

## Medical Management of the Surgical Patient

April 13, 2012

Scott Marsal, M.D. FACP  
Department of Medical Education  
Providence Portland Medical Center  
Affiliate Assoc. Professor of Medicine, OHSU

## Pre-operative visit Continued...

- Meds:
  - ASA, lisinopril, hydrochlorothiazide
- ECG: NSR, LVH
- CBC, lytes, Creat NI
- Walks 2 miles/day
- No CHF/angina
- Exam:
  - HR 74, BP 138/80
  - Cardiopulmonary unremarkable

Disclosures: None

## Objectives



- Understand recommended preoperative evaluation strategies
- Understand appropriate patient selection for perioperative beta blockers
- Understand potential perioperative roles of other medications

## Our Patient



- 64 y/o woman with isolated left colon cancer
- Hemicolectomy planned
- PMH:
  - Hypertension
  - Borderline lipids

## Outline

- Background
- Cardiovascular risk assessment
- Preoperative revascularization
- Medications
- Perioperative pulmonary complications
- Postoperative monitoring

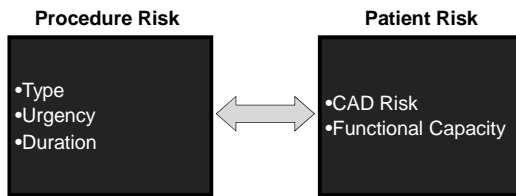
## Perioperative Cardiovascular Events- High Morbidity

- 30+ million noncardiac surgical cases/year
- 30%- CAD or risk factors
- 1 million- cardiovascular complications
- Perioperative MI → 30 - 50% mortality

## Procedure Risk

- > 5% |
  - Aortic, peripheral vascular
  - Big Cases
  - Emergent major (elderly)
- ½1% |
  - Endoscopic
  - Superficial procedures
  - Cataract
  - Breast surgery

## Determinants of Perioperative Cardiac Risk



## Procedure Risk

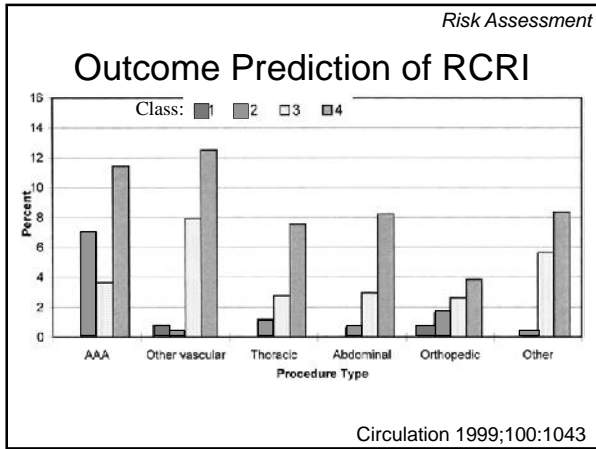
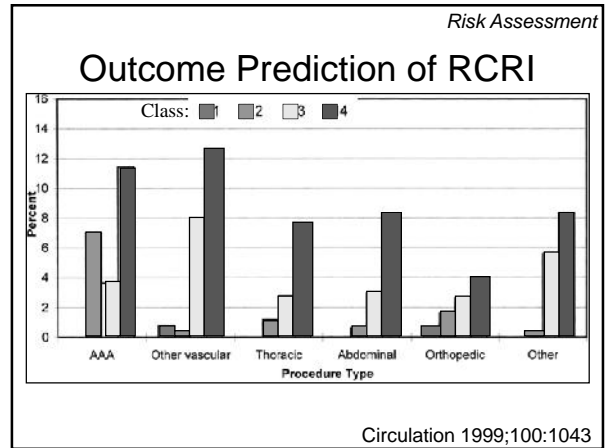
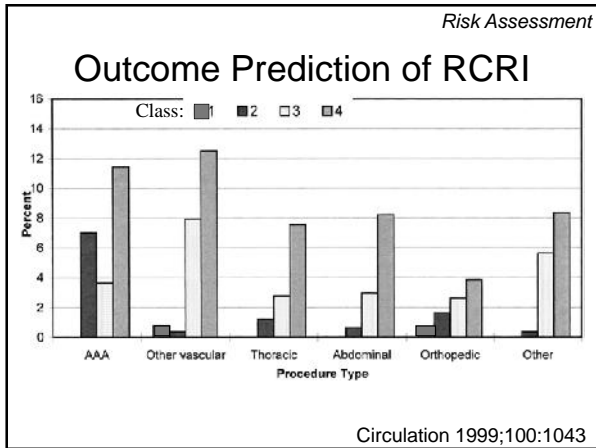
- > 5% |
  - Aortic, peripheral vascular
  - Big Cases
  - Emergent major (elderly)
- ½1% |
  - Endoscopic
  - Superficial procedures
  - Cataract
  - Breast surgery
- 1-5% |
  - All other procedures

## Procedure Risk

- > 5% |
  - Aortic, peripheral vascular
  - Big Cases
  - Emergent major (elderly)

## Patient Risk: Revised Cardiac Risk Index (RCRI)

- Six independent predictors of cardiovascular complications
  - History of ischemic heart disease
  - History of CHF
  - History of cerebrovascular disease
  - Preoperative treatment with insulin
  - Preoperative creatinine >2.0 mg/dL
  - High risk surgery



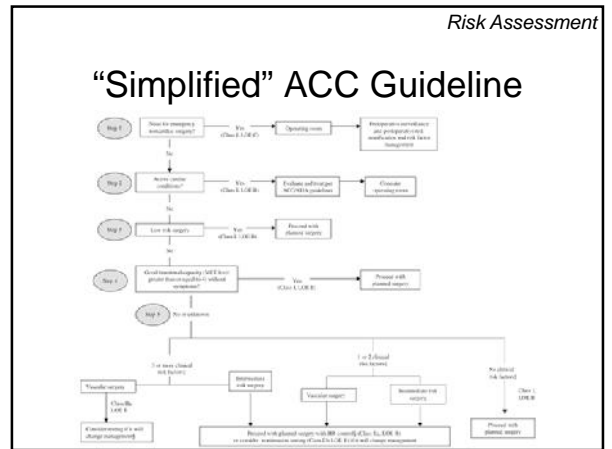
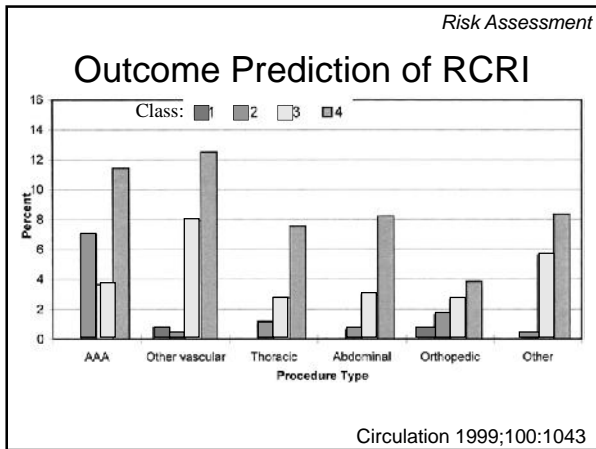
Risk Assessment

**ACC/AHA GUIDELINE**

**ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery**

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*



### ACC Guideline Major Principles

- Search for “active cardiac conditions”

### ACC Guideline Major Principles

- Search for “active cardiac conditions”
- Does the planned surgery have low risk?
- Functional assessment

### ACC Guideline Major Principles

- Search for “active cardiac conditions”
  - ✓Decompensated CHF
  - ✓Active ischemia/recent MI
  - ✓Significant rhythm abnormalities
  - ✓Severe valvular disease

### ACC Guideline Major Principles

- Search for “active cardiac conditions”
- Does the planned surgery have low risk?
- Functional assessment
  - ✓ > 4 Metabolic Equivalent (METS)
  - ✓ “Can you walk 4 mph or go up 2 flights of stairs?”

### ACC Guideline Major Principles

- Search for “active cardiac conditions”
- Does the planned surgery have low risk?

### ACC Guideline Major Principles

- Search for “active cardiac conditions”
- Does the planned surgery have low risk?
- Functional assessment
- Preoperative CABG/percutaneous coronary interventions infrequently necessary

*Revascularization*


The **NEW ENGLAND**  
**JOURNAL of MEDICINE**

ESTABLISHED IN 1812    DECEMBER 30, 2004    VOL. 351    NO. 27

Coronary-Artery Revascularization  
before Elective Major Vascular Surgery

**“CARP Study”**

- RCT evaluating PCI or CABG vs. medical therapy
- Patients: stable CAD
- Primary endpoint: long-term mortality



*Clinical Trials*

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

The DECREASE-V Pilot Study

Don Poldermans, MD,\* Olaf Schouten, MD,† Radosav Vidakovic, MD,‡ Jeroen J. Bax, MD,§

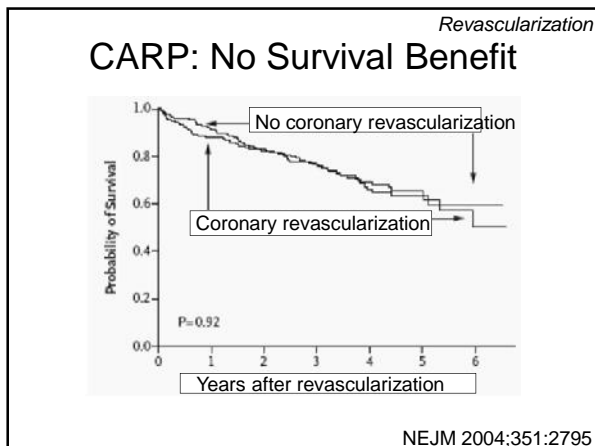
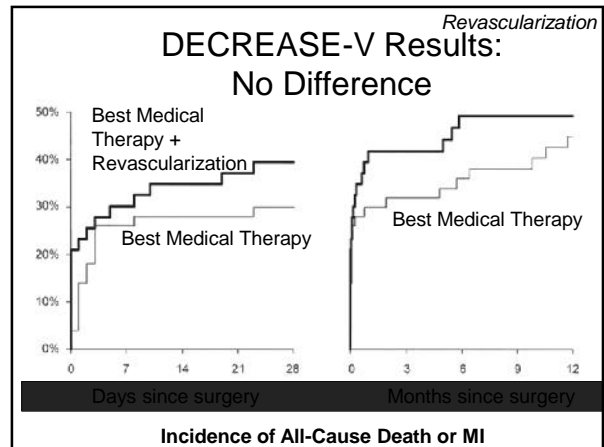
- Aim: Assess efficacy, safety of preoperative revascularization; major vascular surgery
- Prospective RCT
- Higher Risk: 2 - 3 vessel disease; extensive ischemia

J Am Coll Cardiol 2007;49:1763

*Revascularization*

### CARP Study Methods

- 510 Patients: stable symptoms; at risk
- Excluded: Left main disease, EF <20%, severe AS, need urgent/emergent surgery
- Majority: 1-2 vessel disease
- Approximately 3 PCI : 2 CABG
- Median f/u time: 2.8 years



*Revascularization*

### Why Wouldn't Prophylactic Coronary Revascularization Work?

- Delay of needed surgery
- Pro-inflammatory/Pro-thrombotic state
- “Wrong” lesions addressed

ACC/AHA GUIDELINE

**ACC/AHA 2007 Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery**

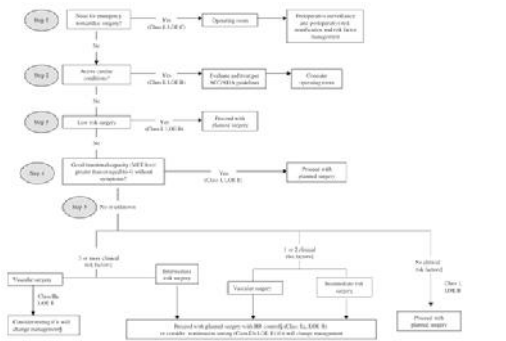
A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Revise the 2002 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery)

“...the literature suggests that PCI (percutaneous coronary intervention) before noncardiac surgery is of no value in preventing perioperative cardiac events, except in those patients in whom PCI is independently indicated for acute coronary syndrome.”

**Ischemic Testing- When?**

- Uncertainty: new ischemic symptoms?
- Willingness to forgo elective surgery if very high risk?
- Probably NOT: poor functional status, intermediate risk surgery.

**Ischemic Testing- When?**



**Our Patient- Risk Assessment**

- Intermediate risk- colectomy
- No “active cardiac conditions”
- Good functional capacity (> 4 METS)
- Cardiovascular Risk ~ 1%
- No further testing



**Ischemic Testing- When?**



**Perioperative Medical Interventions - are they helpful?**

- Nitrates
- Alpha 2 agonists
- Beta blockers
- Statins
- Antiplatelet/stent issues

### Perioperative Medical Interventions - are they helpful?

- Alpha 2 agonists
- Beta blockers
- Statins
- Antiplatelet/stent issues

### DECREASE (Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echocardiography) Trial

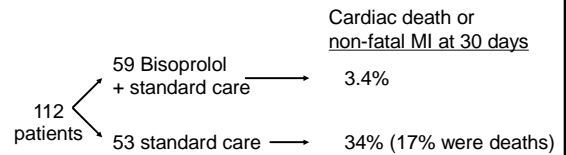
- Aim: Evaluate effect of bisoprolol on perioperative mortality/MI in patients undergoing vascular surgery
- RCT, very high risk patients
  - clinical risk factors + positive dobutamine ECHO
- Drug: bisoprolol 5-10mg/Day (IV metoprolol if NPO)
- End-point: 30 day composite of MI + cardiac death

NEJM 1999;341:1789

### Perioperative Medical Interventions - are they helpful?

- Beta blockers
- Statins
- Antiplatelet/stent issues

### DECREASE Bisoprolol Study

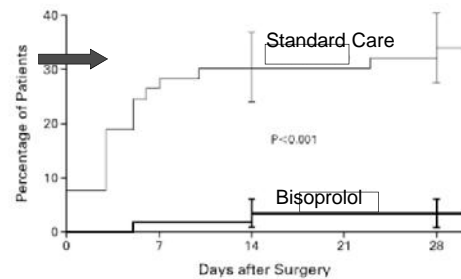


NEJM 1999;341:1789

### Evolving Perioperative Beta-Blocker Science

<u>Pre-1996</u>	No clinically relevant outcomes
<u>2000</u>	2+ trials ⇒ great enthusiasm
<u>2009- present</u>	Newer trials: no benefit POISE: significant risk

### DECREASE: High Event Rate



Kaplan-Meier Estimates: cumulative percentages with cardiac death or nonfatal MI

NEJM 1999;341:1789

ORIGINAL ARTICLE

**Perioperative Beta-Blocker Therapy and Mortality after Major Noncardiac Surgery**

Peter K. Lindenauer, M.D., Penelope Pekow, Ph.D., Kaijun Wang, M.S., Dheeresh K. Mamidi, M.B., B.S., M.P.H., Benjamin Gutierrez, Ph.D., and Evan M. Benjamin, M.D.

- Retrospective cohort study, 782,969 adults undergoing major noncardiac surgery
- Comparison of in-hospital mortality in those receiving/not receiving beta-blocker

NEJM 2005;353:349

**Beta-Blocker Negative Trials**

- DiPOM\* - Diabetic Postoperative Mortality and Mobidity Trial
- MaVS\* - Metoprolol after Vascular Surgery

Propensity-Matched Cohort

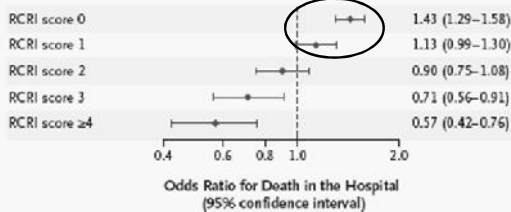


Figure 1. Adjusted Odds Ratio for In-Hospital Death Associated with Perioperative Beta-Blocker Therapy among Patients Undergoing Major Noncardiac Surgery, According to the RCRI Score and the Presence of Other Risk Factors in the Propensity-Matched Cohort and the Entire Study Cohort.

NEJM 2005;353:349

Medications

**Effects of Extended-Release Metoprolol Succinate in Patients Undergoing Non-Cardiac Surgery (POISE)**

- Aim: Evaluate impact of perioperative, long-acting metoprolol on cardiovascular death, non-fatal MI/cardiac arrest
- 8351 patients
- Randomized: metoprolol or placebo
- Target dosing: 200 mg/day
- 30 days of therapy

Lancet 2008;371:1839

Propensity-Matched Cohort

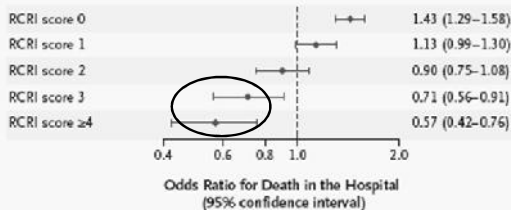


Figure 1. Adjusted Odds Ratio for In-Hospital Death Associated with Perioperative Beta-Blocker Therapy among Patients Undergoing Major Noncardiac Surgery, According to the RCRI Score and the Presence of Other Risk Factors in the Propensity-Matched Cohort and the Entire Study Cohort.

NEJM 2005;353:349

Medications

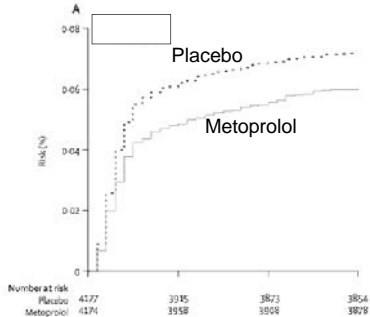
**POISE Trial- Methods**

- Initiation of treatment: 2-4 hours pre-op
- Hold parameters: HR <50; SBP <100
- Pre-specified secondary outcomes
  - Clinically significant hypotension
  - Stroke
  - Total mortality

Lancet 2008;371:1839



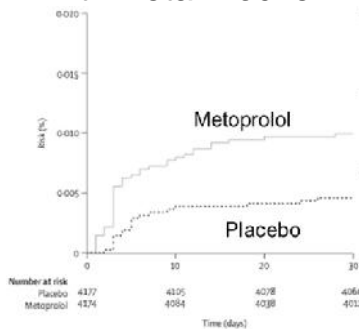
### POISE: Reduced Composite Endpoint with Metoprolol



### POISE Critiques

- High-dose beta blocker
- Immediate preoperative initiation
- Liberal hemodynamic parameters
- Data inconsistencies

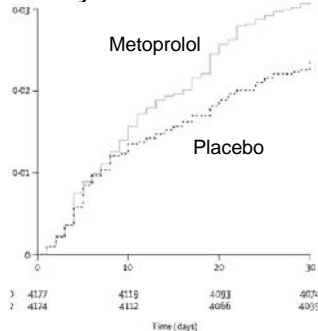
### POISE: Increased Stroke Risk with Beta Blocker



### Beta blocker Literature- Trends

- Higher risk patients appear to benefit
- Dose titration (to resting HR < ~65)
- Immediate pre-op drug initiation: more likely to cause harm

### POISE: Increased Total Mortality with Beta Blocker



### 2009 ACC/AHA Beta Blocker Recommendations

- Class I:
  - patients currently taking beta blockers should continue them through the perioperative period

## 2009 ACC/AHA Beta Blocker Recommendations

- Class IIa (“reasonable to consider”):
  - vascular surgery patients who are at high risk (established CAD or pre-operative ischemia or >1 clinical risk factor)
  - patients undergoing intermediate risk surgery with CHD/high clinical risk

JACC 2009; 22

## Perioperative Medical Interventions - are they helpful?

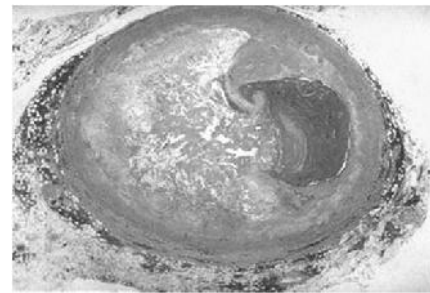
- Beta blockers
- Statins
- Antiplatelet/stent issues

## 2009 ACC/AHA Beta Blocker Recommendations



**2009 update: emphasis on titration to heart rate and blood pressure to avoid hypotension!**

## Perioperative MI Prevention- Role for Perioperative Statins?



## Perioperative Beta Blocker Caveats

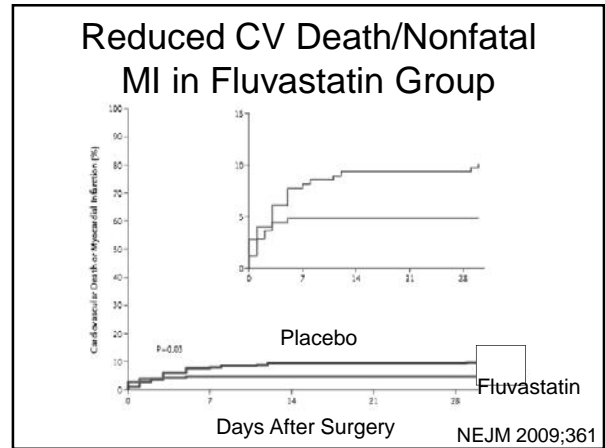
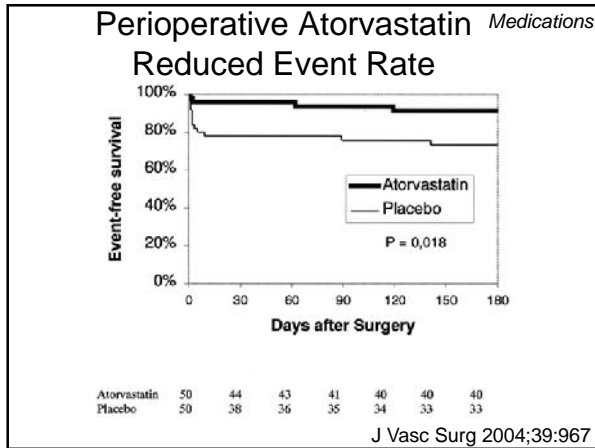
- Watch for bradycardia/hypotension post-op and adjust
- Unknowns:
  - Best drug- long-acting favored
  - Timing- days to weeks pre-op
  - Duration- continue ~ 1+ month

### CLINICAL RESEARCH STUDIES

Reduction in cardiovascular events after vascular surgery with atorvastatin: A randomized trial

- Prospective, double-blind RCT. 100 patients
- Aim: analyze effect of perioperative atorvastatin 20 mg/day (vs. placebo)
- Endpoint: 6-month composite (death, nonfatal MI, unstable angina)
- Started <14 Days pre-op. Duration: 45 days

J Vasc Surg 2004;39:967



*Medications*

ORIGINAL ARTICLE

### Fluvastatin and Perioperative Events in Patients Undergoing Vascular Surgery

Olaf Schouten, M.D., Ph.D., Eric Boersma, Ph.D., Sanne E. Hoeks, M.Sc.,

- Aim: evaluate impact of perioperative statin on adverse cardiovascular events
- Double-blind, placebo-controlled RCT: extended release fluvastatin vs. placebo
- Primary outcome: perioperative ischemia
- Secondary outcome: 30-day composite CV mortality/non-fatal MI

NEJM 2009;361:980

*Medications*

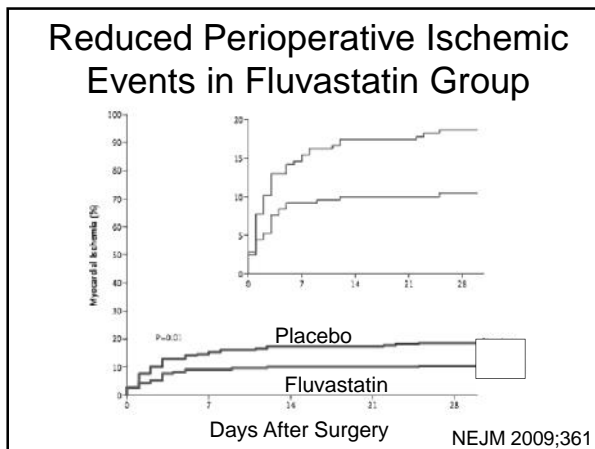
### Perioperative Statin- Systematic Review

- Aim- evaluate evidence of statin impact on perioperative events
- 18 studies- 800,000 patients
- Mostly retrospective

**Limitations**

- Lack of detail- dose, medication, LDL, timing
- Incomplete safety data

BMJ 2006;333:1149



*Medications*

### Perioperative Statin Systematic Review- Benefit Associated with Statin Use

	<b>Perioperative Death or ACS Event Rates in Cohort Studies</b>	<b>Perioperative Death Rates in Cohort Studies</b>
<b>Odds Ratio</b>	<b>0.70 (0.57 - 0.87)</b>	<b>0.58 (0.48-0.72)</b>

BMJ 2006;333:1149

### Perioperative Statin- ACC Guideline Recommendations

<b>Class I</b>	Patients currently taking statins + scheduled for noncardiac surgery: <b>statins should be continued</b>
<b>Class IIa</b>	Patients undergoing vascular surgery: <b>statin use is reasonable</b>

JACC 2007;50:e159

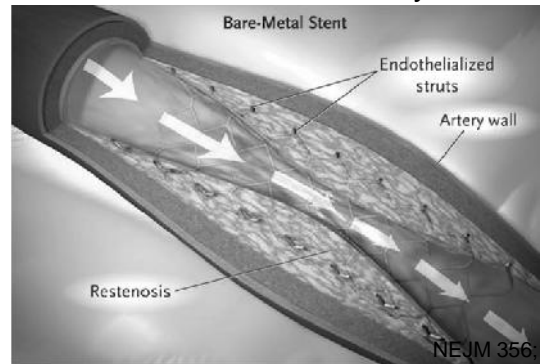
### Coronary Stents and Surgery

- In-stent thrombosis- concern early/ with drug-eluting stents
- Surgery = pro-thrombotic state
- Increased risk during first:
  - 30 - 45 days after bare metal stent
  - 12 months following drug-eluting stent

### Perioperative Statin- Caveats

- Manufacturers suggest holding perioperatively
- “perioperative risk reduction” not FDA approved use
- Ideal LDL levels unknown
- Timing/Dosing questions

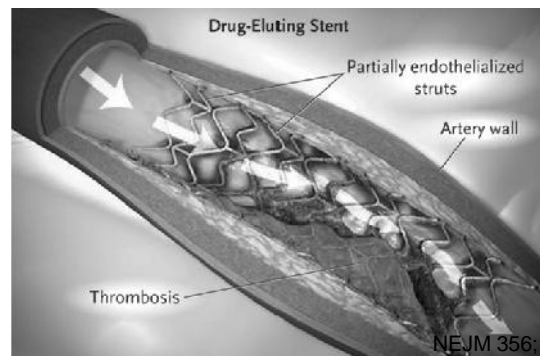
### Bare Metal Stent- Endothelialized Early



### Perioperative Medical Interventions - are they helpful?

- Beta blockers
- Statins
- Antiplatelet/stent issues

### Drug-Eluting Stent- Inhibited Endothelialization



## Predictors of Stent Thrombosis

Table 3. Independent Predictors of Stent Thrombosis

Variables	Hazard Ratio (95% Confidence Interval)	P Value
<b>Subacute stent thrombosis</b>		
Premature antiplatelet therapy discontinuation	161.17 (26.03-997.94)	<.001
Renal failure	10.06 (3.13-32.35)	<.001
Bifurcation lesion	5.96 (1.90-18.88)	.002
Diabetes	5.84 (1.74-19.55)	.004
Left ventricular ejection fraction per 10% decrease	1.12 (1.05-1.19)	<.001
Stent length, per 1-mm increase	1.03 (1.00-1.05)	.01
<b>Late stent thrombosis</b>		
Premature antiplatelet therapy discontinuation	57.13 (14.84-219.99)	<.001
Bifurcation lesion	8.11 (2.50-26.29)	.001
Left ventricular ejection fraction per 10% decrease	1.08 (1.01-1.12)	.03
<b>Cumulative stent thrombosis</b>		
Premature antiplatelet therapy discontinuation	89.76 (29.90-269.60)	<.001
Renal failure	6.49 (2.60-16.15)	<.001
Bifurcation lesion	6.42 (2.93-14.07)	<.001
Diabetes	3.71 (1.74-7.89)	.001
Left ventricular ejection fraction per 10% decrease	1.08 (1.05-1.13)	<.001

Copyright restrictions may apply

JAMA 2005;293:2126

## Implanted Stent-Recommendations

- Delay surgery if at all possible:
  - ⇒ for 6 weeks after bare metal stent
  - ⇒ for 12 months after drug-eluting stent
- If surgery needed: consider dual antiplatelet therapy continuation
- If dual antiplatelet therapy interruption: communication!
- Always continue ASA if possible

JACC 2007;50:e159

## Predictors of Stent Thrombosis

Table 3. Independent Predictors of Stent Thrombosis

Variables	Hazard Ratio (95% Confidence Interval)	P Value
<b>Subacute stent thrombosis</b>		
Premature antiplatelet therapy discontinuation	161.17 (26.03-997.94)	<.001
Renal failure	10.06 (3.13-32.35)	<.001
Bifurcation lesion	5.96 (1.90-18.88)	.002
Diabetes	5.84 (1.74-19.55)	.004
Left ventricular ejection fraction per 10% decrease	1.12 (1.05-1.19)	<.001
Stent length, per 1-mm increase	1.03 (1.00-1.05)	.01
<b>Late stent thrombosis</b>		
Premature antiplatelet therapy discontinuation	57.13 (14.84-219.99)	<.001
Bifurcation lesion	8.11 (2.50-26.29)	.001
Left ventricular ejection fraction per 10% decrease	1.08 (1.01-1.12)	.03
<b>Cumulative stent thrombosis</b>		
Premature antiplatelet therapy discontinuation	89.76 (29.90-269.60)	<.001
Renal failure	6.49 (2.60-16.15)	<.001
Bifurcation lesion	6.42 (2.93-14.07)	<.001
Diabetes	3.71 (1.74-7.89)	.001
Left ventricular ejection fraction per 10% decrease	1.08 (1.05-1.13)	<.001

Hazard Ratio: 89.8 associated with early anti-platelet therapy discontinuation and stent thrombosis

Copyright restrictions may apply

JAMA 2005;293:2126

## Our Patient- Preoperative Medication Issues



- No perioperative beta blocker
- Review last lipids- consider usual indications (NCEP)

## Perioperative Risk Following Recent Bare Metal Stent

- 40 consecutive patients undergoing noncardiac surgery; 13 days post stent implantation
- 8 deaths, 7 MI, 11 major bleeding episodes
- Deaths and MI's due to stent thrombosis
- Conclusion: Delay surgery for 6 weeks if possible

JACC 2000;35:1288

## Pulmonary Complications-Systematic Review

- Inclusion criteria- clinical outcomes
- Findings:
  1. Limited number of patient and procedure related risk factors
  2. Limited number of risk-reducing interventions

Ann Int Med 2006;144:596

## Patient-Related Risk Factors for Perioperative Pulmonary Complications

<u>Risk Factor</u>	<u>Odds Ratio</u>
Age	2.1 - 3
ASA Class	4.8
Abnormal CXR	4.8
CHF	2.9
Functional Dependence	2.5

Ann Int Med 2006;144:596

## Postoperative Monitoring- What to Do?

- Postoperative MI
  - relatively infrequent
  - Asymptomatic/atypical presentations common
  - NSTEMI, first 3 days
- Extensive literature- outdated

Definition of MI { symptoms **or** ECG Δ  
+  
elevated troponin

## Procedure-Related Risk Factors for Perioperative Pulmonary Complications

<u>Risk Factor</u>	<u>Odds Ratio</u>
Surgical Site	
• Aortic	6.9
• Thoracic	4.2
• Any abdominal	3.0
• Upper abdominal	2.9
• Neurosurgery	2.5
Emergency Surgery	2.2
General Anesthesia	1.8

## Postoperative Monitoring- Routine Troponins Problematic

- Elevated troponin: sepsis, PE, CHF, renal insufficiency, hypotension
- Postop elevated troponin more likely from non-MI causes (without ischemic symptoms/ECG Δ)
- Routine postoperative troponin **not** recommended

## Risk Reduction- Effective Strategies

- Selective use of postoperative nasogastric tubes
- Postoperative lung expansion- incentive spirometry, chest physical therapy

## Recommended Monitoring

- Who: 1) symptomatic 2) high clinical concern
- What: serial ECG
- When:
  - Immediately postoperatively
  - Daily x 2 days

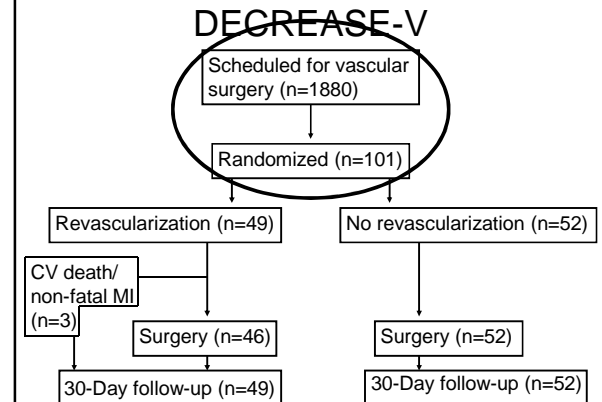
JACC 2007;50:e159

## Our Patient- Postoperative Interventions



- Incentive spirometry
- Pharmacologic venous thromboembolic disease prophylaxis

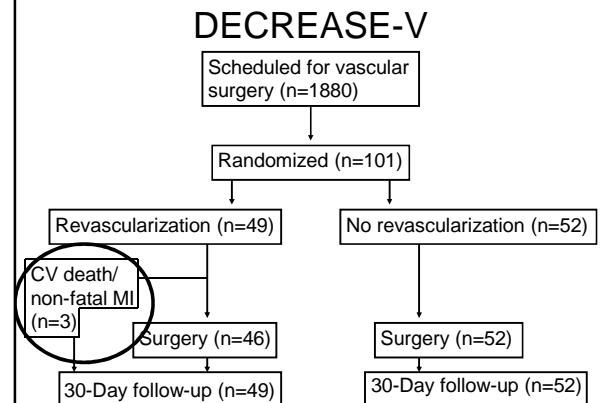
Revascularization



Thank You

Scott.Marsal@Providence.org

Revascularization



Revascularization

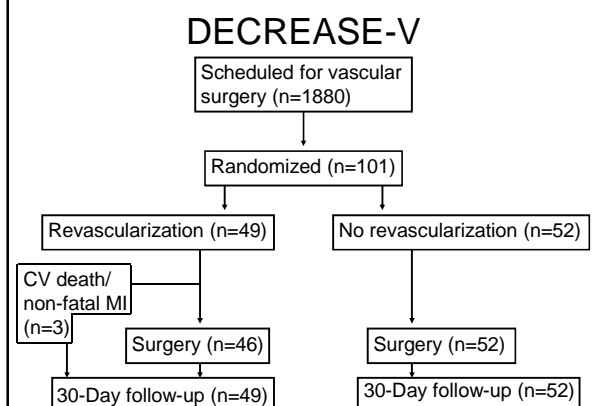
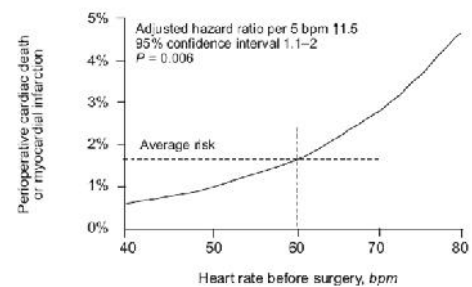


Figure 2. The Relation Between Heart Rate and Perioperative Cardiovascular Events



Intermediate Risk Patients

JACC 2006;48:964

## OSA

- Review chest 2008;133:1128 and ann surgery 2008;247:617
- Prospective assessment of 172 pts w/ 2+ risk factors
- Overnight oximetry; >5 desats/hour
  - Cohort w/ 15% vs. 3 % adjusted odds ratio for periop pulm comp. OR 7.2
- Post op CPAP lowers overall postop pulm comp in those unable to tol active muscle training-- see ann surg paper above
- Prob not screen all yet -- evolving data

DVT Proph

## Extended Prophylaxis

- Most clots- 1st/2nd post-operative week
- Recommended for high risk orthopedics
  - Hip fracture/hip replacement surgery
  - 28-35 days

## What's New: Rivaroxaban

- Oral Anticoagulant
- Direct Factor direct Xa inhibitor, once daily
- Indications: NO existing FDA approvals; VTE prophylaxis-hip and knee arthroplasty
- Dose- fixed
- Contraindications- liver disease?
- Adverse events: increased bleeding risk, hepatic
- NEJM 2008;358:2765

DVT Proph

## Extended Prophylaxis- General Surgery Patients

### Danish study

- 7 vs. 28 days dalteparin
- Reduced DVT (venography)
- RRR: 55%      NNT: 12
- No increased bleeding

J Thromb Haem 2006; 4:2384

## Venous Thromboembolic Disease Prophylaxis- General Surgery Patients

DVT Proph

- 10 - 30% risk
- Higher in cancer patients
- Pharmacologic therapy favored
- Exception- minor general surgery, < 1 hour → "early/aggressive ambulation"

## American College of Chest Physicians- Antithrombotic and Thrombolytic Therapy, 8th Ed.

DVT Proph

- ASA alone **not** adequate
- General surgery
- Low molecular weight heparin, low dose unfractionated heparin (TID), or fondaparinux
- Start within 24 hours
- Duration- minimally to hospital discharge
- Consider extended prophylaxis- 28 days in higher risk subpopulations (cancer, prior VTE)

Chest 2008;133:67s