CARDIAC RISK ASSESSMENT AND CARE FOR THE PATIENT UNDERGOING NONCARDIAC SURGERY

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Ogden Surgical Medical Society
May 15 2015

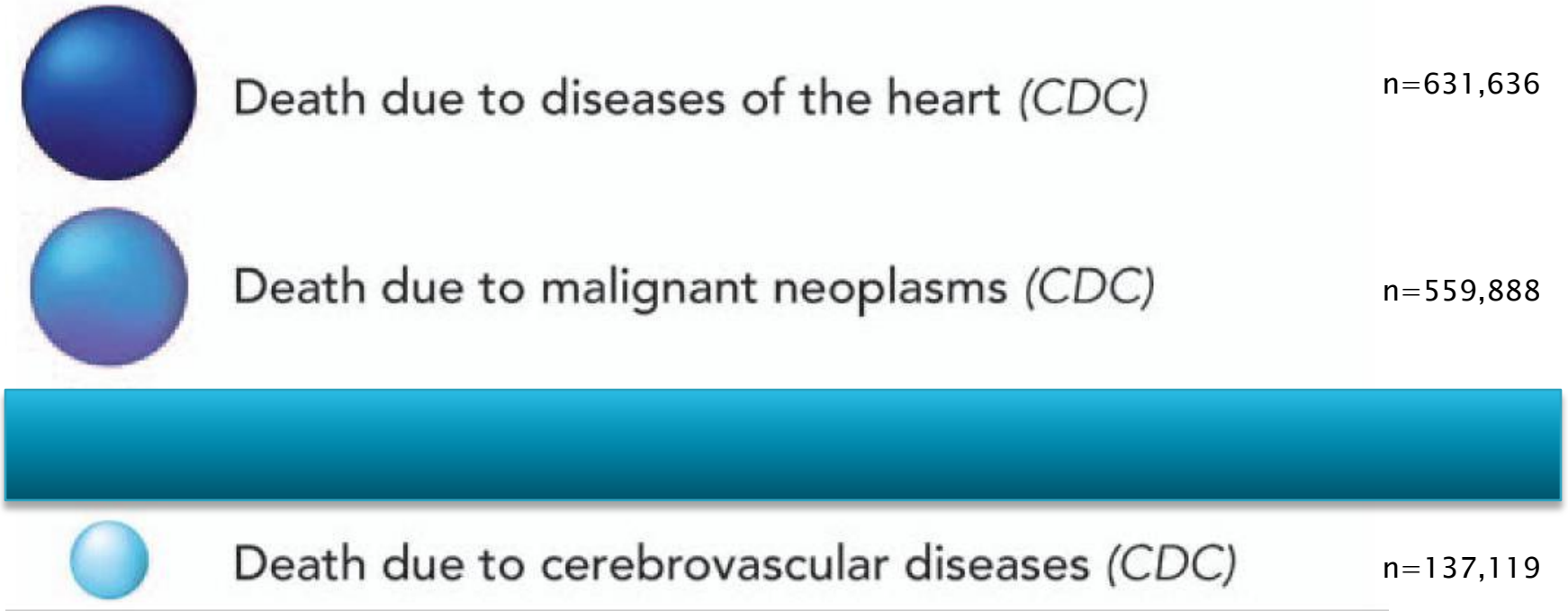
THE MAGNITUDE OF THE PROBLEM

- Of the 200 million adults worldwide who undergo noncardiac surgery each year, more than 1 million will die within 30 days.

  Vision Study Investigators JAMA 2012

- A proportion of these patients have unrecognized or known heart disease and will have recognized or clinically unrecognized cardiac complications from their surgery.
- Our goal as physicians is to minimize the number of cardiac complications occurring in the perioperative period.

CENTER FOR DISEASE CONTROL ANNUAL DEATH RATE TABLE 2006



MYOCARDIAL INJURY AFTER NONCARDIAC SURGERY: A LARGE, INTERNATIONAL, PROSPECTIVE COHORT STUDY ESTABLISHING DIAGNOSTIC CRITERIA, CHARACTERISTICS, PREDICTORS AND 30 DAY OUTCOMES

Anesthesiology March 2014

MYOCADIAL INJURY AFTER NONCARDIAC SURGERY: A LARGE INTERNATIONAL, PROSPECTIVE COHORT STUDY…

Anesthesiology March 2014

- 15065 patients ≥ 45 years undergoing surgery and requiring at least overnight hospitalization
- Troponin T was measured during the first 3 perioperative days or later if patients had ischemic symptoms
- 1.7% of the patients died within 30 days
- Myocardial injury after noncardiac surgery (MINS) was found in 8.0% of the patients
- The 30 day mortality rate was 9.8% in patients with MINS and 1.1% in patients without MINS (OR 10.07; 95% CI, 7.84–12.94, $P<0.001$)
- The population attributable risk of MINS to 30 day mortality is 34%

MYOCARDIAL INJURY AFTER NONCARDIAC SURGERY

- At Risk: older, cardiovascular risk factors and had known cardiovascular disease
- 86% of patients did not have an ischemic symptom
- Only 35% of patients had an ischemic ECG finding

CONTRIBUTORS TO PERIOPERATIVE CARDIOVASCULAR INSTABILITY

- Catecholamine surge
- Prothrombotic milieu
- Volume Shifts
- Blood loss
- Fixed coronary disease
- Coronary plaque destabilization

CARDIAC RISK ASSESSMENT AND CARE FOR THE PATIENT UNDERGOING NONCARDIAC SURGERY

- Given that there is a significant incidence of morbidity and mortality for patients during the perioperative period and that a large proportion of these events are cardiac in nature, how do we minimize these risks for our patients?

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
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PUBLISHED BY ELSEVIER INC.

VOL. 64, NO. 22, 2014
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2014.07.944

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, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists, and Society of Vascular Medicine

Endorsed by the Society of Hospital Medicine

European Heart Journal (2014) **35**, 2383–2431
doi:10.1093/eurheartj/ehu282

ESC/ESA GUIDELINES

2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management

The Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA)

PURPOSE OF THE PREOPERATIVE CARDIAC EVALUATION

NOT TO PROVIDE MEDICAL CLEARANCE

- Assess the presence and stability of risk factors for cardiovascular events
- Establish a clinical risk profile for informed and shared decision making
- Assess the need for cardiac diagnostic testing prior to surgery
- Assess the need for interventions prior to surgery including the initiation or changing of medications, the need for PCI or the need for cardiac surgery
- Recommend precautions or interventions to be taken in the operating room
- Recommend monitoring and treatment during postoperative care

- THE SURGICAL PROCEDURE
- THE PATIENT
- ANESTHESIA

ANESTHESIA

TABLE 7 Summary of Recommendations for Anesthetic Consideration and Intraoperative Management

Recommendations	COR	LOE	References
Volatile general anesthesia versus total intravenous anesthesia			
Use of either a volatile anesthetic agent or total intravenous anesthesia is reasonable for patients undergoing noncardiac surgery	IIa	A	(340,341)
Perioperative pain management			
Neuraxial anesthesia for *postoperative* pain relief can be effective to reduce MI in patients undergoing abdominal aortic surgery	IIa	B	(348)
Preoperative epidural analgesia may be considered to decrease the incidence of *preoperative* cardiac events in patients with hip fracture	IIb	B	(349)
Prophylactic intraoperative nitroglycerin			
Prophylactic intravenous nitroglycerin is not effective in reducing myocardial ischemia in patients undergoing noncardiac surgery	III: No Benefit	B	(292,355,356)
Intraoperative monitoring techniques			
Emergency use of perioperative TEE in patients with hemodynamic instability is reasonable in patients undergoing noncardiac surgery if expertise is readily available	IIa	C	N/A
Routine use of intraoperative TEE during noncardiac surgery is not recommended	III: No Benefit	C	N/A
Maintenance of body temperature			
Maintenance of normothermia may be reasonable to reduce perioperative cardiac events	IIb	B	(364,365)
Hemodynamic assist devices			
Use of hemodynamic assist devices may be considered when urgent or emergency noncardiac surgery is required in the setting of acute severe cardiac dysfunction	IIb	C	N/A
Perioperative use of pulmonary artery catheters			
Use of pulmonary artery catheterization may be considered when underlying medical conditions that significantly affect hemodynamics cannot be corrected before surgery	IIb	C	N/A
Routine use of pulmonary artery catheterization is not recommended	III: No Benefit	A	(380–382)

COR indicates Class of Recommendation; LOE, Level of Evidence; MI, myocardial infarction; N/A, not applicable; and TEE, transesophageal echocardiogram.

2014 ACC/AHA Guidelines

DEFINING RISK BASED ON COMBINED SURGICAL AND PATIENT CHARACTERISTICS

- Low Risk – risk of major adverse cardiac events $< 1\%$
- Elevated Risk – risk of major adverse cardiac events $\geq 1\%$

LOW RISK SURGICAL PROCEDURES

- Superficial procedures
- Cataract surgery
- Breast surgery
- Endoscopic procedures
- Ambulatory surgery

ELEVATED RISK SURGICAL PROCEDURES

- Vascular surgery
- Intraperitoneal surgery
- Intrathoracic surgery
- Head and neck surgery
- Orthopedic surgery
- Prostate surgery

CLASSIFICATION OF THE URGENCY OF SURGERY

- Emergency: necessary within 6 hours
- Urgent: necessary within 6-24 hours
- Time sensitive: can delay 1-6 weeks
- Elective: can delay up to 1 year

2014 ACC/AHA Guidelines

EMERGENCY SURGERY

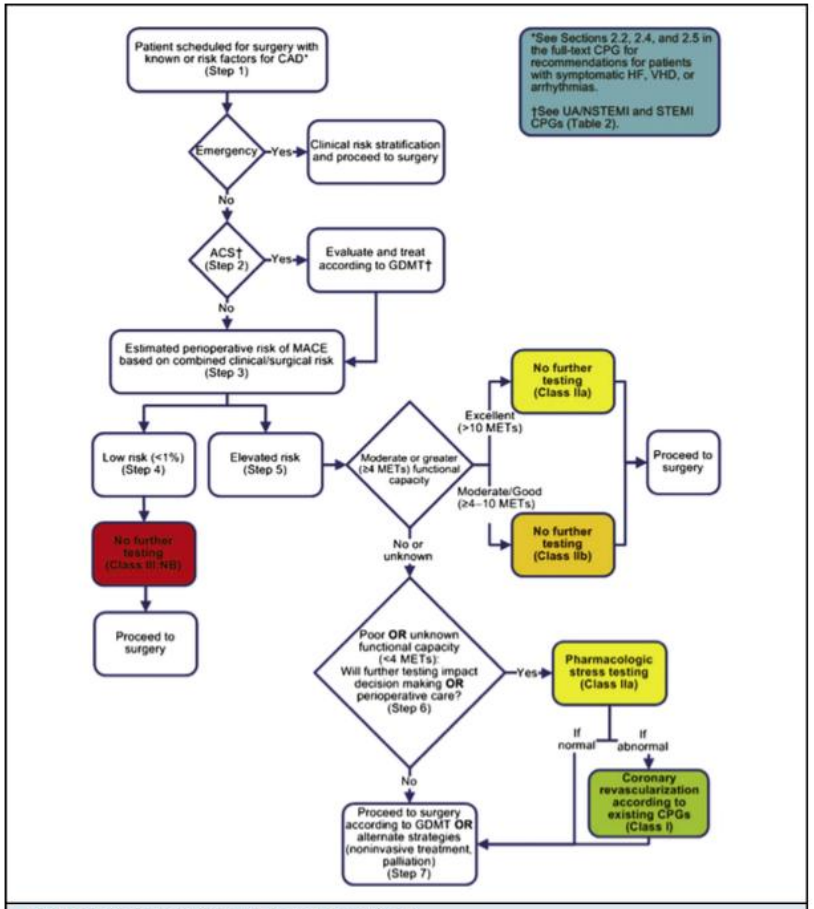

FIGURE 1 Stepwise Approach to Perioperative Cardiac Assessment for CAD

2014 ACC/AHA Guidelines

THE PATIENT

- Estimating the perioperative risk of major cardiac events
- The 2014 ACC/AHA Guidelines suggest using the
  - Revised Cardiac Risk Index
- or a risk calculator based on a data base from
  - American College of Surgeons National
    - Surgical Quality Improvement Project

THE REVISED CARDIAC RISK INDEX

- High risk surgery
- History of ischemic heart disease
- History of congestive heart failure
- History of cerebrovascular disease
- Preoperative treatment with insulin
- Preoperative serum creatinine $\geq$ 2.0 mg/dl

- Lee T., Circulation September 1999

THE REVISED CARDIAC RISK INDEX
RISK OF MAJOR ADVERSE CARDIAC EVENTS

POINTS	DERIVATION COHORT	VALIDATION COHORT
0	0.5%	0.4
1	1.3	0.9
2	4	7
≥3	9	11%

FOUR ACTIVE CARDIAC CONDITIONS THAT SHOULD DELAY NON-EMERGENCY SURGERY

- Acute coronary syndrome
- Decompensated congestive heart failure
- Severe valvular heart disease
- Hemodynamically destabilizing arrhythmias

RISK OF POST-OPERATIVE MYOCARDIAL INFARCTION FOLLOWING RECENT MYOCARDIAL INFARCTION

Time from MI to operation (days)	Rate of Myocardial infarction (%)	30 day rate of mortality	1 year rate of mortality
0 – 30	32.8	14.2	41.2
31 – 60	18.7	11.5	39.4
61 – 90	10.5	10.5	34.5
91-180	9.9	9.9	32.2

- Livhits M., ANN SURG May 2011

- The data suggest that ≥ 60 days should elapse after a MI before non-cardiac surgery, in the absence of a coronary intervention.

- 2014 ACC/AHA Guidelines

HIGH EVENT RATES IN PATIENTS WITH SYMPTOMATIC HEART FAILURE

Table 2. Left Ventricular (LV) Function and Postoperative Outcome

	Normal LV Function	Asymptomatic Isolated Diastolic LV Dysfunction	Asymptomatic Systolic LV Dysfunction	Symptomatic Heart Failure	*P* Value
30-day					
Cardiovascular events (183)	51/499 (10)	38/209 (18)	44/194 (23)	50/103 (49)	< 0.001
Myocardial ischemia/infarction (172)	50/499 (10)	36/209 (17)	41/194 (21)	45/103 (44)	< 0.001
Cardiovascular mortality (24)	2/499 (0)	4/209 (2)	7/194 (4)	11/103 (11)	< 0.001
All cause mortality (29)	6/499 (1)	5/209 (2)	7/194 (4)	11/103 (11)	< 0.001
Long term					
Cardiovascular mortality (107)	15/499 (3)	21/209 (10)	31/194 (16)	40/103 (39)	< 0.001
All-cause mortality (164)	54/499 (11)	31/209 (15)	38/194 (20)	41/103 (40)	< 0.001

All values are given as n (%).

Fiu W-J, Anesthesiology June 2010

30 DAY MORTALITY RATES FOLLOWING NON-CARDIAC SURGERY IN PATIENTS WITH HEART FAILURE

	30 Day Mortality Rate	30 Day Mortality Rate for those newly diagnosed with heart disease
Ischemic Heart Failure	9.2	13.9
Non-ischemic Heart Failure	9.3	13.2
Coronary Artery Disease	2.9	5.4
Atrial Fibrillation	6.4	12.0

Vandiepen S., Circulation July 2011

- Patients with active heart failure have a significantly higher risk of postoperative death than patients with coronary artery disease

- 2014 ACC/AHA Guidelines

VALVULAR HEART DISEASE

Stenotic lesions are associated with a greater risk of perioperative adverse cardiac events than regurgitant lesions

- Perioperative risk of mortality in patients with symptomatic severe aortic stenosis is 16%

- Perioperative risk of mortality in patients with asymptomatic severe aortic stenosis is $< 5\%$

CLASS 1 RECOMMENDATIONS FOR VALVULAR STENOSIS

- 1. It is recommended that patients with clinically suspected moderate or greater degrees of valvularstenosis or regurgitation undergo preoperative echocardiography if there has been either 1) no prior echocardiography within 1 year or 2) a significant change in clinical status or physical examination since last evaluation. (Level of Evidence: C)

- 2014 ACC/AHA Guidelines

CLASS 1 RECOMMENDATIONS FOR VALVULAR STENOSIS

- 2. For adults who meet standard indications for valvular intervention (replacement and repair) on the basis of symptoms and severity of stenosis or regurgitation, valvular intervention before elective noncardiac surgery is effective in reducing perioperative risk. (Level of Evidence: C)

- 2014 ACC/AHA Guidelines

ASYMPTOMATIC SEVERE AORTIC STENOSIS

- Class IIa

- 1. Elevated-risk elective noncardiac surgery with appropriate intraoperative and postoperative hemodynamic monitoring is reasonable to perform in patients with asymptomatic severe aortic stenosis (AS). (Level of Evidence: B)

- 2014 ACC/AHA Guidelines

SEVERE MITRAL STENOSIS

- Class IIb

- Elevated-risk elective noncardiac surgery using appropriate intraoperative and postoperative hemodynamic monitoring may be reasonable in asymptomatic patients with severe mitral stenosis if valve morphology is not favorable for percutaneous mitral balloon commissurotomy. (Level of Evidence: C)

- 2014 ACC/AHA Guidelines

SEVERE AORTIC AND SEVERE MITRAL REGURGITATION

- Class IIa

- 1. Elevated-risk elective noncardiac surgery with appropriate intraoperative and postoperative hemodynamic monitoring is reasonable in adults with asymptomatic severe MR. (Level of Evidence: C)

  2. Elevated-risk elective noncardiac surgery with appropriate intraoperative and postoperative hemodynamic monitoring is reasonable in adults with asymptomatic severe aortic regurgitation (AR) and a normal LVEF. (Level of Evidence: C)

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HEMODYNAMICALLY DESTABILIZING ARRHYTHMIAS

- High grade atrioventricular block
- Symptomatic ventricular arrhythmias in the presence of underlying heart disease
- Supraventricular arrhythmias with uncontrolled ventricular rate

CARDIAC RISK ASSESSMENT AND CARE FOR THE PATIENT UNDERGOING NON-CARDIAC SURGERY

Low risk: proceed to surgery

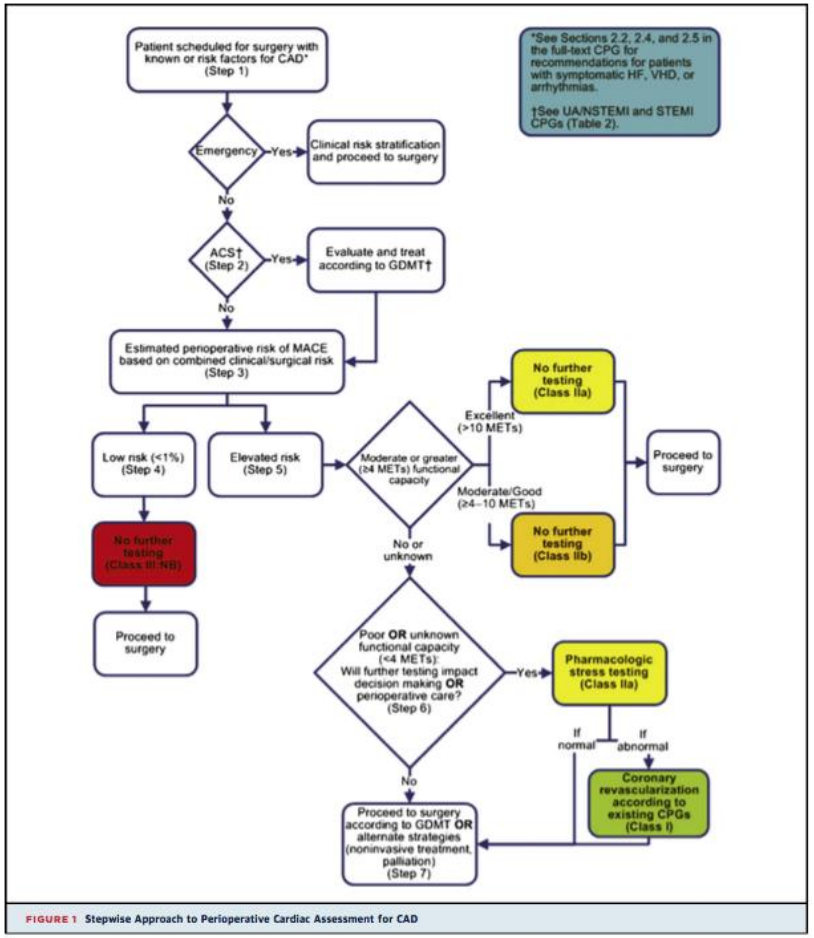


FIGURE 1 Stepwise Approach to Perioperative Cardiac Assessment for CAD

Elevated risk: determine functional capacity

CARDIAC DIAGNOSTIC TESTS TO CONSIDER

- Electrocardiogram
- Echocardiogram
- Stress testing
- Cardiac catheterization

THE 12 LEAD ELECTROCARDIOGRAM RECOMMENDATIONS

- Class IIa
- 1. Preoperative resting 12-lead electrocardiogram (ECG) is reasonable for patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease, cerebrovascular disease, or other significant structural heart disease, except for those undergoing low-risk surgery. (Level of Evidence: B)

- Class IIb
- 1. Preoperative resting 12-lead ECG may be considered for asymptomatic patients without known coronary heart disease, except for those undergoing low-risk surgery (37,138-140). (Level of Evidence: B)

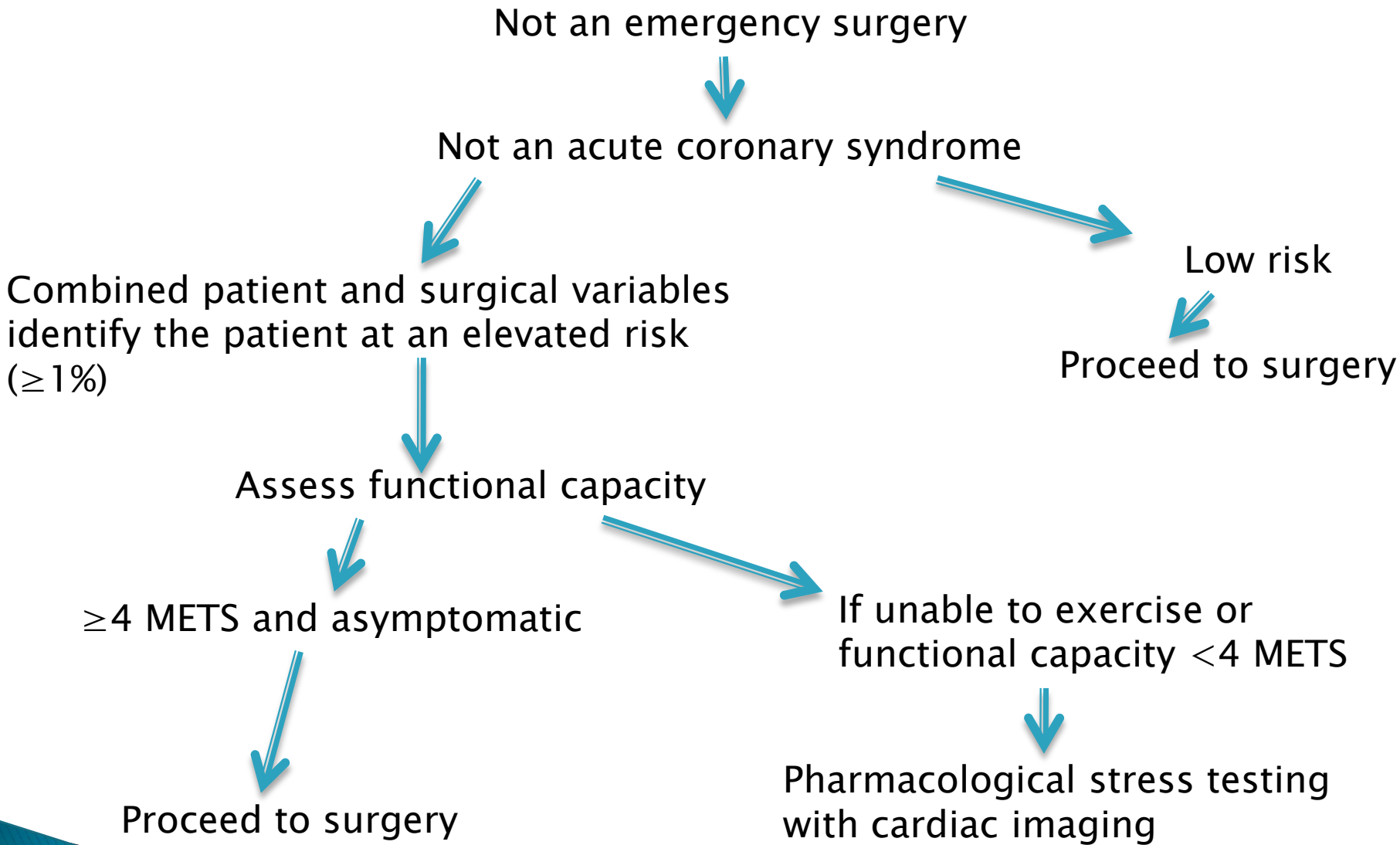
- Class III: No Benefit
- 1. Routine preoperative resting 12-lead ECG is not useful for asymptomatic patients undergoing low-risk surgical procedures (35,141). (Level of Evidence: B)

- 2014 ACC/AHA Guidelines

ECHOCARDIOGRAM PRIOR TO NON-CARDIAC SURGERY

- Not routinely indicated
- Can consider in a patient with a cardiac murmur, who has not received a previous echocardiogram
- Can consider in a patient with dyspnea of unknown etiology
- Reasonable in patients with known heart failure and worsening clinical status
- Can consider in clinically stable patients with known LV dysfunction and no reassessment of LV function in the past year

WHO GETS A STRESS TEST?



If the results will change management

WHO GETS CARDIAC CATHETERIZATION?

- In general studies have shown that the presence of a moderate or large amount of myocardium at risk predicts an increased risk of perioperative myocardial infarction and death

WHO GETS CORONARY REVASCULARIZATION?

- Class III: No Benefit

  It is not recommended that routine coronary revascularization be performed before noncardiac surgery exclusively to reduce perioperative cardiac events. (Level of Evidence: B)

- Class I:

  Revascularization before noncardiac surgery is recommended in circumstances in which revascularization is indicated according to existing CPGs.

- 2014 ACC/AHA Guidelines

40 CONSECUTIVE PATIENTS UNDERGOING NONCARDIAC SURGERY WITHIN SIX WEEKS OF CORONARY BARE METAL STENTING

- 25 patients had surgery 1-14 days following stent placement
- 7 patients had myocardial infarction
- 8 patients died

- 15 patients had surgery 15-39 days following stent placement
- 0 patients had myocardial infarctions
- 0 patients died

- Kaluza GL., JACC April 2000

NONCARDIAC SURGERY AFTER CORONARY STENTING: EARLY SURGERY AND INTERRUPTION OF ANTIPLATELET THERAPY ARE ASSOCIATED WITH AN INCREASE IN MAJOR ADVERSE CARDIAC EVENTS

- Retrospective Study
- 192 patients between 1999 and 2005
- 30 patients underwent early surgery after coronary stenting. Defined as undergoing surgery when the FDA label for the stent indicated they should be on DAPT
- 162 patients with late surgery
- Schouten O., JACC Jan 2007

INTERRUPTION OF ANTIPLATELET THERAPY AFTER CORONARY STENTING

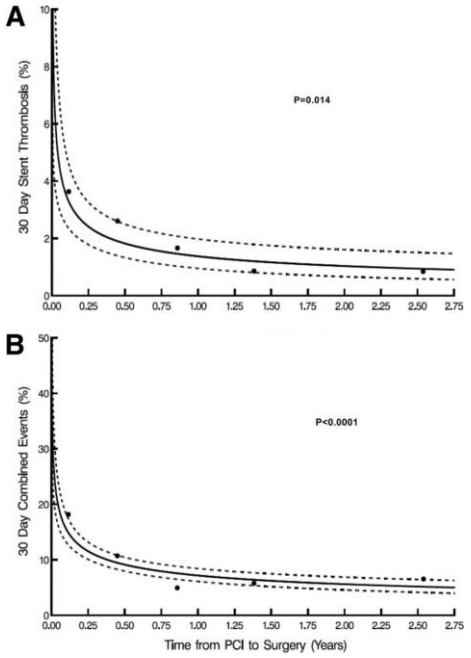
- Incidence of MI/Death within 30 days of noncardiac surgery

- Early Surgery 4/30 (13.3%)
- Antiplatelets stopped 4/13 (30.7%)
- Antiplatelets continued 0/17 (0%)

- Late Surgery 1/162 (0.6%)

Schouten O., JACC Jan 2007

POSTOPERATIVE RISK ASSOCIATED WITH PRIOR DRUG ELUTING STENT USE



- Anwaruddin S., JACC INTV., June 2009

IN ELECTIVE SURGERY, WHAT DELAY DO THE GUIDELINES RECOMMEND IN PATIENTS WITH PREVIOUS PCI?

- Balloon Angioplasty 14 days
- Bare Metal Stent 30 days
- Drug Eluting Stent Ideal 365 days Class I
- 180 days Class IIb

2014 ACC/AHA Guidelines

TIMING OF ELECTIVE NONCARDIAC SURGERY IN PATIENTS WITH PREVIOUS PCI: CLASS III RECOMMENDATIONS

- Elective noncardiac surgery should not be performed within 30 days after BMS implantation or within 12 months after DES implantation in patients in whom dual antiplatelet therapy (DAPT) will need to be discontinued perioperatively. (Level of Evidence: B)

- Elective noncardiac surgery should not be performed within 14 days of balloon angioplasty in patients in whom aspirin will need to be discontinued perioperatively. (Level of Evidence: C)

ANTIPLATELET THERAPY IN PATIENTS UNDERGOING NONCARDIAC SURGERY

- Class I Recommendations
- 1. In patients undergoing urgent noncardiac surgery during the first 4 to 6 weeks after BMS or DES implantation, DAPT should be continued unless the relative risk of bleeding outweighs the benefit of the prevention of stent thrombosis. (Level of Evidence: C)
- 2. In patients who have received coronary stents and must undergo surgical procedures that mandate the discontinuation of P2Y12 platelet receptor-inhibitor therapy, it is recommended that aspirin be continued if possible and the P2Y12 platelet receptor-inhibitor be restarted as soon as possible after surgery. (Level of Evidence: C)
- 3. Management of the perioperativeantiplatelet therapy should be determined by a consensus of the surgeon, anesthesiologist, cardiologist, and patient, who should weigh the relatiave risk of bleeding with that of stent thrombosis. (Level of Evidence: C)
- 2014 ACC/AHA Guidelines

ADDITIONAL RECOMMENDATIONS

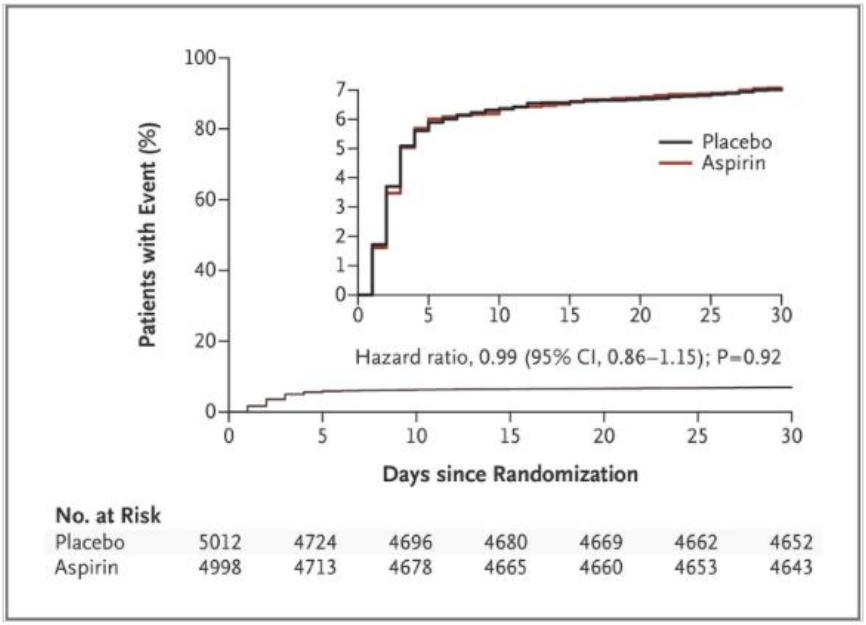
- Class IIb
- 1. In patients undergoing nonemergency/nonurgentnoncardiac surgery who have not had previous coronary stenting, it may be reasonable to continue aspirin when the risk of potential increased cardiac events outweighs the risk of increased bleeding (298,306). (Level of Evidence: B)

- Class III: No Benefit
- 1. Initiation or continuation of aspirin is not beneficial in patients undergoing elective noncardiacnoncarotid surgery who have not had previous coronary stenting (298)(Level of Evidence: B), unless the risk of ischemic events outweighs the risk of surgical bleeding. (Level of Evidence: C)

ASPIRIN IN PATIENTS UNDERGOING NONCARDIAC SURGERY: POISE-2

- Using a 2x2 factorial design, 10,010 patients undergoing noncardiac surgery were randomized to aspirin or placebo and clonidine or placebo
- Excluded: patients who received a bare metal stent less than 6 weeks before surgery or a drug eluting stent less than 1 year before surgery
- Primary outcome: death or non-fatal myocardial infarction at 30 days
- Devereaux PJ, NEJM April 2014

POISE-2



Slide

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.

Devereaux PJ., NEJM April 2014

POISE-2

Slide

Table 2. Effects of Aspirin on 30-Day Outcomes.

Outcome	Aspirin (N=4998)	Placebo (N=5012)	Hazard Ratio (95% CI)†	P Value
	no. (%)			
Primary composite outcome: death or nonfatal myocardial infarction	351 (7.0)	355 (7.1)	0.99 (0.86–1.15)	0.92
Secondary outcomes				
Death, nonfatal myocardial infarction, or nonfatal stroke	362 (7.2)	370 (7.4)	0.98 (0.85–1.13)	0.80
Death, nonfatal myocardial infarction, cardiac revascularization, nonfatal pulmonary embolism, or nonfatal deep venous thrombosis	402 (8.0)	407 (8.1)	0.99 (0.86–1.14)	0.90
Tertiary outcomes — no. (%)				
Death from any cause	65 (1.3)	62 (1.2)	1.05 (0.74–1.49)	0.78
Death from cardiovascular cause	35 (0.7)	35 (0.7)	1.00 (0.63–1.60)	0.99
Myocardial infarction	309 (6.2)	315 (6.3)	0.98 (0.84–1.15)	0.85
Nonfatal cardiac arrest	9 (0.2)	12 (0.2)	0.75 (0.32–1.79)	0.52
Cardiac revascularization	13 (0.3)	17 (0.3)	0.77 (0.37–1.58)	0.47
Pulmonary embolism	33 (0.7)	31 (0.6)	1.07 (0.65–1.74)	0.79
Deep-vein thrombosis	25 (0.5)	35 (0.7)	0.72 (0.43–1.20)	0.20
New clinically important atrial fibrillation	109 (2.2)	94 (1.9)	1.16 (0.88–1.53)	0.28
Peripheral arterial thrombosis	13 (0.3)	15 (0.3)	0.87 (0.41–1.83)	0.71
Amputation	10 (0.2)	13 (0.3)	0.77 (0.34–1.76)	0.54
Rehospitalization for cardiovascular reasons	70 (1.4)	54 (1.1)	1.30 (0.91–1.86)	0.15
Acute kidney injury with receipt of dialysis‡	33 (0.7)	19 (0.4)	1.75 (1.00–3.09)	0.05
Safety outcomes				
Life-threatening bleeding	87 (1.7)	73 (1.5)	1.19 (0.88–1.63)	0.26
Major bleeding	230 (4.6)	188 (3.8)	1.23 (1.01–1.49)	0.04
Clinically important hypotension	2143 (42.9)	2096 (41.8)	1.03 (0.97–1.09)	0.37
Stroke	16 (0.3)	19 (0.4)	0.84 (0.43–1.64)	0.62
Congestive heart failure	44 (0.9)	38 (0.8)	1.16 (0.75–1.79)	0.50
Infection	488 (9.8)	495 (9.9)	0.99 (0.87–1.12)	0.86
Sepsis	243 (4.9)	258 (5.2)	0.94 (0.79–1.13)	0.52

* Percentages were calculated with the use of the Kaplan–Meier method.
† Hazard ratios are for the aspirin group, as compared with the placebo group.
‡ For this outcome, an odds ratio is provided instead of a hazard ratio, because the date that patients first started dialysis was not known.

Devereaux PJ., NEJM April 2014

POISE-2

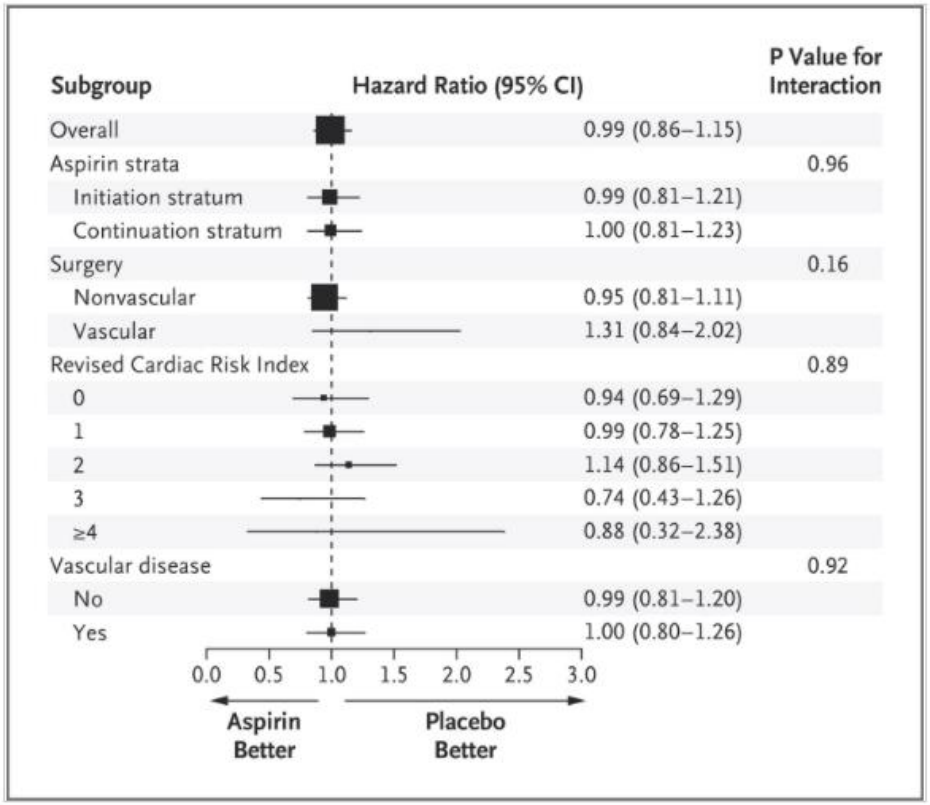


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Figure 2. Subgroup Analyses of the Primary Outcome.

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.

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POISE-2

Table 3. Absolute Increase in the Risk of a Composite of Life-Threatening or Major Bleeding with Aspirin Therapy, Starting on Each of the First 10 Postoperative Days until 30 Days after Surgery.*

Day at Start of Risk Analysis	Aspirin†	Placebo†	Absolute Increase in Risk with Aspirin	P Value
	no./total no. (%)		*percentage points*	
Day of surgery	311/4953 (6.3)	254/4978 (5.1)	1.2	0.01
Day 1 after surgery	191/4832 (4.0)	129/4852 (2.7)	1.3	<0.001
Day 2 after surgery	138/4779 (2.9)	92/4813 (1.9)	1.0	0.002
Day 3 after surgery	102/4741 (2.2)	59/4777 (1.2)	1.0	<0.001
Day 4 after surgery	73/4710 (1.6)	33/4748 (0.7)	0.9	<0.001
Day 5 after surgery	59/4693 (1.3)	27/4739 (0.6)	0.7	<0.001
Day 6 after surgery	43/4674 (0.9)	25/4736 (0.5)	0.4	0.03
Day 7 after surgery	39/4667 (0.8)	22/4731 (0.5)	0.3	0.03
Day 8 after surgery	20/2623 (0.8)	14/2662 (0.5)	0.3	0.29
Day 9 after surgery	15/2617 (0.6)	14/2660 (0.5)	0.1	0.82
Day 10 after surgery	14/2614 (0.5)	12/2657 (0.5)	0.0	0.67

* Among patients who were alive and had not already had life-threatening or major bleeding, we determined the risk of the composite of life-threatening or major bleeding until day 30, starting on the day of surgery and then on each subsequent day. We also determined the absolute increase in risk among patients in the aspirin group and the P value for the comparison between aspirin and placebo. This allows the inference that, for example, if aspirin is started on the day of surgery, the cumulative incremental risk of bleeding attributable to aspirin over the next 30 days is 1.2%. If aspirin had been started on day 4 after surgery, the cumulative incremental risk over the next 26 days would be 0.9%, and so forth. Starting on day 8 after surgery, the sample was restricted to patients in the initiation stratum because all patients in the continuation stratum stopped taking the study drug in the aspirin trial on day 8 after surgery and resumed their regular aspirin regimen.

† Percentages were calculated with the use of the Kaplan–Meier method.

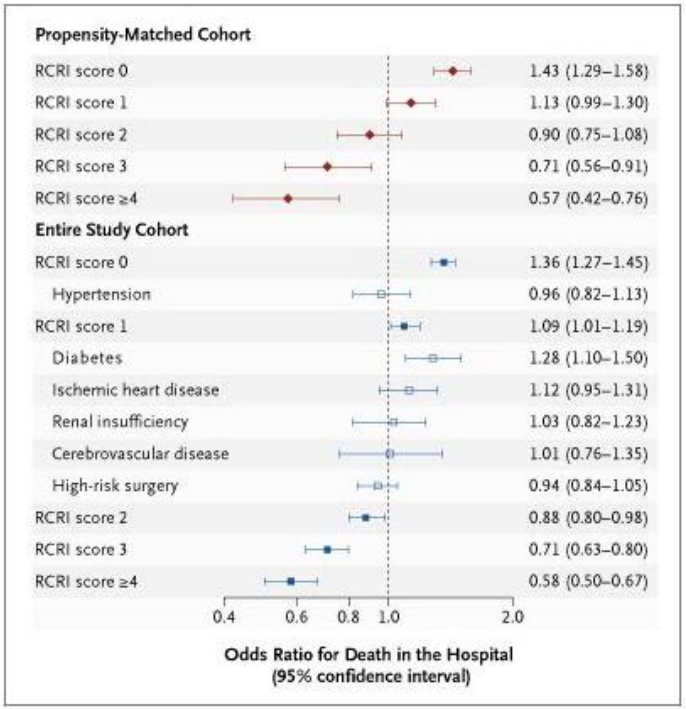
Devereaux PJ., NEJM April 2014

BETA BLOCKERS

- Decrease the risk of myocardial ischemia
- Increase the risk of bradycardia and hypotension

PERIOPERATIVE BETA-BLOCKER THERAPY AND MORTALITY AFTER MAJOR NONCARDIAC SURGERY

Retrospective study using data from 329 hospitals
Propensity-score matching and multivariable logistic modeling
663,635 patients included in the analyses



Slide

Figure 1. Adjusted Odds Ratio for In-Hospital Death Associated with Perioperative Beta-Blocker Therapy among Patients Undergoing Major Noncardiac Surgery, According to the RCRI Score and the Presence of Other Risk Factors in the Propensity-Matched Cohort and the Entire Study Cohort.

Open boxes represent patient subgroups within the listed RCRI category.

Lindenauer P., NEJM July 2005

THE POISE TRIAL

- 8351 patients with or at risk of atherosclerotic disease who were undergoing noncardiac surgery
- Randomized to receive extended release metoprololsuccinate or placebo for 30 days
- Primary endpoint: a composite of cardiovascular death, non-fatal myocardial infarction and non-fatal cardiac arrest at 30 days
- Poise Study Group, Lancet May 2008

THE POISE TRIAL

	Metoprolol	Placebo	P value
Primary outcome	5.8%	6.9%	.04
Total mortality	3.1	2.3	.03
Myocardial infarction	4.2	5.7	.002
Stroke	1.0	0.5	.005
Hypotension	15.0	9.7	<.0001
Bradycardia	6.6%	2.4%	<.0001

THE POISE TRIAL

- Patients received metoprololsuccinate 2-4 hours before surgery
- Depending on heart rate and blood pressure, patients received an additional 100mg within 6 hours following surgery
- 12 hours after their first postoperative dose, patients started on metoprololsuccinate 200mg daily

PERIOPERATIVE BETA-BLOCKER THERAPY

Class I	**Continue beta blockers in patients who already take them**
Class IIb	It is reasonable to start beta blockers in patients with
	- Intermediate or high risk ischemia on a stress test
	- 3 or more RCRI risk factors
Class III	Do not start beta blockers on the day of surgery
Class IIb	It is preferable to start beta blockers 2-7 days prior to surgery and titrate to effect
Class IIa	Following surgery, titrate beta blockers to effect

ANTICOAGULANTS

- Bridging is required for patients with mechanical mitral valves

- For patients with mechanical aortic valves, patients with additional risk factors, such as atrial fibrillation, LV dysfunction, h/othromboembolism, hypercoagulable state or older generation valve, require bridging

THE NOVEL ORAL ANTICOAGULANTS STOPPING BEFORE SURGERY

Dabigatran	**CrCl> 50 ml/min 1-2 days** **CrCl< 50 ml/min 3-5 days**
Rivaroxaban	2-3 days
Apixaban	2-3 days

POSTOPERATIVE SURVEILLANCE FOR MYOCARDIAL ISCHEMIA

- Class I
- 1. Measurement of troponin levels is recommended in the setting of signs or symptoms suggestive of myocardial ischemia or MI. (Level of Evidence: A)
- 2. Obtaining an ECG is recommended in the setting of signs or symptoms suggestive of myocardial ischemia, MI, or arrhythmia. (Level of Evidence: B)

- Class IIb
- 1. 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. (Level of Evidence: B)
- 2. 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. (Level of Evidence: B)

- Class III: No Benefit
- 1. 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. (Level of Evidence: B)

CONCLUSIONS

- Adverse cardiac events during the perioperative period occur frequently
- Cardiologists do not clear patients for surgery but are happy to inform surgeons and patients in a model of collaborative decision making
- Revascularization or other intervention is rarely needed to get a patient safely through surgery
- But thoughtful evaluation, monitoring and active medical management are always required