CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE
CONTROVERSIES & UPDATES IN VASCULAR SURGERY
JANUARY 17-19 2013
MARRIOTT RIVE GAUCHE & CONFERENCE CENTER PARIS, FRANCE

Myocardial Infarction Following Vascular Surgery: Why We Should Take It Seriously

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CACVS
January, 2013

Faculty Disclosure

Peter Schneider

I disclose the following financial relationships:

Consultant for Abbott (non-paid), Medtronic (non-paid)

Royalty from Cook (modest)

Receive research support from Abbott, Gore, Medtronic, Cordis (non-paid)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Stenting versus Endarterectomy for Treatment of Carotid-Artery Stenosis

Thomas G. Brott, M.D., Robert W. Hobson, II, M.D.,* George Howard, Dr.P.H., Gary S. Roubin, M.D., Ph.D., Wayne M. Clark, M.D., William Brooks, M.D., Ariane Mackey, M.D., Michael D. Hill, M.D., Pierre P. Leimgruber, M.D., Alice J. Sheffet, Ph.D., Virginia J. Howard, Ph.D., Wesley S. Moore, M.D., Jenifer H. Voeks, Ph.D., L. Nelson Hopkins, M.D., Donald E. Cutlip, M.D., David J. Cohen, M.D., Jeffrey J. Popma, M.D., Robert D. Ferguson, M.D., Stanley N. Cohen, M.D., Joseph L. Blackshear, M.D., Frank L. Silver, M.D., J.P. Mohr, M.D., Brajesh K. Lal, M.D., and James F. Meschia, M.D., for the CREST Investigators†

New England Journal of Medicine May, 2010

MI Matters

MI following vascular procedures is associated with substantially increased mortality in comparison to patients who do not have an MI.

- It is better not to have an MI.
- Patients do not look at MI the same way they look at a stroke, however, now we know that MI has broad implications for the patient.
- We are going to have to pay attention to MI as a primary outcome going forward.

Asymptomatic	CAS Events (%)	CEA Events (%)	P value
All Stroke	15 (2.5)	8 (1.4)	0.15
Stroke and death	15 (2.5)	8 (1.4)	0.15
MI	7 (1.2)	13 (2.2)	0.76
Stroke, death, MI	21 (3.5)	21 (3.6)	0.96

Symptomatic	CAS Events (%)	CEA Events (%)	P value
All Stroke	37 (5.5)	21 (3.2)	0.043
Stroke and death	40 (6.0)	21 (3.2)	0.019
MI	7 (1.0)	15 (2.3)	0.083
Stroke, death, MI	45 (6.7)	35 (5.4)	0.30

Silver et al. Stroke 2011;42:675

42 MIs in CREST

- 14 after CAS and 28 after CEA
- 29/42 occurred 1st 24 hrs
  - 9 in the 1st week, 3 in more 1 week to 1 month
- 20 biomarker elevations without chest pain or EKG changes:
  - 8 after CAS and 12 after CEA
  - 18/20 occurred in 1st 24hrs

MI Endpoint Definitions

- EKG: before and up to 48 hours after procedure.
- Biomarkers: before and after (up to 8 hours post).

- Evidence of myocardial ischemia
  - ECG evidence of > 1mm ST elevation or depression in 2 contiguous leads and/or
  - Chest pain
- Cardiac biomarkers (CK-MB or troponin) ≥2 times normal level
- All endpoints adjudicated by CEC

Table 2. Results of Multivariable Analysis of Risk Factors for Periprocedural Myocardial Infarction

Variable	HR	95% CI	*P*
MI model*			
Age*	1.03	0.99–1.08	0.19
Prior cardiovascular disease or CABG*	2.22	1.13–4.35	0.02

Patients with heart disease did better with CAS

Among patients enrolled in CREST

44% had prior cardiovascular disease

21% had previous CABG

Circulation 2011;123:2571

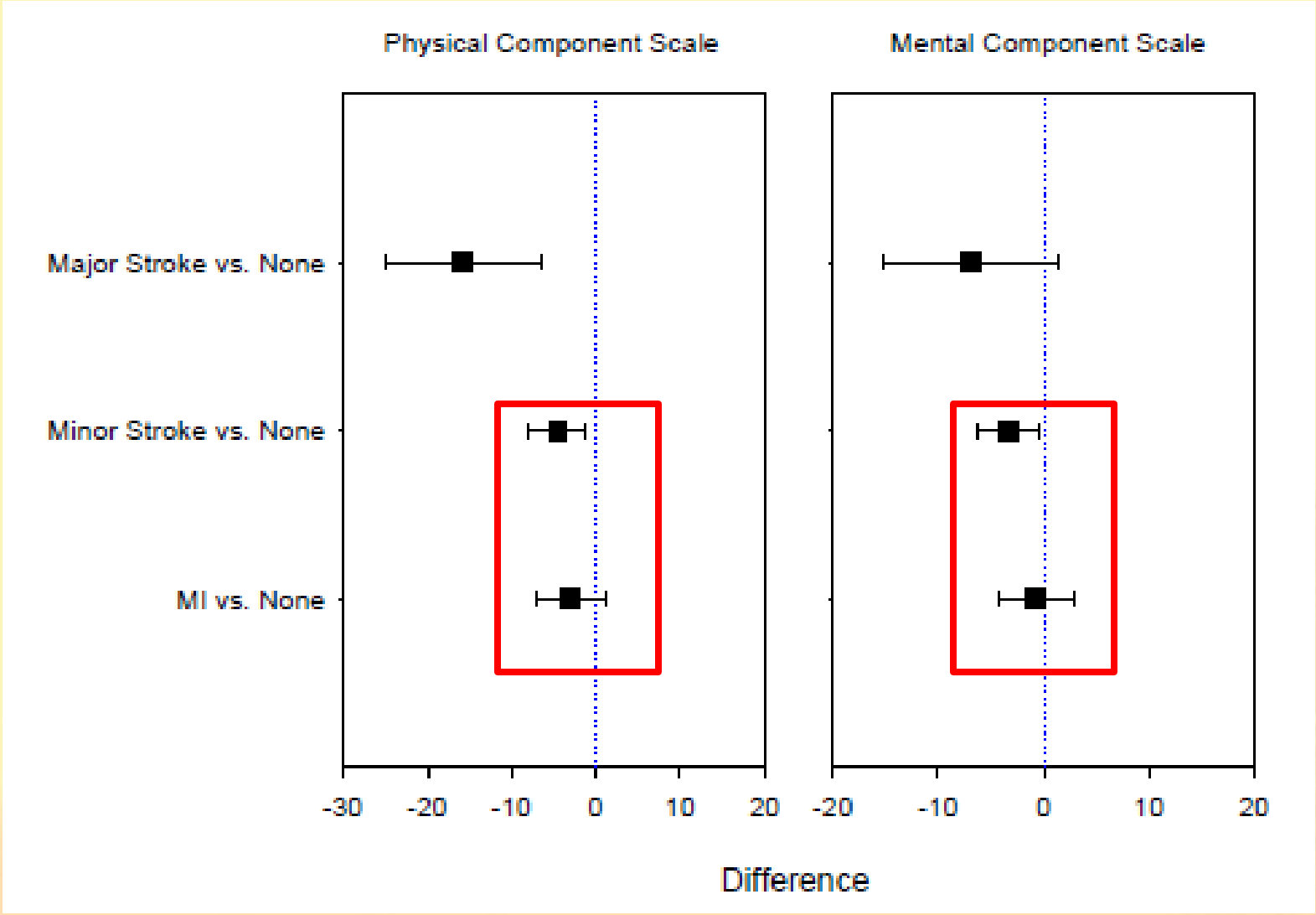
Independent Predictors of Mortality

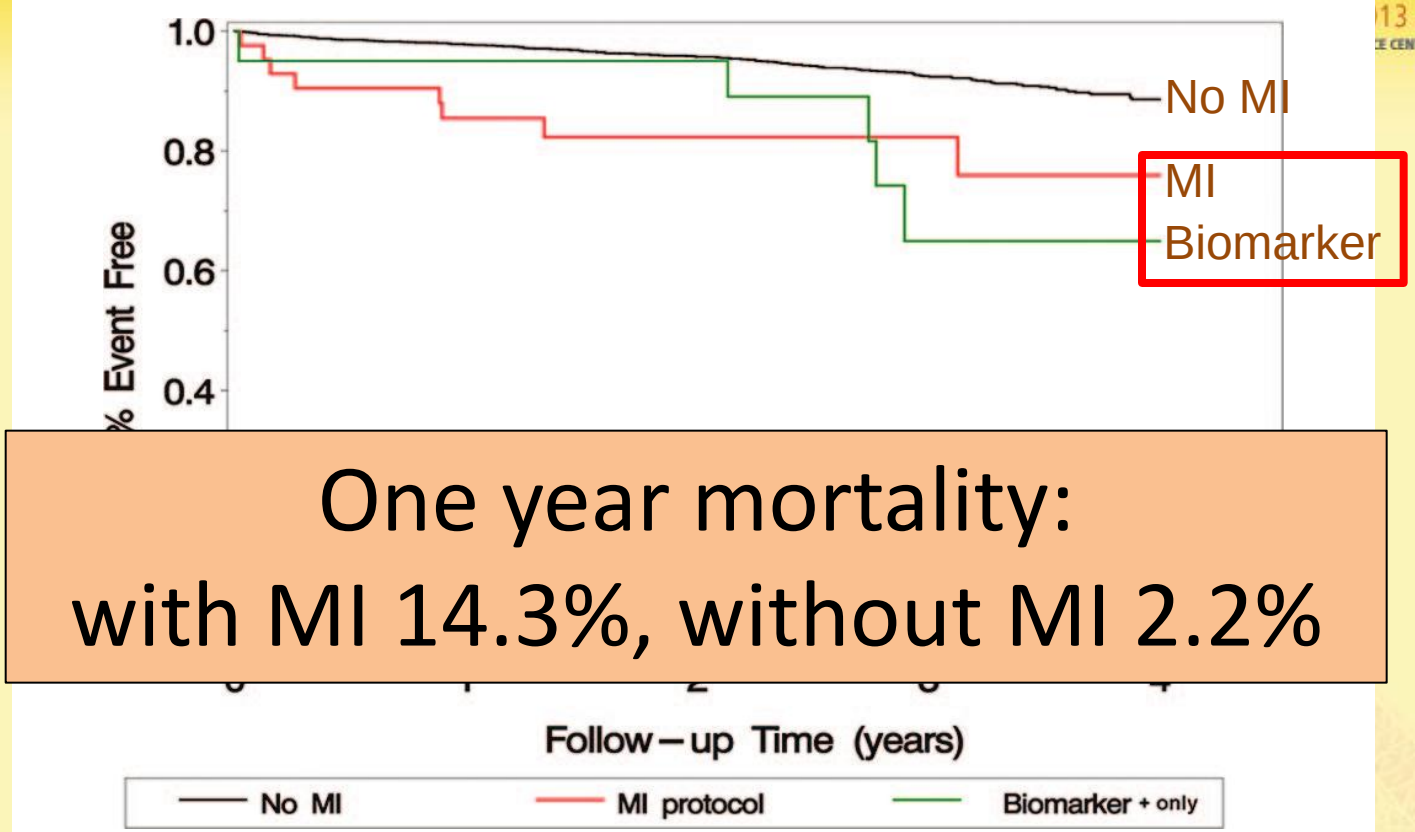
Variable	HR	95% CI	p-value
Any stroke within 30 days (yes vs. no)	2.49	1.44 - 4.32	0.0011
MI within 30 days (yes vs. no)	2.14	1.23 - 3.86	0.0079
Current Smoker (yes vs. no)	1.69	1.19 - 2.39	0.0034
Diabetes (yes vs. no)	1.57	1.16 - 2.12	0.0032
Sex (male vs. female)	1.50	1.08 - 2.08	0.0150
Ischemic Heart Disease/ Congestive Heart Failure (yes vs. no)	1.48	1.10 - 2.00	0.0097
Age (in Years)	1.06	1.04 - 1.08	< 0.0001

p-values from Cox regression model, for descriptive purposes only

FDA Panel Presentation
Jan. 26, 2011

Does MI Matter?
Quality of Life from CREST by event





One year mortality:
with MI 14.3%, without MI 2.2%

Figure 2. Kaplan-Meier survival curves after randomized carotid revascularization in the Carotid Revascularization Endarterectomy Versus Stenting Trial (CREST). Groups represented include myocardial infarction (MI) patients, biomarker+ only patients, and patients with neither MI nor biomarker+ only.

Blackshear et al. Circulation 2011;123:2571

Perioperative myocardial ischemic injury in high-risk vascular surgery patients: Incidence and clinical significance in a prospective clinical trial

William C. Mackey, MD,[a] Lee A. Fleisher, MD,[b] Seema Haider, MSc,[c] Saraih Sheikh, MSc,[c] Joseph C. Cappelleri, PhD, MPH,[c] Won Chan Lee, PhD,[d] Qin Wang, MS,[d] and Jennifer M. Stephens, PharmD,[e] *Boston, Mass; New London, Conn; and Bethesda, Md*

Table III. All-cause mortality and PMII-related events overall and by index procedure

Event	*Overall*	*AAA*	*Afem*	*Fempop*	*Femtib*
Death	8 (3.4%)	2 (4.6%)	1 (3.5%)	2 (3.2%)	2 (2.8%)
PMII death	7 (3.0%)	1 (2.3%)	1 (3.5%)	2 (3.2%)	2 (2.8%)
PMII overall	42 (17.8%)	9 (20.5%)	7 (24.1%)	8 (12.9%)	14 (19.7%)
MI (nonfatal)	22 (9.3%)	5 (11.4%)	4 (13.8%)	4 (6.5%)	7 (9.9%)
CHF	11 (4.7%)	2 (4.6%)	3 (10.3%)	1 (1.6%)	4 (5.6%)

of 236 patients: 22 myocardial infarctions, 11 congestive heart failures, and 12 new arrhythmias (3 patients had 2 PMII events). There was no evidence of differences in the incidence of PMII among the various index procedures. PMII was

Table IV. Index hospitalization length of stay data through day 30 by the presence of a PMII event

Resource utilization item	*Overall PE substudy (n = 236)*	*PMII event*		P *value*
		Yes (n = 42)	*No (n = 194)*	
No. patients still hospitalized from index operation at day 30	9 (3.8%)	6 (14.3%)	3 (1.6%)	<.001
Mean length of index stay, d (SD)	11.2 (7.4)	16.8 (8.9)	10.0 (6.4)	<.001
No. patients requiring ICU stay during index hospitalization	156 (66.1%)	35 (83.3%)	121 (62.4%)	<.009
Mean ICU length of stay during index hospitalization, d (SD)	4.4 (4.6)	6.6 (6.3)	3.7 (3.7)	<.009

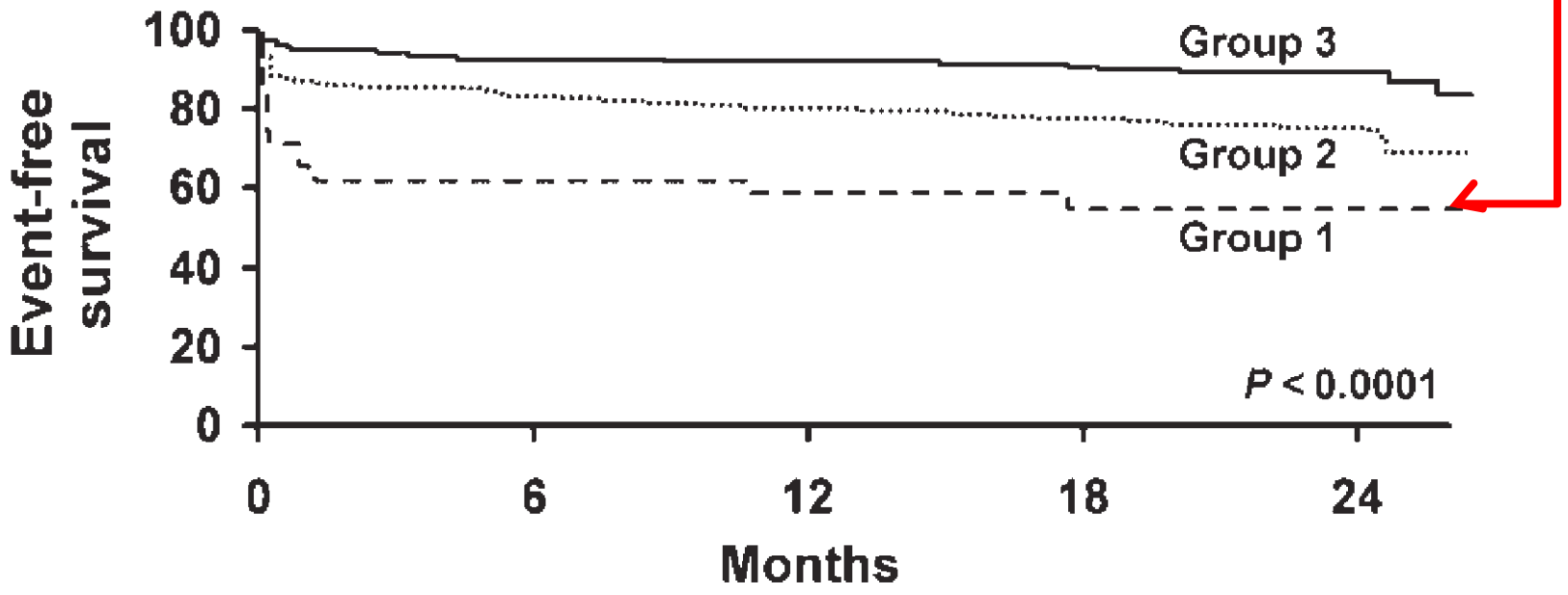
PMII, Perioperative myocardial ischemic injury; *PE*, pharmacoeconomic; *ICU*, intensive care unit.

European Heart Journal (2005) 26, 2448–2456
doi:10.1093/eurheartj/ehi430

Clinical research

Vascular surgery patients: perioperative and long-term risk according to the ACC/AHA guidelines, the additive role of post-operative troponin elevation

Group 1: Coronary revascularization within the past 5 years



ated with adverse outcomes even after multivariable adjustment at long-term (adjusted overall HR¼4.73, 95%CI¼2.92–7.65; P, 0.0001) and at 30 days (adjusted HR¼5.52, 95%CI¼3.23–9.42; P, 0.0001).

Conclusion After pre-operative stratification, patients undergoing elective major vascular surgery remain at high risk of MI and death. Events occur mainly early after surgery. cTnI elevations are frequent and independently associated with increased risk. These findings suggest the need for a major re-evaluation of our approach to these patients.

Journal of Thrombosis and Haemostasis, **6**: 742–748 DOI: 10.1111/j.1538-7836.2008.02948.x

2009

ORIGINAL ARTICLE

Myocardial infarction and cerebrovascular accident following non-cardiac surgery: differences in postoperative temporal distribution and risk factors

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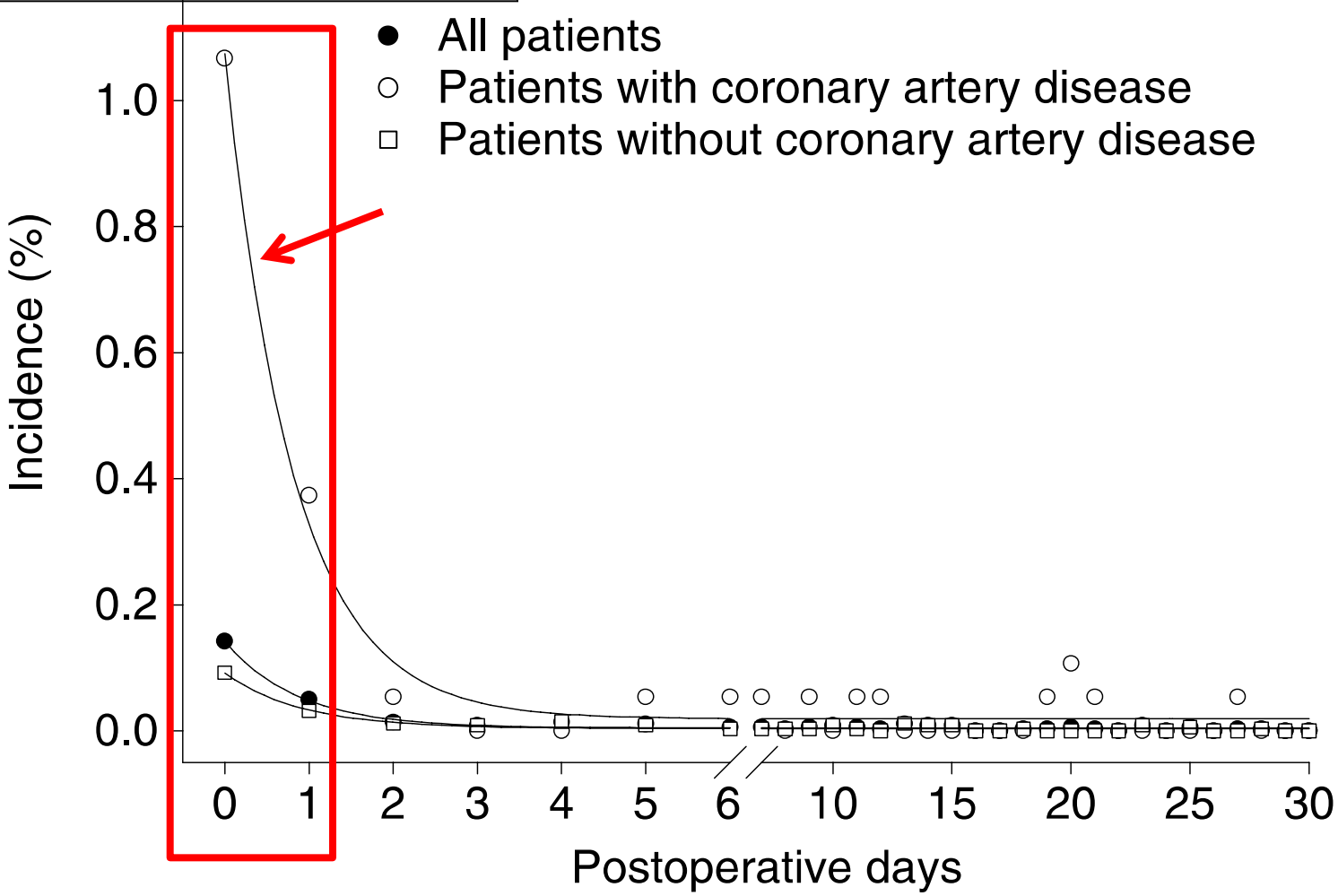
Myocardial infarction



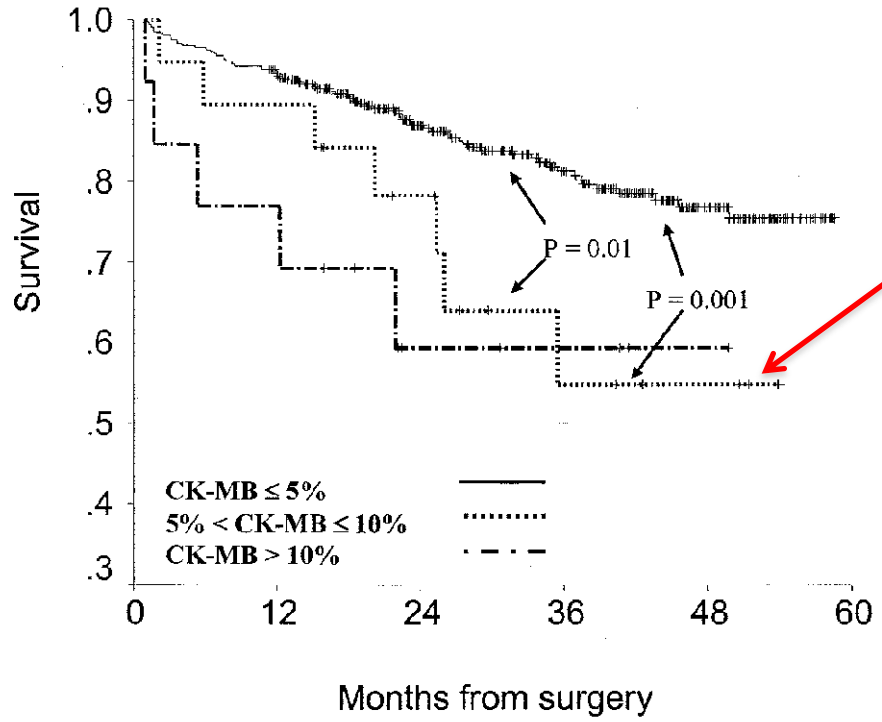


Figure 2. Kaplan-Meier survival curves of all patients divided according to their highest postoperative creatine kinase-MB fraction (CK-MB) level: Group I—CK-MB ≤5%; Group II—5% < CK-MB ≤10%; Group III—CK-MB >10%; Groups II and III had worse long-term survival than Group I ($p = 0.01$ and 0.001, respectively, by log-rank test).

Association of Cardiac Troponin, CK-MB, and Postoperative Myocardial Ischemia With Long-Term Survival After Major Vascular Surgery

Giora Landesberg, MD, DSc,*† Vadim Shatz, MD,*† Inna Akopnik, MD,‡ Yehuda G. Wolf, MD,‡ Michael Mayer, DSc,§ Yacov Berlatzky, MD,‡ Charles Weissman, MD,*† Morris Mosseri, MD‖

CONCLUSIONS Postoperative CK-MB and troponin, even at low cutoff levels, are independent and complementary predictors of long-term mortality after major vascular surgery. (J Am Coll Cardiol 2003;42:1547–54) © 2003 by the American College of Cardiology Foundation

Cardiac Troponin I Predicts Short-Term Mortality in Vascular Surgery Patients

Lauren J. Kim, MPH; Elizabeth A. Martinez, MD; Nauder Faraday, MD; Todd Dorman, MD;

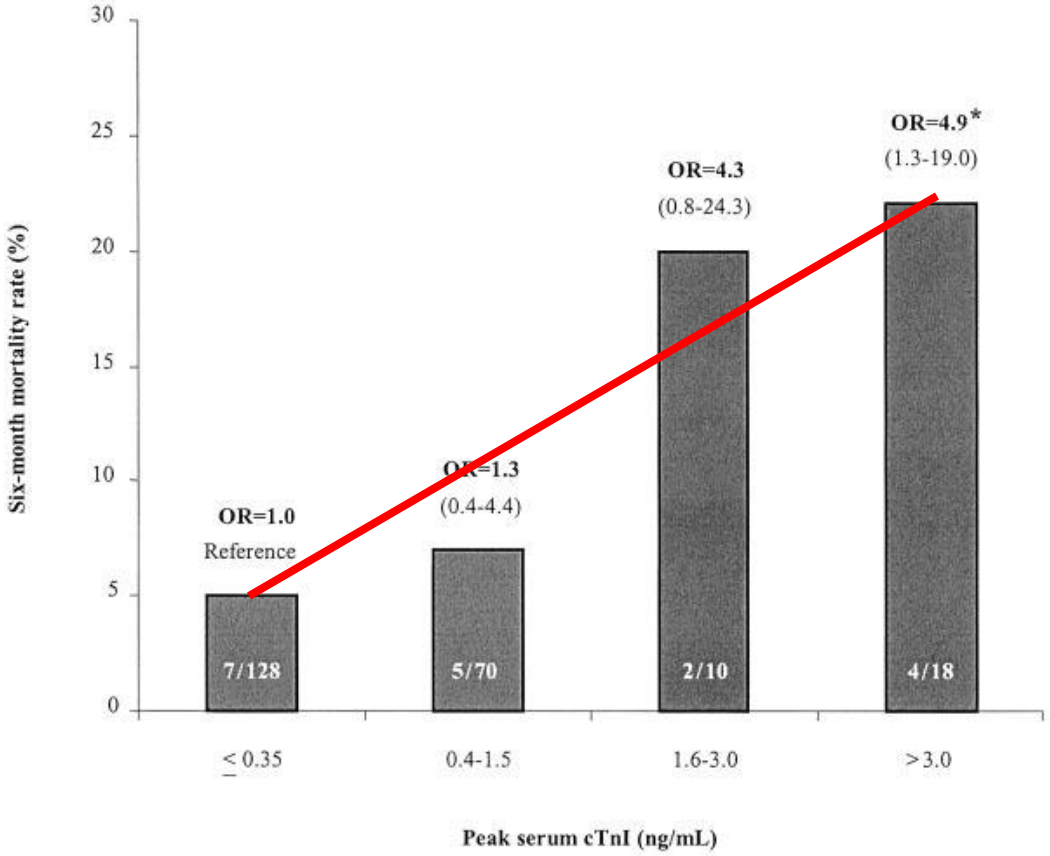


Figure 1. Dose-response relation between peak serum cTnI and 6-month mortality. Peak cTnI concentrations are categorized into 4 groups and presented with 6-month mortality rates. Numbers inside bars indicate number of deaths divided by total number of patients in each group. Odds ratios and 95% confidence intervals for mortality are shown above bars. The ≤0.35 ng/mL group is the reference category to which other groups with increasing cTnI levels are compared. *$P<0.05$.

Does MI Matter?

- Suppose I said that perioperative MI does not matter after:
  - AAA repair
  - Aortofemoral bypass
  - Femoral-popliteal bypass
  - Distal bypass

Myocardial Infarction Following Vascular Surgery: Why We Should Take It Seriously

Conclusion

- MI will be an important primary outcome going forward.
- MI is an important outcome measure in all other vascular procedures.
- MI is associated with increased mortality.
- We should look for ways to reduce it.

Myocardial Infarction Following Vascular Surgery: Why We Should Take It Seriously

Perioperative myocardial infarction occurring with vascular intervention or vascular surgery:

- Is associated with substantially increased mortality in comparison to patients who did not experience a myocardial infarction.

- Typically occurs in first 48 hours but not necessarily on the table.
- It is sometimes best to treat medically and will at times require intervention.
- Causes more morbidity for the patient correlating with the rise of cardiac enzymes.