

Update in Perioperative Medicine

SGIM 2008

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ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery: Executive Summary

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery) Developed in Collaboration With the American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, and Society for Vascular Surgery.

Fleisher LA, Beckman JA, Brown KA, et al. *J Am Coll Cardiol* 2007; Oct 3;50(17):1707-1732.

<http://content.onlinejacc.org/cgi/content/full/j.jacc.2007.09.001>

Aim

To update the 2002 guidelines for preoperative cardiac risk evaluation and perioperative care of the patient undergoing noncardiac surgery.

Methods

- Literature review 2002-2007
- English language
- PubMed, Medline, Cochrane Library
- Summary listed recommendations with level of evidence
- Full guidelines online

ACC Clinical Predictors of Increased Perioperative Risk

- Active cardiac conditions (“major”): unstable coronary syndromes (recent MI, class III-IV angina), decompensated CHF, significant arrhythmias, severe valvular disease (AS,MS)
- Clinical risk factors (“intermediate”): CAD (prior MI, Class I-II angina), compensated or prior CHF, diabetes (*insulin?*), CRI (Cr>2),
CVA ←
- (Minor): ~~CVA, advanced age, abnormal EKG, non-sinus rhythm, low functional capacity, uncontrolled hypertension~~

ACC Cardiac Risk Stratification for Noncardiac Surgical Procedures

- **High**: (cardiac risk > 5%)
 - Emergent major operations, aortic and major vascular, peripheral vascular, prolonged procedures with large fluid shifts or blood loss
- **Intermediate**: (cardiac risk < 5%)
 - Carotid endarterectomy, *endovasc AAA, (stents/coils)*, head and neck, intraperitoneal, intrathoracic, orthopedic, prostate
- **Low**: (cardiac risk < 1%)
 - Endoscopic, superficial, cataract, breast

Energy Requirements for Various Activities

■ 1 MET

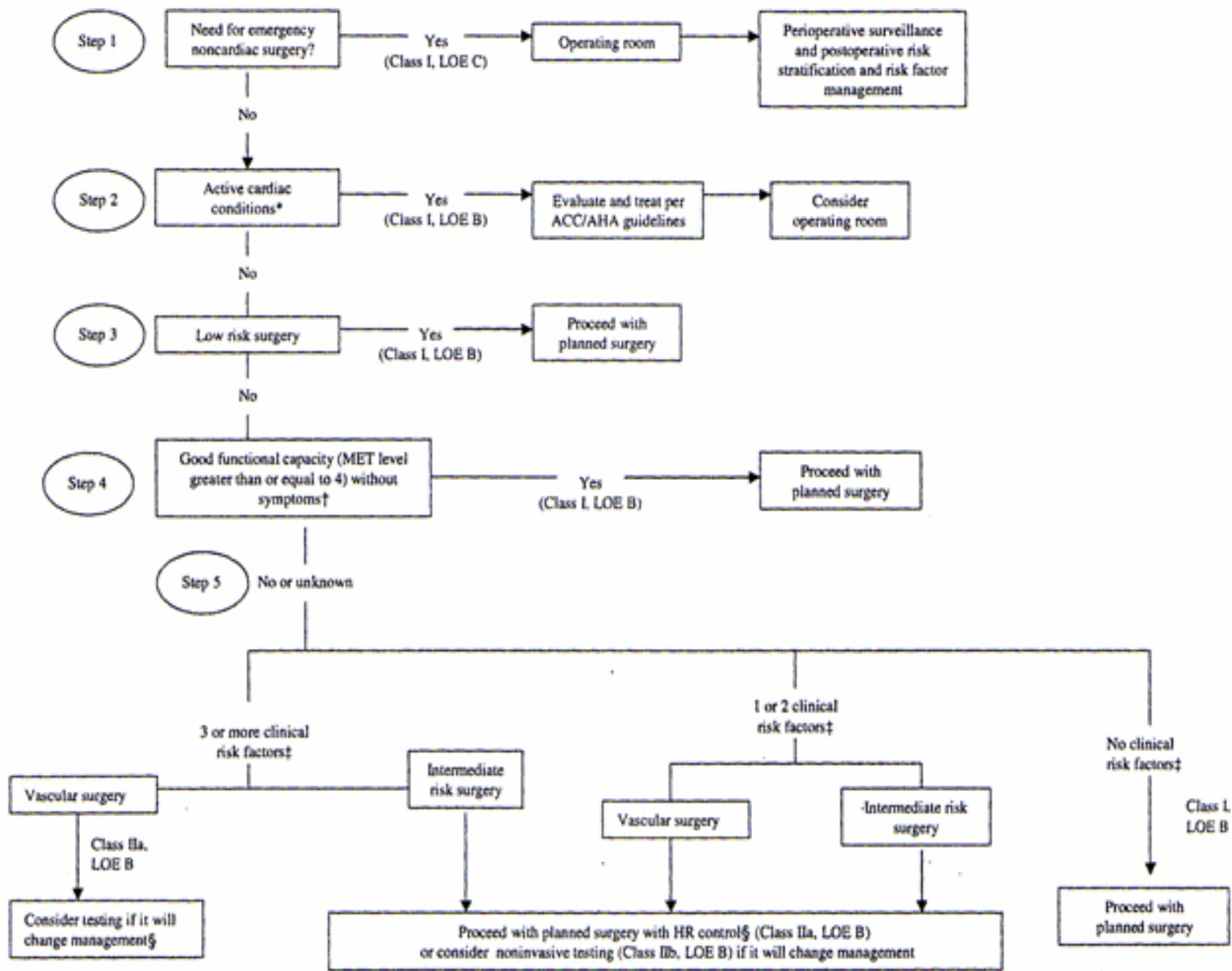
- take care of self
- eat, dress, toilet
- walk indoors
- walk 1-2 blocks (level) at 2-3 mph
- do light work around the house (dust, wash dishes)

■ 4 METS

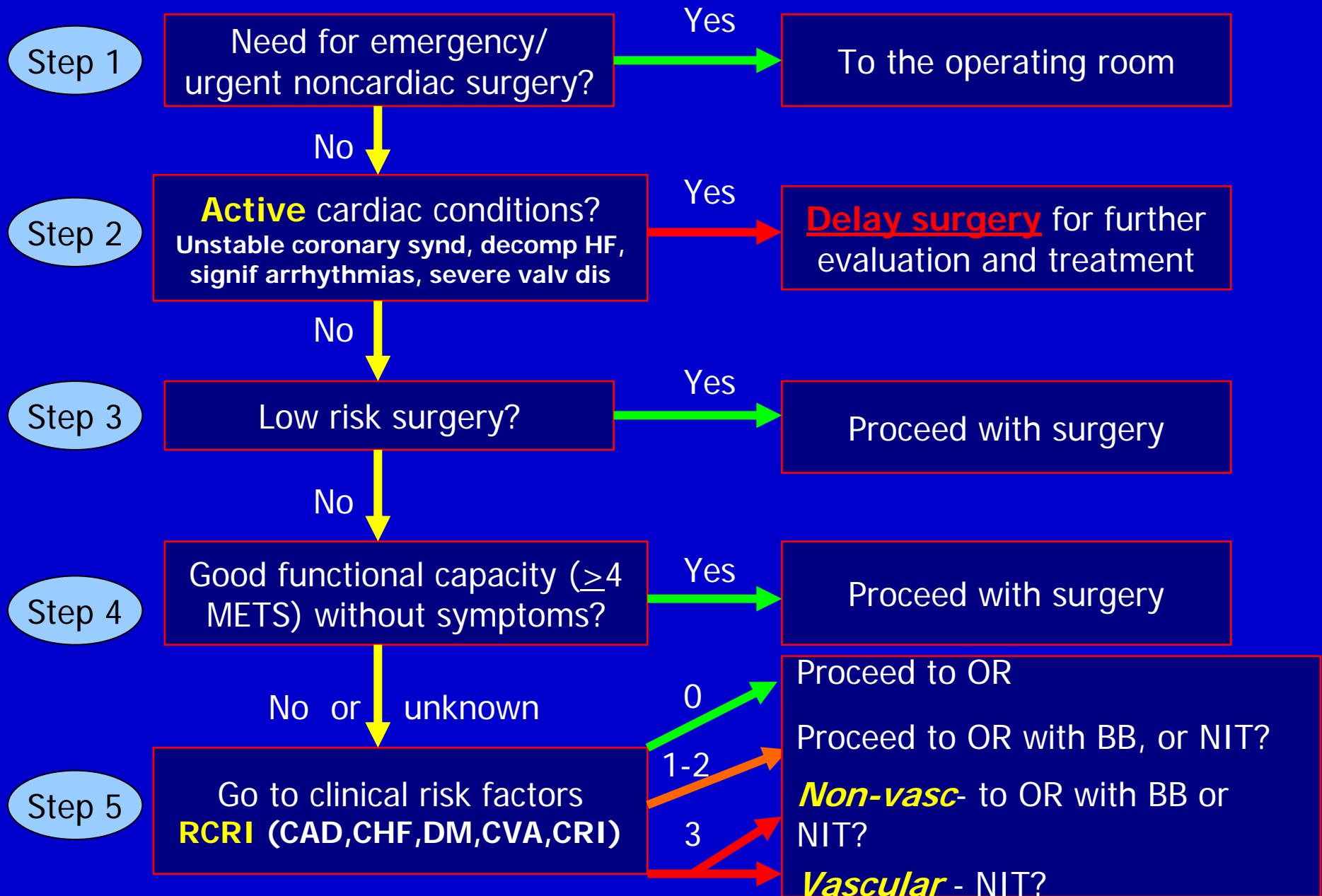
■ 4 METS

- climb 1 flight, go uphill
- walk on level ground 4 mph
- do heavy housework (scrub floors, move furniture)
- do moderate recreational activities
- participate in strenuous sports

■ \geq 10 METS



ACC/AHA Cardiac Evaluation & Care Algorithm 2007



Other Recommendations

- Incorporated ACC/AHA update on antiplatelet agents and PCI
 - Timing
 - PTCA:2-4 wks, BMS:4-6 wks, DES:12 mos
 - Continue at least ASA if possible
- Incorporated 2006 BB update
- Made statin recommendations
 - Consider if otherwise indicated
 - Continue periop if already on them

Impact on Internal Medicine

- Updated preoperative algorithm to minimize cardiac testing
- Favored medical therapy over non-invasive testing
 - However, it was published before results of POISE were available

POISE: Perioperative Ischemia Evaluation Trial

- 8351 pts ≥ 45 yrs old; with/at risk for ASHD
- Metoprolol CR (100mg preop; 100 mg 6 hrs postop; 200 mg 12 hrs later and then daily x30 days)
- Dose NOT titrated; held if syst BP < 100mmHg
- 1^o outcome: MI, cardiac arrest, cardiac death
- 2^o outcomes: AF, revasc, CVA, total mortality
- Safety measures: significant bradycardia, hypotension

POISE: Primary outcome and major secondary outcomes

Outcome	Metoprolol (n=4174), n (%)	Placebo (n=4177), n (%)	Hazard ratio	p
Primary composite	243 (5.8)	290 (6.9)	0.83	0.04
Nonfatal MI	151 (3.6)	215 (5.1)	0.70	0.0007
Total mortality	129 (3.1)	97 (2.3)	1.33	0.03
Stroke	41 (1.0)	19 (0.5)	2.17	0.005

POISE: Secondary outcomes

Outcome	Metoprolol (n=4174), n (%)	Placebo (n=4177), n (%)	Hazard ratio	p
Revascularization	11 (0.3)	27 (0.6)	0.41	0.01
Atrial fibrillation	91 (2.2)	120 (2.9)	0.76	0.04
Significant hypotension	626 (15.0)	404 (9.7)	1.55	<0.0001
Significant bradycardia	274 (6.6)	101 (2.4)	2.71	<0.0001

Conclusions

- Although perioperative BB decreased postop MI and cardiac death, it did so at the expense of increased overall mortality and stroke.

Impact on Internal Medicine

- Be cautious when using perioperative beta-blockers.
- At this time they should probably only be used in patients:
 - Already on them
 - With CAD &/or evidence of ischemia
 - In high risk pts (RCRI ≥ 3) going for intermediate to high risk surgery
- Titrate the dose and follow closely

A Clinical Randomized Trial to Evaluate the Safety and Efficacy of a Noninvasive Approach in High-Risk Patients Undergoing Major Vascular Surgery

The DECREASE-V Pilot Study

Poldermans D, Schouten O, Vidakovic R, et al. *J Am Coll Cardiol* 2007; 49:1763-1769

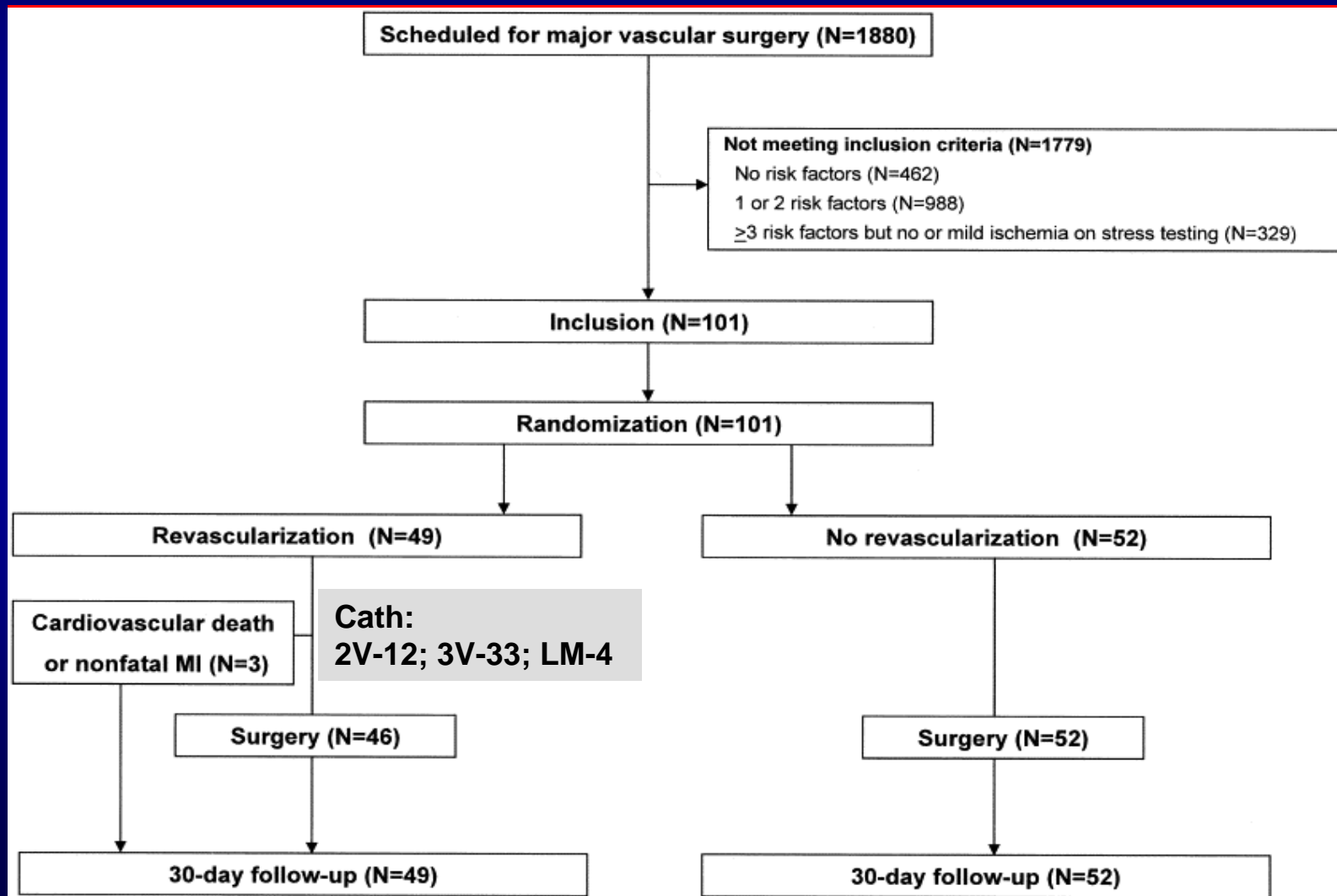
Aim

Determine feasibility to design a study of prophylactic coronary revascularization in high-risk patients with extensive stress-induced ischemia on preoperative testing

Methods

- Screened 1880 pts
 - 430:modified RCRI ≥ 3
- DSE or dipyridamole nuclear scan
 - $\geq 5/17$ segs or $\geq 3/6$ walls randomized to revasc or non-invasive approach
- All got BB (HR 60-65)
- Antiplatelets continued
- Primary outcome – 30d & 1yr composite of:
 - All cause death
 - Myocardial infarction

Results

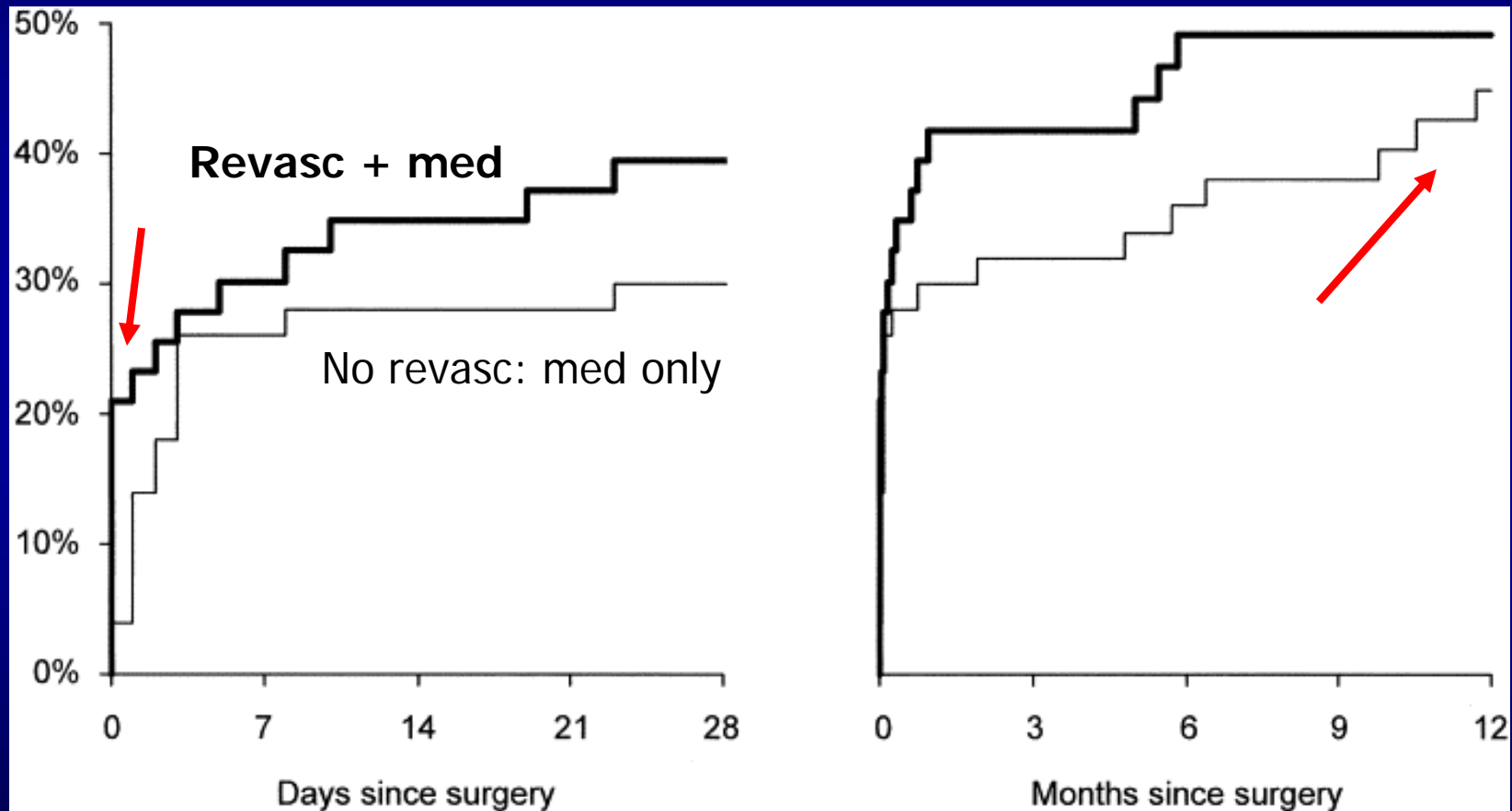


Patient Outcome

	Revasc - 49 n (%)	No revasc - 52 n (%)
30 d events		
All-cause mortality	11 (22.5)	6 (11.5)
MI	17 (34.7)	16 (30.8)
Composite	21 (42.9)	17 (32.7)
1 yr events		
All-cause mortality	13 (26.5)	12 (23.1)
MI	18 (36.7)	19 (36.5)
Composite	24 (49.0)	23 (44.2)

Patient Outcome

All Cause Death or MI



Light line = best medical treatment only;
dark line = best medical treatment and prophylactic revascularization

Conclusions

- Prophylactic revascularization did not improve outcome (30d or 1 yr) in high-risk vascular surgery patients.
 - Need sample size of 9000 major vascular surgery pts, of which 2000 would have ≥ 3 cardiac risk factors, to get 300 patients in each arm to demonstrate a 20% improvement in outcome.

Impact on Internal Medicine

- This reinforces the ACC guidelines that prophylactic revascularization should be reserved for patients with unstable cardiac disease.

Perioperative Medicine Update: Anticoagulation and Thromboembolism

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Disclosure

- Consultant
 - Sanofi-Aventis, Astra-Zeneca, Boehringer Ingelheim
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- Speakers Bureau
 - Sanofi-Aventis, Roche Diagnostics
- Board Member
 - SPAQI, Anticoagulation Forum

4 Articles

- Discontinuation of antiplatelet therapy prior to low-risk noncardiac surgery in patients with drug-eluting stents
- Risk of thromboembolism with short-term interruption of warfarin therapy
- Multivariate Predictors of Postoperative Venous Thromboembolism after General and Vascular Surgery
- Dabigatran Vs. Enoxaparin after total hip replacement

Discontinuation of antiplatelet therapy
prior to low-risk noncardiac surgery in
patients with drug-eluting stents: a
retrospective cohort study.

Brotman DJ, Bakhru M, Saber W et al.
J Hosp Med. 2007 Nov;2(6):378-84

Aim

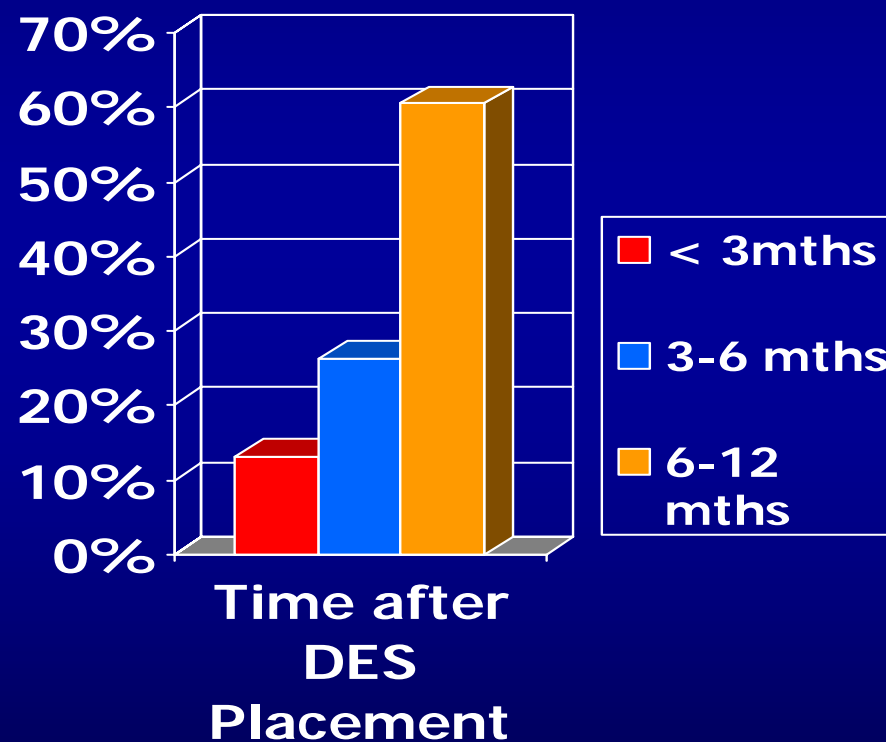
To determine the perioperative risk of discontinuing aspirin and clopidogrel in patients with drug eluting stents undergoing non-cardiac surgery

Methods

- Single center, retrospective study at the Cleveland Clinic between July 2003-July 2005
- 114 patients
- DES placement and subsequently evaluated for noncardiac surgery at their preoperative center
- Outcome measures included 30-day rate of postoperative myocardial infarction (MI), DES thrombosis, major bleeding, and all-cause mortality

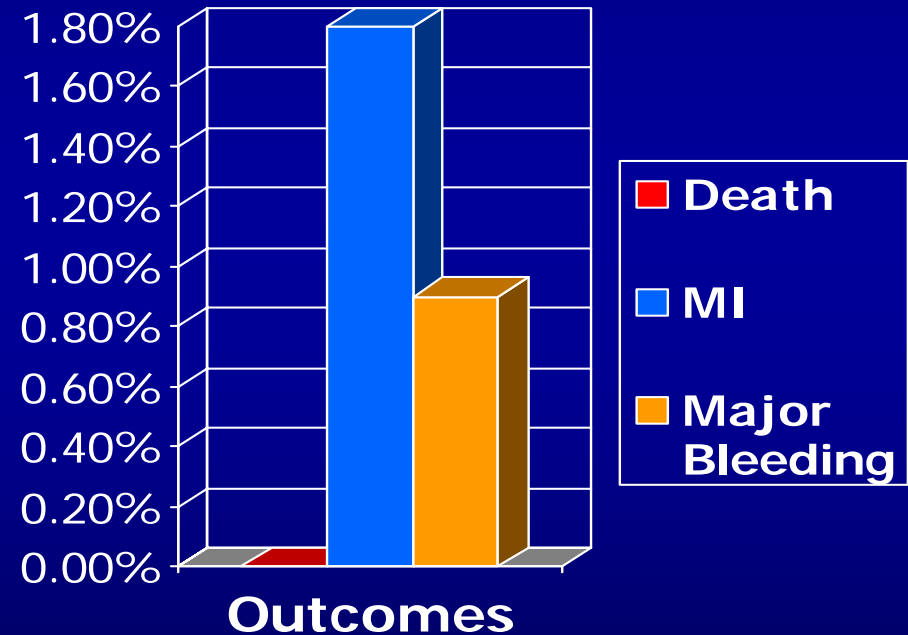
Discontinuation of Antiplatelet Therapy in Patients with DES Prior to Low-risk Non-cardiac Surgery

- ~50% had outpatient or same-day surgery
- 21% had ASA + CP continued periop



Discontinuation of Antiplatelet Therapy in Patients with DES Prior to Low-risk Non-cardiac Surgery

- No stent thrombosis by cardiac cath
- Patient 1
 - had three DES stents placed
 - anti-platelet therapy stopped 33 days after stenting
 - 17 days preoperatively
- Patient 2
 - had 1 DES stent placed
 - clopidogrel stopped 287 days after stenting
 - 7 days preoperatively



Conclusions

- These data suggest that the overall risk of stent thrombosis is low in low-risk noncardiac surgery patients with DESs, particularly those who have undergone at least 180 days of antiplatelet therapy, even after complete discontinuation of antiplatelet agents.

Impact on Internal Medicine

- ACC/AHA guidelines recommend delaying surgery within 1-yr of DES
- For low risk surgeries especially after 6 months of dual antiplatelet therapy it may be ok to have urgent surgery

Multivariate Predictors of Postoperative Venous Thromboembolic Events after General and Vascular Surgery: Results from the Patient Safety in Surgery Study

Rogers SO, Kilaru RK, Hosokawa P et al.
J Am Coll Surg 2007;204:1211-1221

Aim

To develop and validate a risk model to predict patients at high risk for postoperative venous thromboembolism

Methods

- The Patient Safety Study (PSS) was conducted by the ACS and Dept. of VA National Surgery Quality Improvement Program (NSQIP)
- 2002-2004 at 128 VA medical centers, 14 private hospitals
- Prospective data collection by trained nurse
- Total of 183,069 patients were used for the analyses
- Preoperative characteristics, risk factors, intraoperative processes and postoperative adverse occurrences on first 36 operations in each 8-day cycle
- Outcomes were objectively diagnosed VTE occurring up to day 30 after surgery
- Logistic Model was generated from the development cohort and run on the validation cohort

Results

- VTE occurred in 1,162/183,069 (0.63%) patients
- 30-day mortality in patients who suffered a VTE was 11.9%
- 15 variables were independently associated with increased risk of VTE
- The variables were used to develop a predictive model for postoperative VTE

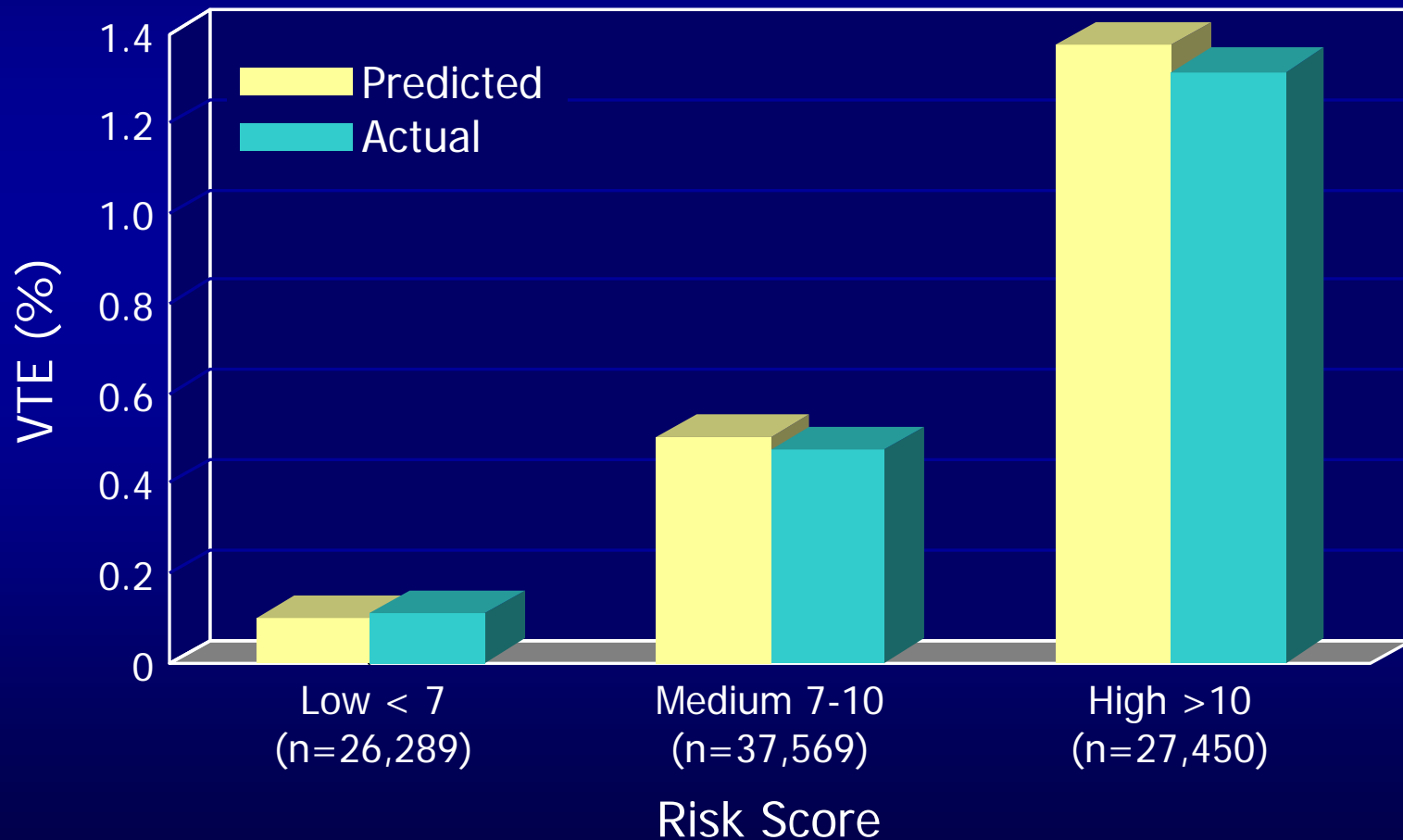
VTE Complication Risk Index for General and Vascular Surgery Patients

Risk Factor	Risk Score Points
Operation type other than endocrine	
Respiratory and hemic	9
Throacoabdominal aneurysm, embolectomy / thrombectomy, venous reconstruction, and endovascular repair	7
Aneurysm	4
Mouth, palate	4
Stomach, intestines	4
Integument	3
Hernia	2
ASA physical status classification	
3, 4, or 5	2
2	1
Female gender	1
Work RVU	
>17	3
10-17	2

VTE Complication Risk Index for General and Vascular Surgery Patients

Risk Factor	Risk Score Points
Two points for each of these conditions	2
Disseminated cancer	
Chemotherapy for malignancy within 30 days of operation	
Preoperative serum sodium >145 mmol/L	
Transfusion > 4 U packed RBCs in 72 h before operation	
Ventilator-dependent	
One point for each of these conditions	1
Wound class (clean / contaminated)	
Preoperative hematocrit \leq 38%	
Preoperative bilirubin > 1.0 mg/dL	
Dyspnea	
Albumin \leq 3.5 mg/dL	
Emergency	
Zero points for each of these conditions	0
ASA physical status class I	
Work RVU < 10	
Male gender	

Actual vs Predicted VTE Rates by Risk Index Levels in the Validation Data Sets



Conclusions

- Symptomatic postoperative VTE was not relatively infrequent but highly lethal
- The risk-prediction scoring system developed by using logistic regression odds ratio helps to identify patients at risk for postoperative VTE and to institute appropriate prophylactic measures.

Impact on Internal Medicine

- The first study to develop and validate a VTE risk index
- Will help identify high risk patients at the time of the preoperative evaluation so VTE prophylaxis measures can be initiated

Risk of Thromboembolism with Short-Term Interruption of Warfarin Therapy

Garcia DA, Regan Susan, Lori Henault et al.
Arch Intern Med 2008;168(1):63-69

Aim

To quantify the risk for thromboembolism and bleeding associated with the short-term interruption of warfarin therapy for minor procedures

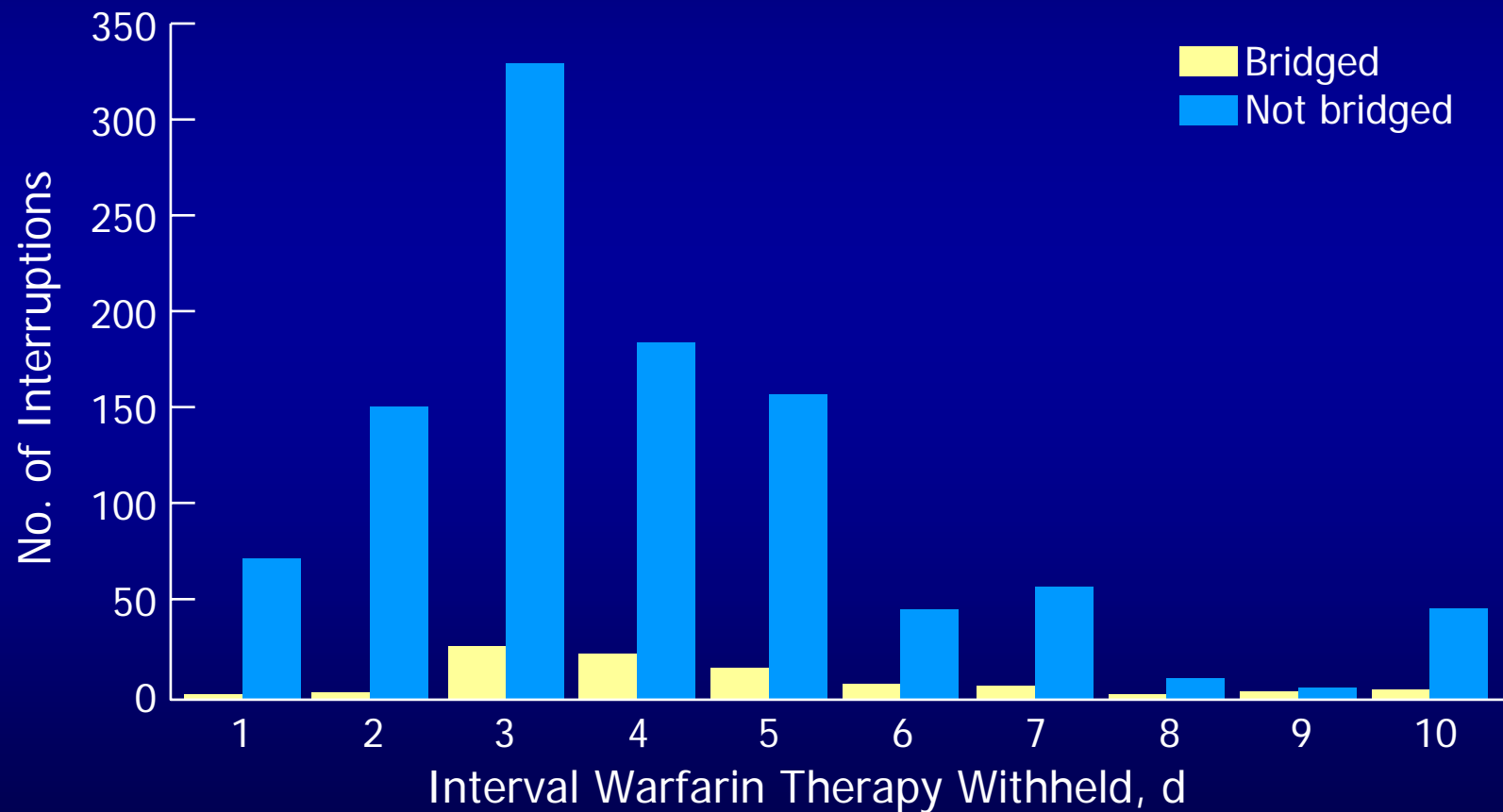
Methods

- Prospective observational study of 6761 patients
 - 1293 warfarin interruptions in 1024 individuals
 - Study performed at 101 sites in the US from April 2000-March 2002
- Main outcome measures were thromboembolism or clinically significant hemorrhage within 30-days of warfarin interruption

Results

- Mean Age 71.9 (10.6) yrs
- 42.8% Female
- The most common indications for anticoagulant therapy were Afib (n=550), VTE (n=144) and mechanical heart valves (n=132)
- 108 (8.4%) were bridged
- Most common procedures were C-scope, oral surgery and ophthalmic surgery
- TE =0.7% (CI, 0.3%-1.4%)
- Major bleeding =0.6 % (CI, 0.2-1.3%) vs. 3.7%
- Major bleeding (bridged) =3.7%

Overview of the Frequency with which Different Interruption Intervals were Chosen



Clinical Details of Thromboembolic Events

Thromboembolic Event	Warfarin Indication	Age, y/ Sex	Procedure	Days, No.		Comment
				Warfarin Withheld	Event	
Minor stroke	AF	72/F	Shoulder procedure	4	6	
Minor stroke	AF	75/F	Foot surgery	4	10	
Ischemic bowel (probable)	AF	73/F	Colonoscopy	5	11	Died within 30 days
Stroke	AF	82/F	Oral surgery	7	30	
Pulmonary embolism	AF	72/M	EGD	5	9	Active cancer
DVT	DVT	53/F	Sinus surgery	10	15	
Pulmonary embolism	DVT	69/F	Myelogram	10	10	Distal DVT 2-3 wk earlier

Proportion of Patients with Atrial Fibrillation Who Received Bridging Therapy According to Stroke Risk Factors

Stroke Risk Factor	No. of Patients (n=550)	Received Bridging Therapy, No. (%) (n=15)	Arterial Events, No. (%) (n=4)
Age >75 y	285	4 (1.4)	2 (0.7)
Prior stroke	60	6 (9.8)	2 (3.3)
Hypertension	277	9 (3.2)	2 (0.7)
Diabetes mellitus	104	1 (0.96)	1 (0.96)
Heart failure	139	7 (5)	1 (0.7)
No. of risk factors			
0	75	2 (2.7)	0
1	191	5 (2.6)	0
2	194	4 (2.0)	4 (2.1)
3	75	2 (2.7)	0
≥4	15	2 (13.3)	0

Conclusions

- For many patients undergoing a minor procedure, periprocedural interruption is associated with low risk of TE
- The risk of major bleeding in patients undergoing minor procedures should be weighed against a low risk of thromboembolism

Impact on Internal Medicine

- These results suggest that thromboembolic complications do occur when warfarin is stopped in the perioperative period.
- Unclear whether the rate of these complications would have been any different had warfarin not been stopped, as there was no control group.

Dabigatran vs. Enoxaparin for
Prevention of VTE after THA:
A randomized, double-blind, non-
Inferiority Trial

Erriksson BI, Dahl, OE, Rosencher N et al
Lancet 2007;370:949-956

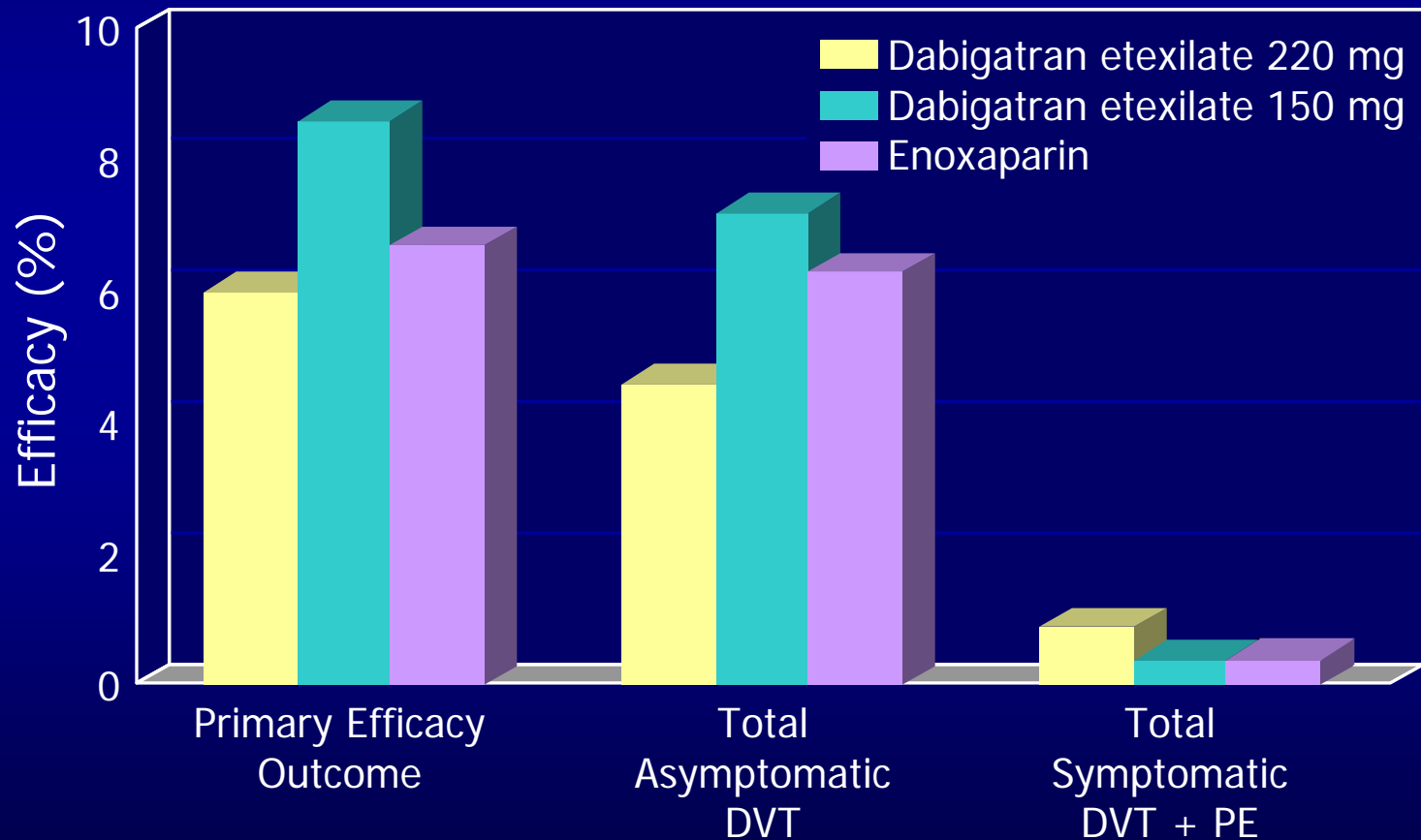
Aim

To assess the safety and efficacy of the oral direct thrombin inhibitor Dabigatran for the prevention of VTE after hip surgery.

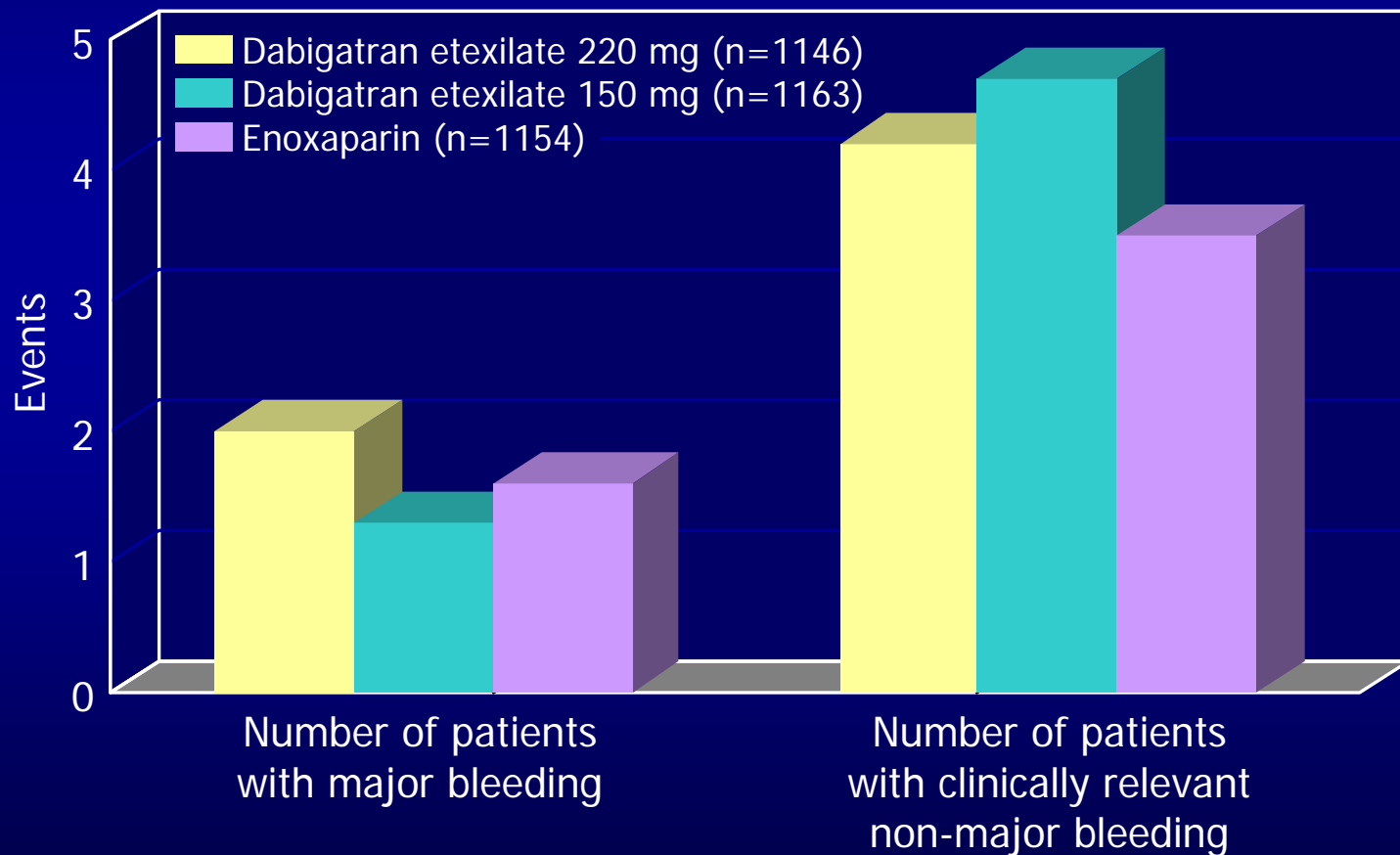
Methods

- Randomized, double-blind study at 115 centers across the world
- 3494 patients undergoing THA
- Randomized to dabigatran 220mg vs. 150 mg vs. Enoxaparin for 28-35 days
- Main outcome measures were efficacy (total VTE and death), major bleeding and clinically relevant bleeding
- Non-inferiority study design

Efficacy Outcomes During the Treatment Period



Bleeding Events During the Treatment Period



Conclusions

- Dabigatran was as effective and safe as enoxaparin in reducing the risk of VTE after total hip arthroplasty

Impact on Internal Medicine

- Currently dabigatran is not FDA-approved
- Has potential as an oral anticoagulant
- More studies are underway with this drug

Predictors of Postoperative Acute Renal Failure after Noncardiac Surgery in Patients with Previously Normal Renal Function

Kheterpal S, Tremper KK, Englesbe MJ
et al.

Anesthesiology 2007; 107:892-902

Aim

Identify risk factors for postoperative acute renal failure (ARF) after major noncardiac surgery in patients with previously normal renal function

Methods

- Prospective observational study
- 15,102 patients
- Normal preoperative creatinine clearance (> 80 ml/min)
- Exclusion criteria: IV contrast, urology and transplant procedures, aortic cross-clamping
- Primary outcome
 - ARF
 - (New creatinine clearance <50)
- Secondary outcome
 - Mortality
- Independent predictors of ARF identified

Independent Preoperative Predictors of Postoperative Acute Renal Failure

<i>Preoperative Predictor</i>	<i>Hazard Ratio</i>	<i>P value</i>
Age	4.2	< 0.001
Emergent surgery	1.9	<0.001
Liver disease	2.4	<0.001
Body mass index	1.9	<0.001
High-risk surgery	2.9	0.001
Peripheral vascular disease	4.2	0.015
COPD requiring bronchodilator therapy	3.0	0.045

Frequency and Hazard Ratio of ARF Based on Preoperative Risk Factors

<i>Preoperative Risk</i>	<i>ARF(%)</i>	<i>Hazard Ratio</i>
0 risk factors	0.3	
1 risk factor	0.5	2.0
2 risk factors	1.3	4.7
3 risk factors	4.3	16.0

Intraoperative Predictors of Postoperative Acute Renal Failure

Vasopressor infusion	(p < 0.05)
Total vasopressor dose	(p < 0.05)
Diuretic administration (furosemide, mannitol)	(p < 0.05)

Conclusions

Age, BMI, COPD, liver disease, PVD emergent and high risk surgery are independent preoperative predictors of ARF

Intraoperative vasopressor and diuretic use are predictive of postoperative ARF

Postoperative ARF is associated with increased all-cause 30 day, 60 day and 1 year mortality

Impact on Internal Medicine

- Risk factors for postoperative ARF can be identified preoperatively in noncardiac surgical patients
- Overall risk of ARF may be stratified by the total number of risk factors and considered preoperatively

Risk Factors for Mortality After Surgery in Patients with Cirrhosis

Teh SH, Nagorney DM, Stevens SR, et al
Gastroenterology 2007;132:1261-1269

Aim

To determine the risk for postoperative mortality in patients with cirrhosis

Methods

- Retrospective chart review
- Single institution
- 772 patients with cirrhosis having major digestive, orthopaedic, or cardiac surgery
- Minor surgery and non-surgical control groups

- MELD scores and ASA class determined within 24 hours preoperatively
- Primary outcome:
 - Postoperative mortality

MELD-Model for End stage Liver Disease

Results: Cirrhosis and Mortality

- Multivariate Analysis
- Only 3 factors were significant predictors of mortality throughout follow-up
 - MELD score
 - Age (greater than 70)
 - American Society of Anesthesiologists class

Relationship Between MELD Score and Postoperative Mortality

MELD Score	Mortality (rounded to nearest %)					
	7 day	30 d	90 d	1 yr	5 yr	10 yr
0-7	2	6	10	19	51	73
8-11	3	10	18	29	59	78
12-15	8	25	32	45	70	87
16-20	14	44	56	70	94	94
21-25	23	54	67	85	92	100
>25	30	90	90	100	100	100

Results

- A single point increase in MELD score is associated with a 14% increased mortality in 30-90 days postop
- Excess risk from 1-20 years is constant

Conclusions

- MELD score, age, ASA class are predictors of postoperative mortality in patients with cirrhosis
- Mortality in the first 7 days postop is best associated with ASA class
- MELD score is the best predictor of 30 day and beyond postop mortality

Impact on Internal Medicine

- MELD scores can guide preoperative decision making in patients with cirrhosis
- MELD scores lack arbitrary cutoffs and may replace Child's scores for preoperative risk assessment
- ASA class and age can be taken into account when considering perioperative mortality

Predictors of Cognitive Dysfunction after Major Noncardiac Surgery

Monk TG, Weldon BC, Garvan CW,
et al.

Anesthesiology 2008;108:18-30

Aim

Identify risk factors for postoperative cognitive dysfunction (POCD) in noncardiac surgery patients

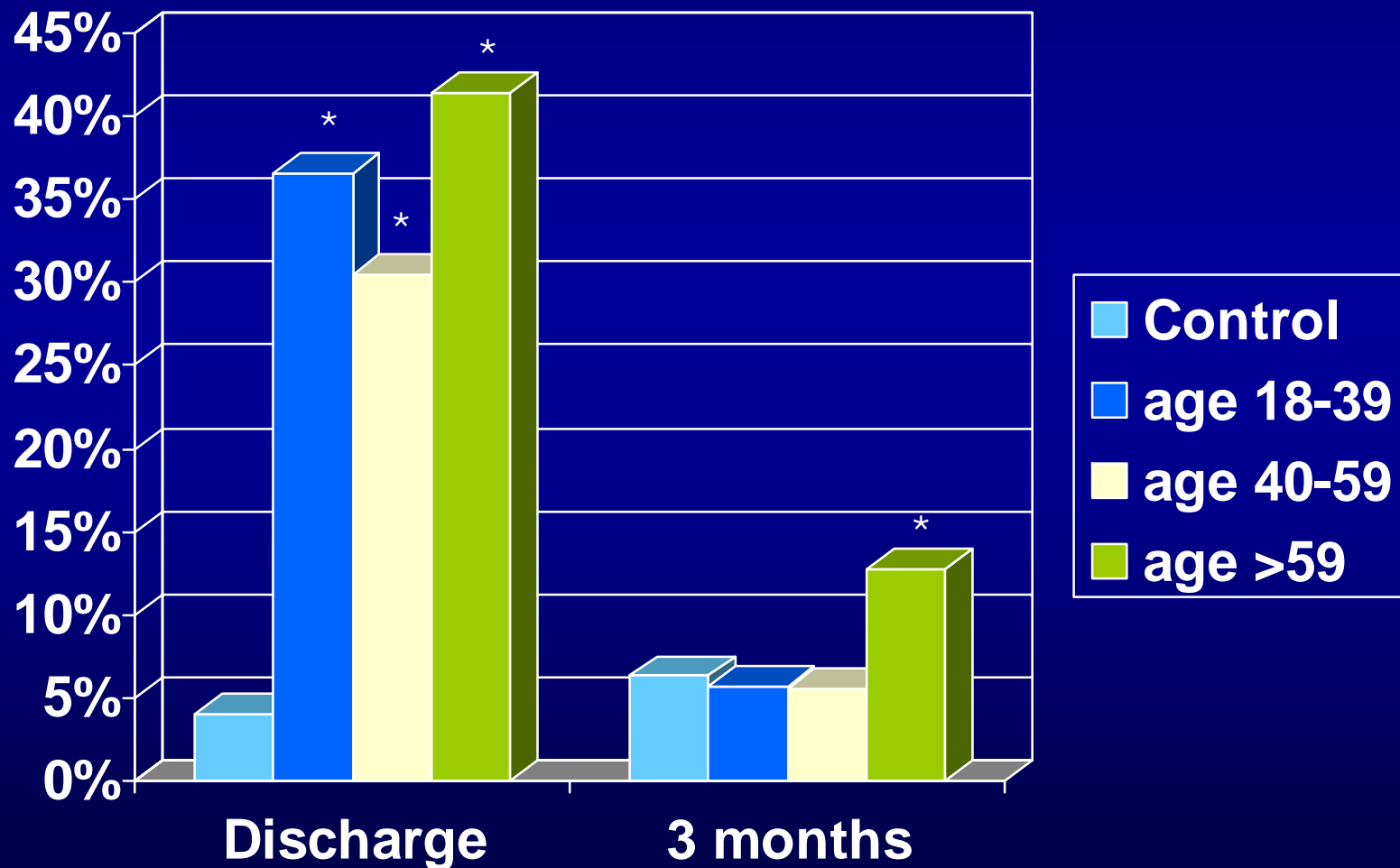
Assess the impact of POCD on mortality

Methods

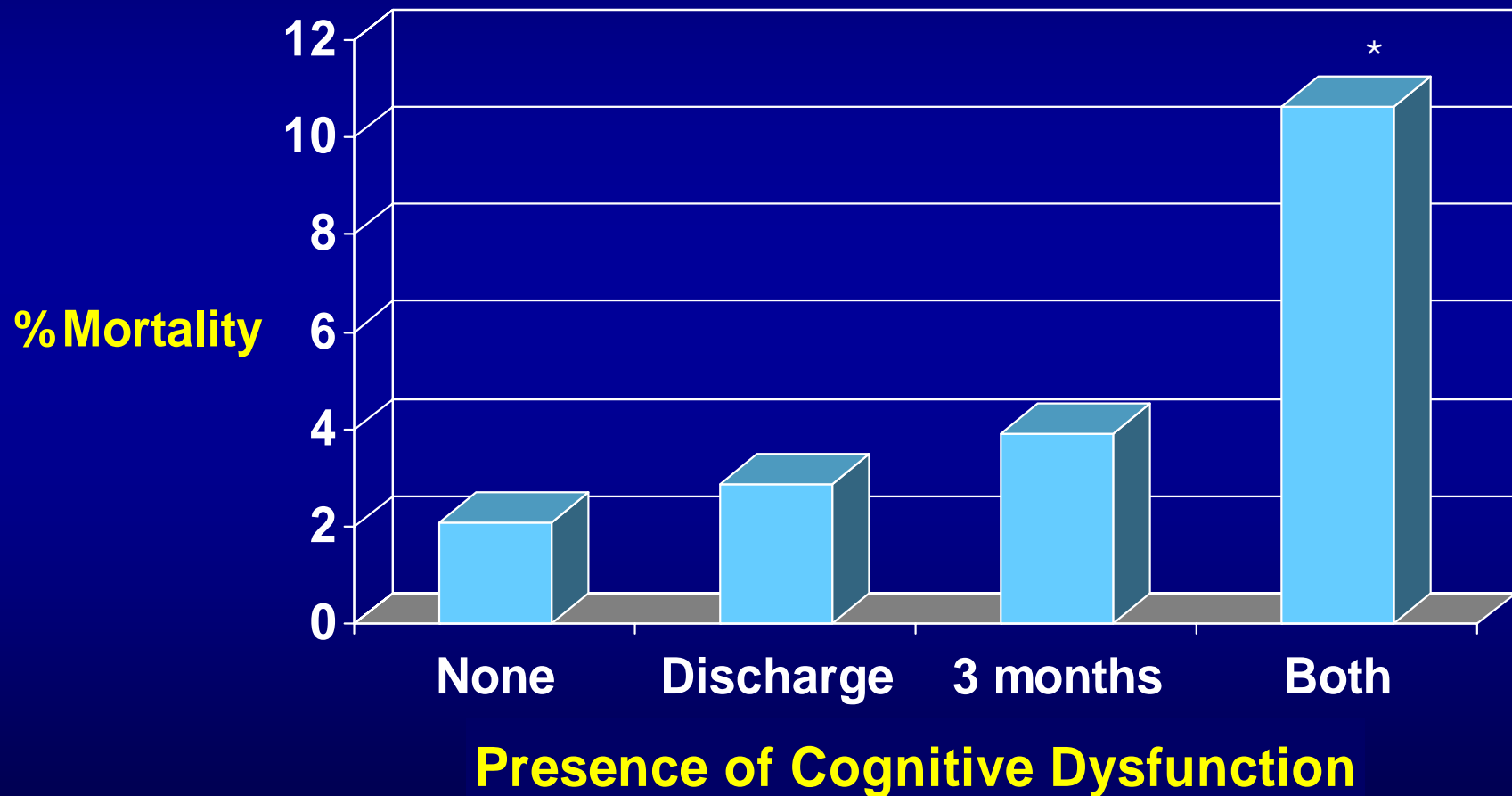
- Single center study
- 1,064 patients
- Prospective longitudinal
- Neuropsychiatric testing preoperatively, at discharge, 3 months postop

- Primary outcome
 - POCD
- Secondary outcome
 - mortality
- Risks for POCD identified

Results: Rates of POCD



Mortality in Patients with POCD



Independent Predictors of POCD

- POCD at Hospital Discharge
 - Age
 - Years of education
 - ASA status
 - Surgical category
 - Delirium during hospital stay
 - Opioid use
- POCD at 3 months (“late” POCD)
 - Age
 - Years of education
 - History of cerebral vascular accident

Conclusions

- Risk factors for late POCD include age, lower educational level, CVA history, and POCD at hospital discharge
- Only elderly patients have late POCD
- Late POCD is associated with increased mortality

Impact on Internal Medicine

- Preoperative risk factors that identify the risk for POCD and increased mortality can be identified
- Further research is needed to identify pathogenic mechanisms and possible therapeutic interventions