	852	773	687	586	435	307	200	114	61	23	14	6
Restrictive	1003	864	800	717	602	458	315	215	122	65	26	14	3

# POISE-II Clonidine Arm

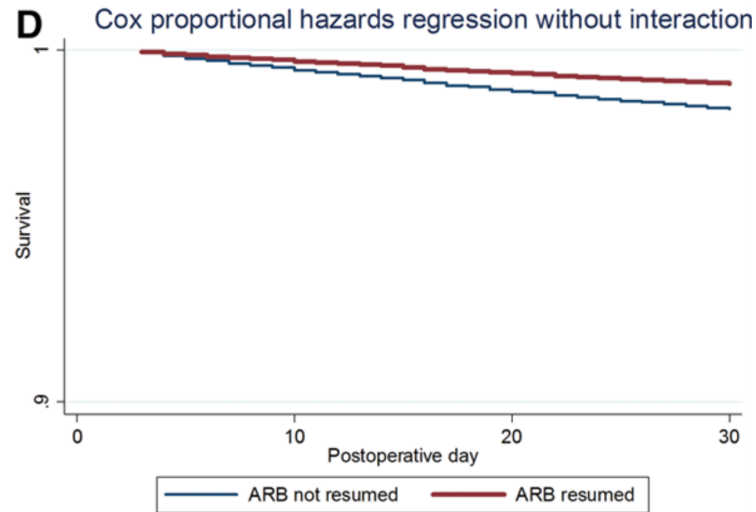
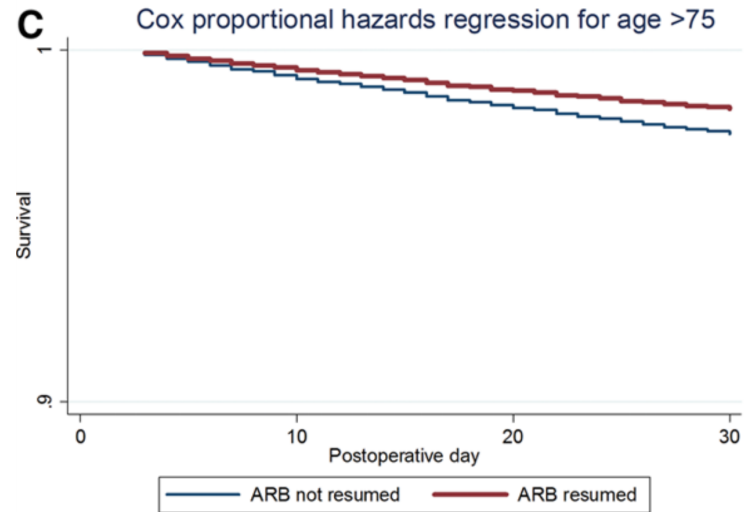
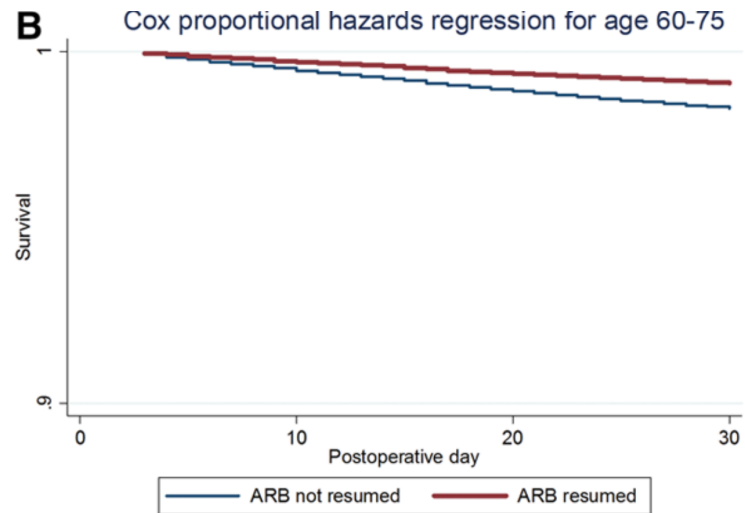
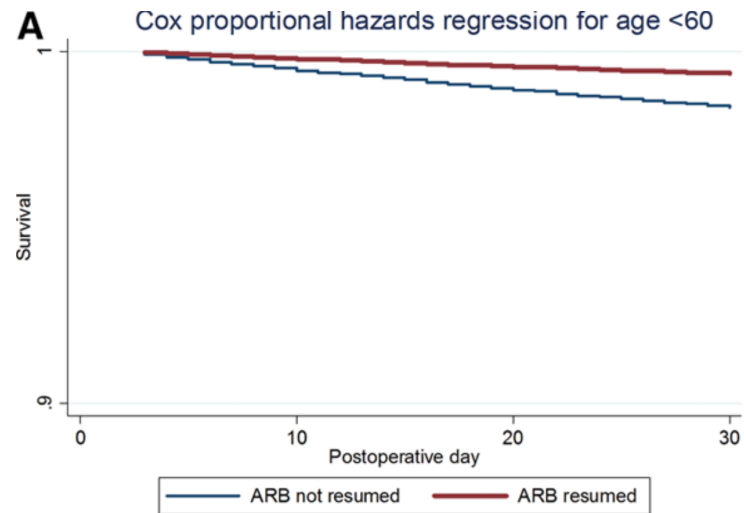
## Kaplan–Meier Estimates of the Primary Outcome



### No. at Risk

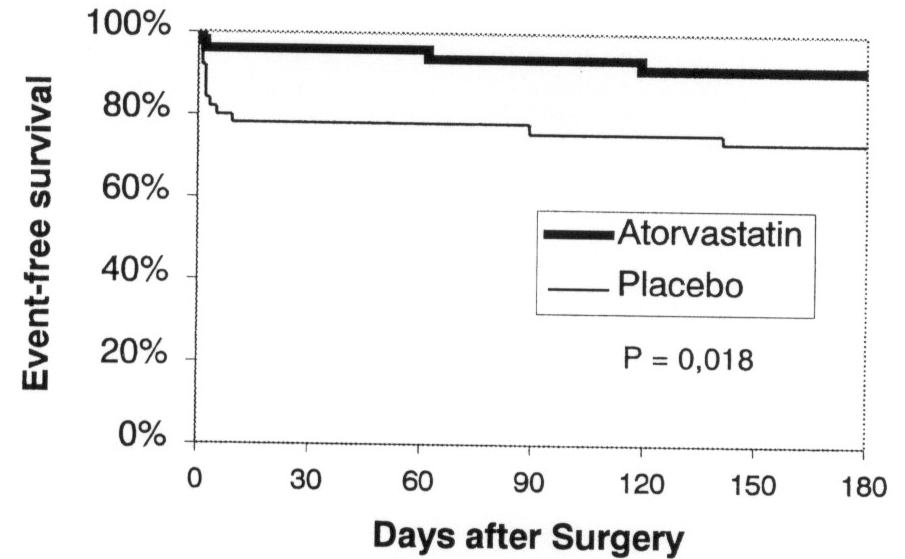
Placebo	5001	4728	4697	4681	4675	4669	4658
Clonidine	5009	4709	4677	4664	4651	4647	4638

# Association between Withholding Angiotensin Receptor Blockers in the Early Postoperative Period and 30-day Mortality: A Cohort Study of the Veterans Affairs Healthcare System



# RCT of Statins

- 100 vascular surgery patients
- 20mg atorvastatin or placebo for 45 days
- Vascular surgery an average of 30 days after randomization



Atorvastatin	50	44	43	41	40	40	40
Placebo	50	38	36	35	34	33	33

**Table 4.** Independent Variables Associated with Postoperative Cardiac Myonecrosis in Patients Chronically Treated with Statins Regardless of the Period of Study Where Delay Between Surgery and Restarting of Statins was Known ( $N = 262$ )

Variables	Odds ratio (95% confidence interval)	<i>P</i> value
Obliterative vascular disease	1.8 (1.1–3.2)	0.04
Coronary artery disease	1.8 (1.1–3.2)	0.03
Age >75 yr	2.0 (1.1–3.7)	0.03
Statins withdrawal = 4 days	2.9 (1.6–5.5)	0.001
Reintervention (any type)	3.7 (1.9–7.1)	<0.001
PRBC >3 units	4.1 (2.4–7.2)	<0.001

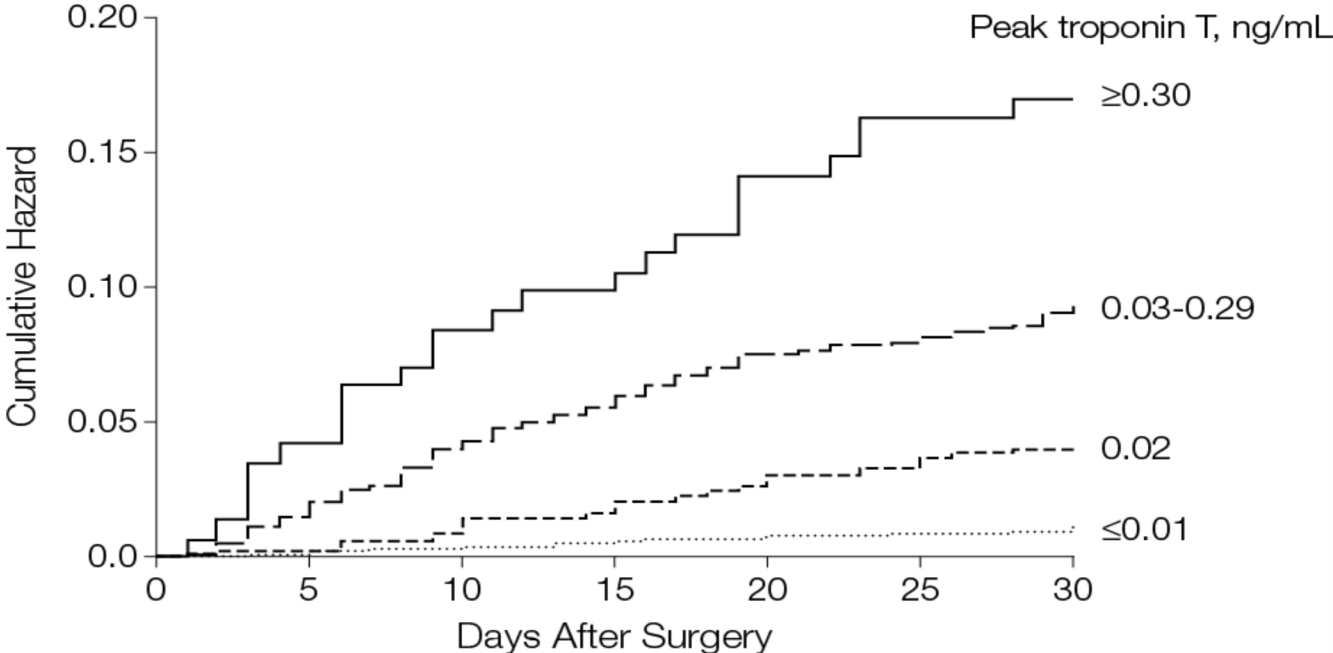
PRBC = Packed red blood cell units.



## Perioperative Statin Therapy

<b>Recommendations</b>	<b>COR</b>	<b>LOE</b>
Statins should be continued in patients currently taking statins and scheduled for noncardiac surgery.	I	B
Perioperative initiation of statin use is reasonable in patients undergoing vascular surgery.	IIa	B
Perioperative initiation of statins may be considered in patients with clinical indications according to GDMT who are undergoing elevated-risk procedures.	IIb	C

# Association Between Postoperative Troponin Levels and 30-Day Mortality Among Patients Undergoing Noncardiac Surgery



No. at risk							
Peak troponin T, ng/mL							
≥0.30	142	136	129	127	121	118	117
0.03-0.29	1121	1103	1075	1058	1036	1030	1018
0.02	494	492	489	485	480	477	473
≤0.01	13376	13348	13300	13271	13250	13230	13209

## Surveillance and Management for Perioperative MI

<b>Recommendations</b>	<b>COR</b>	<b>LOE</b>
Measurement of troponin levels is recommended in the setting of signs or symptoms suggestive of myocardial ischemia or MI.	I	A
Obtaining an ECG is recommended in the setting of signs or symptoms suggestive of myocardial ischemia, MI, or arrhythmia.	I	B
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 in the absence of established risks and benefits of a defined management strategy.	IIb	B

## Surveillance and Management for Perioperative MI (cont'd)

<b>Recommendations</b>	<b>COR</b>	<b>LOE</b>
The usefulness of postoperative screening with ECGs in patients at high risk for perioperative MI, but without signs or symptoms suggestive of myocardial ischemia, MI, or arrhythmia, is uncertain in the absence of established risks and benefits of a defined management strategy.	IIb	B
Routine postoperative screening with troponin levels in unselected patients without signs or symptoms suggestive of myocardial ischemia or MI is not useful for guiding perioperative management.	III: No Benefit	B

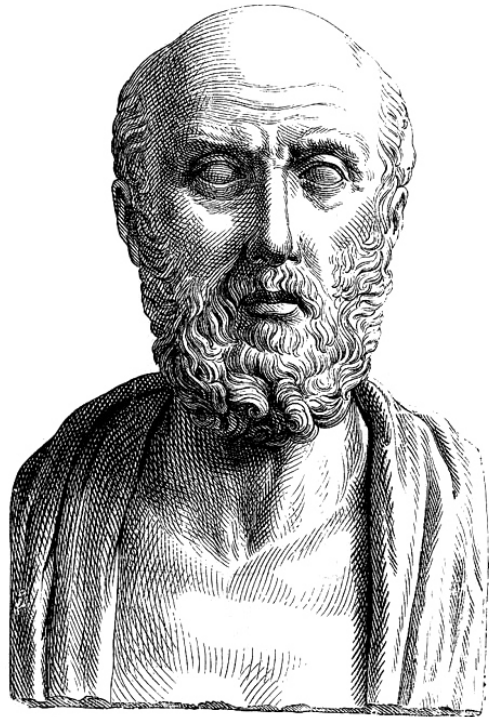
# Scenarios

- Patient scheduled for colon resection for cancer
  - 65 year old diabetic hypertensive. Q waves on ECG
    - Should we test?
      - **NO, UNLESS UNSTABLE SYMPTOMS**
    - Should we start medications?
      - **IF TIME, PERHAPS STATINS, BETA BLOCKERS ONLY IF >7 DAYS AND WOULD CONTINUE THERAPY**

# Scenarios

- Patient scheduled for colon resection for cancer
  - 68 year old s/p DES stent placement 4 months ago on DAPT
    - What should we do with medications?
      - **GIVEN URGENCY OF SURGERY, HOLD P2Y12 INHIBITOR FOR 5 DAYS AND CONTINUE ASA, RESTART ASAP**
  - 68 year old with stable ischemic heart disease
    - No postoperative symptoms. Should we get Troponin?
      - **NOT UNLESS SYMPTOMATIC**

“As to diseases, make a habit of two things — to help, or at least, to do no harm.”



Hippocrates