Perioperative Medicine Summit

Evidence Based Perioperative Medical Care

Perioperative MI Surveillance

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Disclosures

- None relevant to this presentation

POSTOP TROPONIN: QUESTIONS

- Should routine postop monitoring of troponin levels in at-risk patients be performed?
  - Who is at risk? Which patients? Which procedures?
- What will we do with the results?
- Will any management changes based on postop troponins improve outcome?

ARS Question 1

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65 y/o man with h/o DM, HTN, HLD is s/p THR. In PACU his BP is 100/60, P100, R 18 but he is asymptomatic.

- **Would you order a troponin level?**

A. YES

B. NO

ARS Question 2

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65 y/o man with h/o DM, HTN, HLD is s/p fem-pop bypass. In PACU his BP is 160/95, P100, R 18 and he is asymptomatic.

- **Would you order a troponin level?**

A. YES

B. NO

ELEVATED TROPONIN IS ASSOCIATED WITH INCREASED MORTALITY

Author (yr)	# pts	Troponin	% abnormal	Outcome
Devereaux POISE (2011)	8,351	T (CPK)	13.3%	5% with Dx of MI 8.3% elevated w/o MI
Beattie (2012)	51,701	I	11% >0.7ug/L Postop	LR 3.0 for 30 day mortality; gradient "dose response" relationship
Devereaux-VISION (2012)	15,133	T 4th gen	12% >0.01ng/ml 8% >0.03ng/ml Postop	Peak trop assoc with 30 day mortality; the higher the value,the higher the mortality and shorter time to death;added prognostic value
Levy (2011) Systematic review	3,318	I and T	8-52% Postop	OR 3.4 – independent predictor of mortality
VanWaes-CHASE (2013)	2,232	I	19% >0.07ug/L Postop	Trop level correlated with incr risk of 30-day mortality; gradient response
Sandhu (2013) Systematic review – elderly hip Fx pts	979	I and T	22-39% Postop	Higher troponin level correlated with increased mortality
Weber (2013)	979	hsTnT 5th gen	24%>14ng/L Preop	Trop level was the strongest predictor for comb of mortality, MI, card arrest, CHF
Naegle (2013)	608	hsTnT 5th gen	41% >14ng/L Preop	Trop was associated with incr MI and long-term mortality
Kavsak (2011) Subset of VISION	325	hsTnT 5th gen	21% >14ng/L Preop 45% >14ng/LPostop	More pts had elevated 5th generation hsTnT vs 4th generation troponin T

CAUSES OF ELEVATED TROPONIN LEVELS OTHER THAN ACUTE CORONARY SYNDROMES

Cardiac causes	Noncardiac causes
Arrhythmias – tachy, brady	**Pulmonary embolism**
Aortic dissection	Pulmonary hypertension
Aortic valve disease	**Sepsis**/critical illness/ARF
Apical ballooning syndrome	Renal failure/CKD
Cardiac contusion/trauma	**Stroke**/SAH/head trauma
Cardiac surgery	Extensive burns
Cardioversion/ablation/PCI/Bx	Extreme exertion
Cardiotoxic drugs	Rhabdomyolysis
Hypertension/hypotension	Infiltrative diseases – amyloidosis, sarcoidosis
Heart failure – acute, chronic	
Hypertrophic cardiomyopathy/LVH	
Vasculitis, myocarditis, endocarditis, pericarditis	

DEFINITION OF PERIOPERATIVE MI (POISE)

Elevated cardiac biomarkers or enzymes

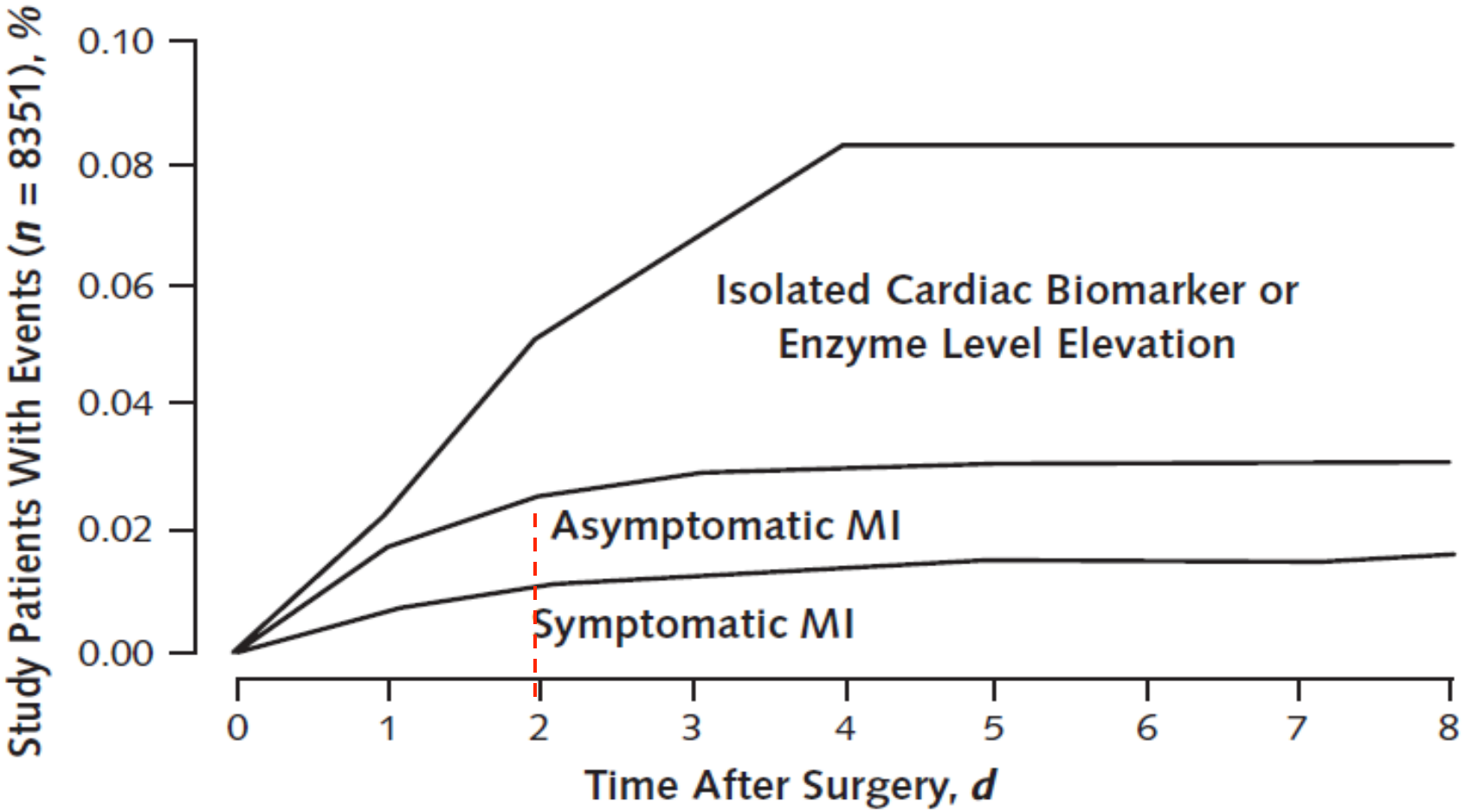
AND 1 or more of the following:

- Ischemic symptoms (only 35% in POISE)
- New pathologic Q waves
- Ischemic changes on EKG
- PCI or CABG
- MI by cardiac imaging
- MI by autopsy findings

If only troponin elevation, new diagnosis "MINS" – myocardial injury after noncardiac surgery.

Devereaux et al. Ann Intern Med 2011

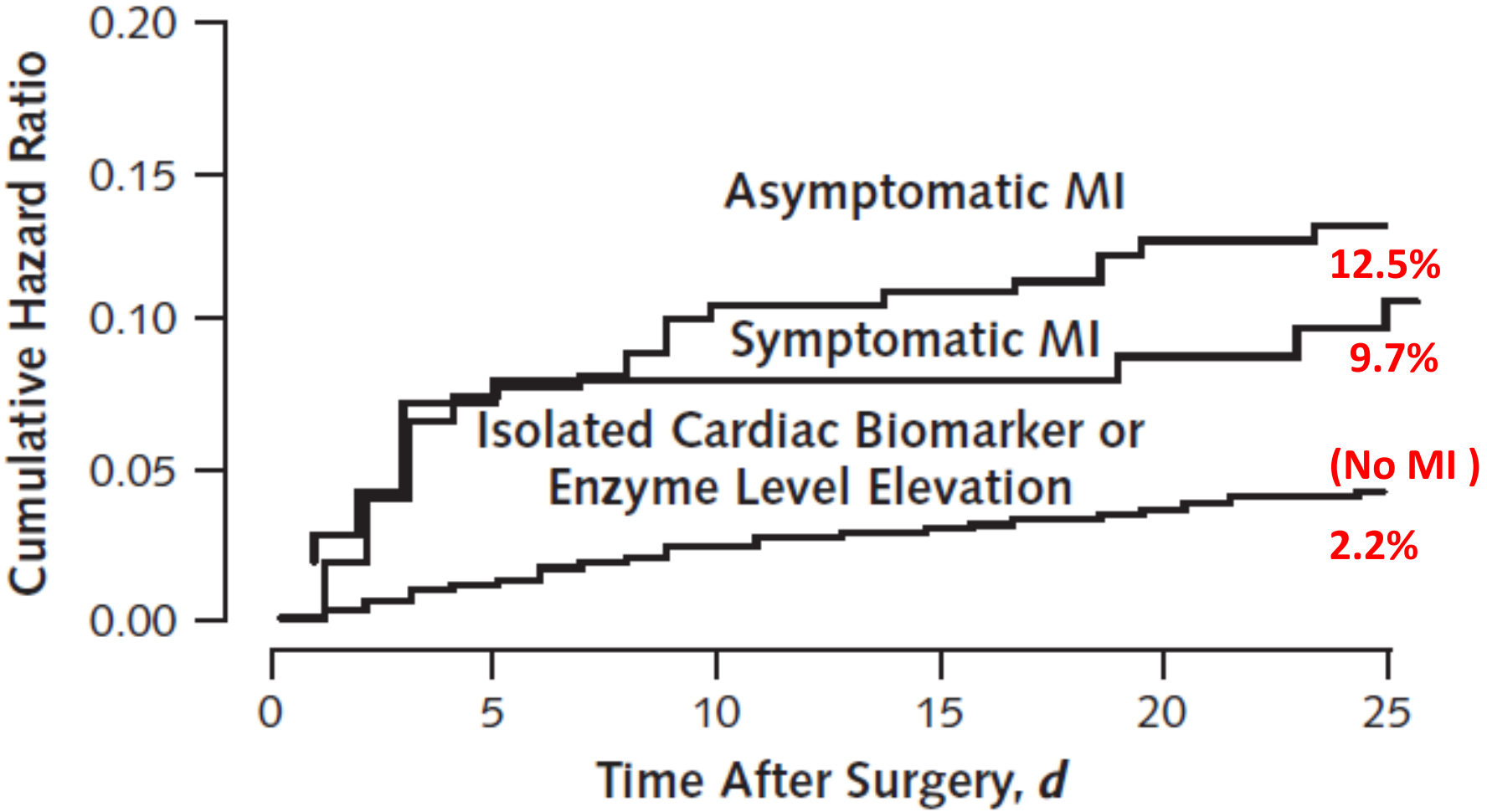
TIMING OF PERIOPERATIVE MI:
MOST OCCURRED WITHIN 48 HOURS OF SURGERY



Devereaux et al. Ann Intern Med 2011

MORTALITY FOR POSTOP MI

SIMILAR WITH OR WITHOUT SYMPTOMS

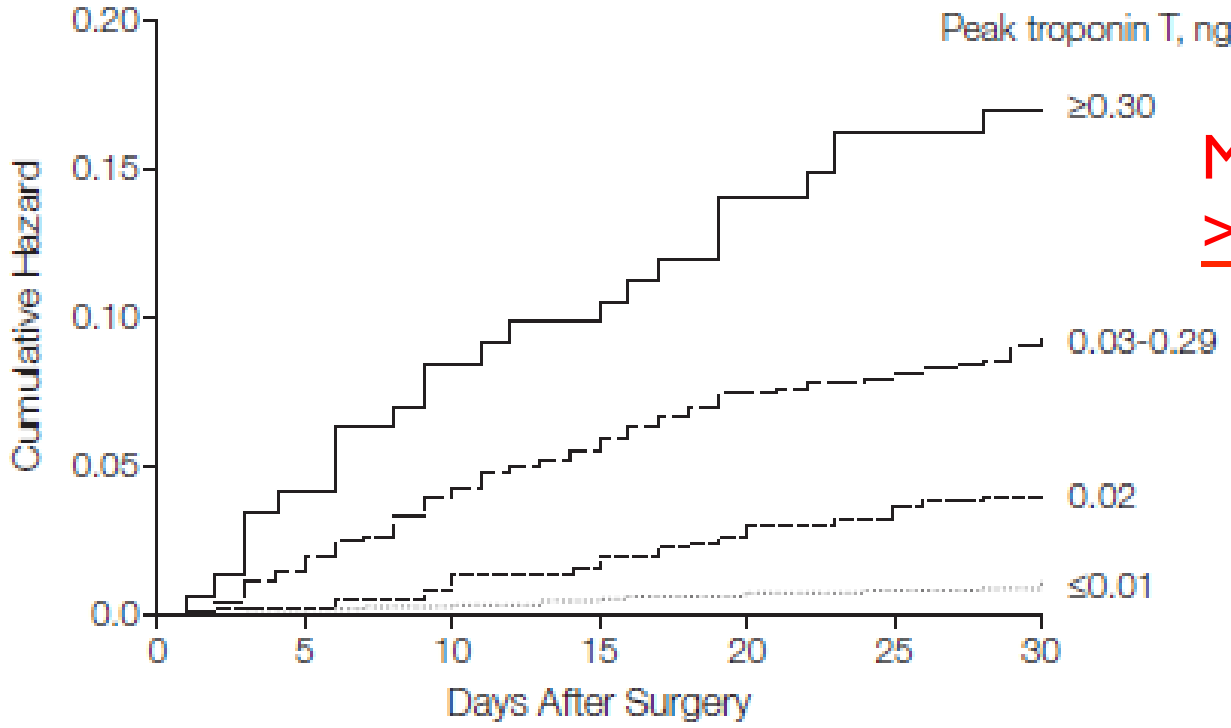


Devereaux et al. Ann Intern Med 2011

VISION

INCREASING TROPONIN PREDICTED MORTALITY

Figure 2. Kaplan-Meier Estimates of 30-Day Mortality Based on Peak Troponin T Values



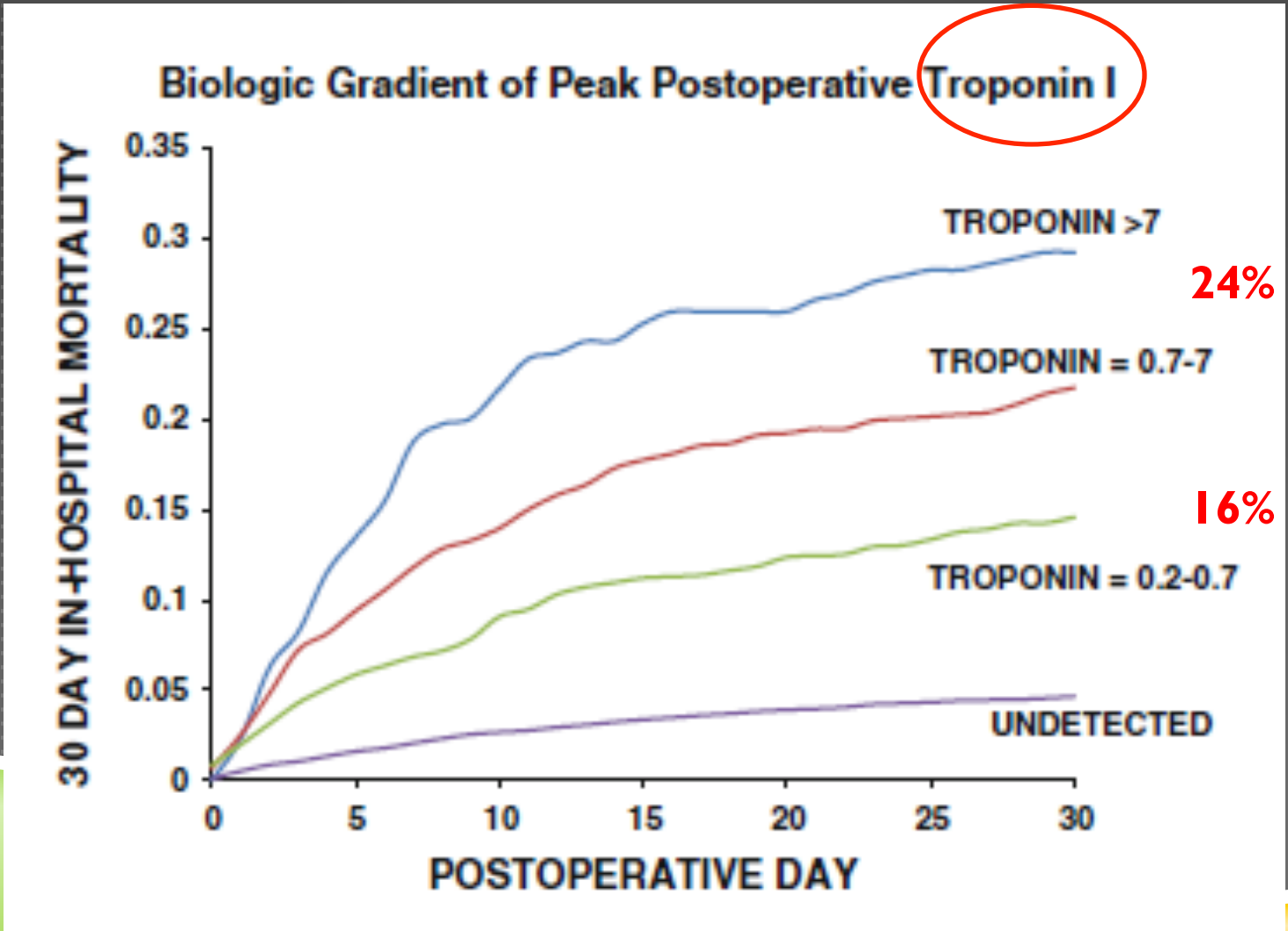
MINS ≥0.03

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

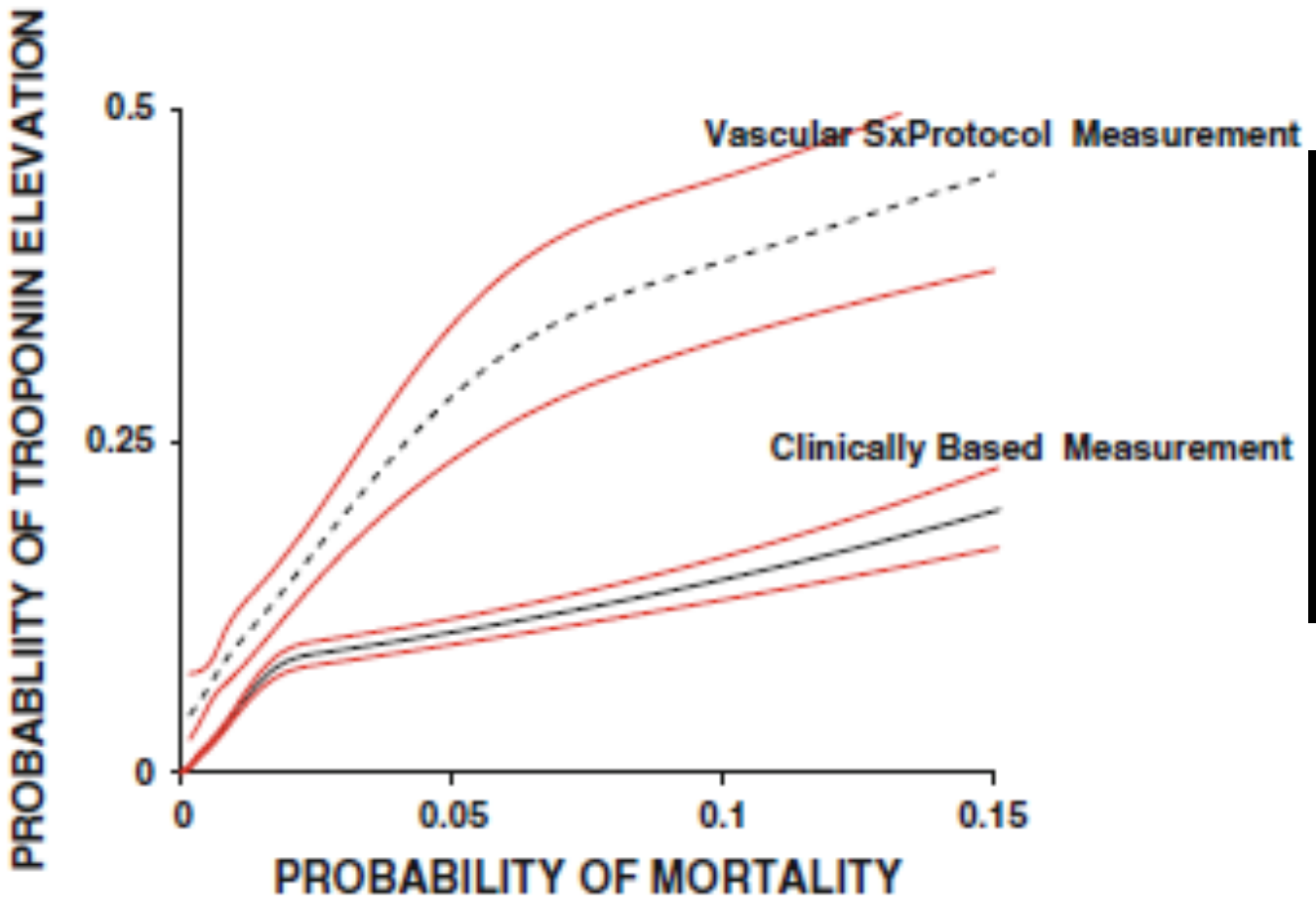
JAMA. 2012;307(21):2295-2304

INCREASING TROPONIN I PREDICTED MORTALITY



Beattie et al. Can J Anesth 2012

UNIVERSAL VS INTERMITTENT TROPONIN



Routine measurement of troponin in vasc surgery pts increased chance of detecting myocardial injury from 12 to 31%

Beattie et al. Can J Anesth 2012

TROPONIN ELEVATION INCREASES PROBABILITY OF MORTALITY EXCEPT IN LOW RISK PATIENTS

Table 3 Pre-test and post-test probability (troponin elevation increases probability of mortality)

	Risk Class 1 (<0.2%) $n = 13,976$	Risk Class 2 (0.2-0.6%) $n = 15,172$	Risk Class 3 (0.6-1.25%) $n = 8,266$	Risk Class 4 (1.25-3.75%) $n = 7,640$	Risk Class 5 (>3.75%) $n = 6,647$
Troponin measured, *n* (%)	948 (6.8%)	1,764 (11.6%)	1,656 (20%)	2,599 (34%)	3,414 (36.2%)
Troponin elevations, % (SD) (as percent of # measured)	71 (7.5)	215 (12.2)	244 (14.7)	569 (21.8)	1,236 (18.6)
All-cause Mortality, *n* (%)	3 (0.021%)	34 (0.22%)	54 (0.7%)	189 (2.5%)	794 (11.9%)
Cardiac Mortality*, *n* (%) (as a percent of ACM)	1 (33%)	12 (34%)	11 (20.4%)	80 (42.3%)	353 (59.9%)
Cardiac Rescue Rate**	99%	94.4%	94.4%	86%	71.5%
Likelihood Ratio* (95% CI)	6.7 (1.66 to 27.5)	5.4 (3.76 to 7.84)	3.01 (1.97 to 4.60)	2.83 (2.40 to 3.34)	1.76 (1.61 to 1.92)
Post-test Probability (of a positive troponin)***	0.14%	1.12%	2.1%	7.1%	20.3%

Beattie et al. Can J Anesth 2012

TROPONIN & TYPE OF SURGERY

Table 4 Effect of troponin measurement by surgical type

	ALL $n = 51,701$	General $n = 9,574$	ENT $n = 5,031$	Gyn $n = 3,378$	Plastics $n = 2,545$	Neuro $n = 6,467$	Ortho $n = 8,839$	Spinal $n = 3,518$	Thoracic $n = 4,159$	Urology $n = 5,775$	Vascular $n = 2,420$
Troponin ordered	10,534 (20.4)	2,220 (23.1)	503 (10)	363 (10.7)	145 (5.7)	1,537 (23.7)	1,449 (16.4)	767 (21.8)	676 (19.1)	551 (9.5)	2,158 (89.1)
Charlson (2 or more)	9,903 (19.2)	2,255 (23.6)	1,132 (22.5)	1,032 (30.5)	140 (5.5)	1,272 (19.7)	687 (7.8)	407 (11.5)	1,145 (27.5)	764 (13.2)	1,069 (44.2)
Myocardial Infarcts	2,055 (4.0)	451 (4.7)	83 (1.6)	55 (1,6)	24 (0.9)	320 (4.9)	291 (3.7)	92 (2.9)	237 (5.7)	70 (1.2)	229 (13.9)
Mortality (cardiac)	427 (0.8)	130 (1.4)	19 (0.4)	8 (0.3)	4 (0.1)	95 (1.5)	47 (0.6)	11 (0.3)	36 (0.9)	6 (0.1)	52 (2.4)
Mortality (all cause)	1,074 (2.1)	282 (2.9)	45 (0.8)	27 (0.8)	10 (0.4)	246 (3.8)	102 (1.2)	30 (0.8)	109 (2.6)	14 (0.2)	128 (5.2)
Likelihood ratio * (95% CI)	3.0 (2.8 to 3.2)	3.4 (2,9 to 4.0)	4.4 (3.0 to 6.3)	3.7 (2.1 to 6.5)	2.7 (1.1 to 6.4)	2.2 (1.8 to 2.7)	2.63 (2.1 to 3.3)	3.3 (2.0 to 5.6)	1.9 (1.5 to 2.5)	3.6 (1.9 to 6.8)	3.2 (2.7 to 3.8)

+ troponin was associated with a statistically significant mortality ratio (from 1.9-4.4) for <u>all surgical types</u>

Beattie et al. Can J Anesth 2012

DO WE HAVE TIME TO INTERVENE?

	Peak Troponin T value (ng/ml)	30-day mortality	Median time to death (days)
VISION	≤0.01	1.0%	
	0.02	4.0%	13.5
	0.03-0.29	9.3%	9
MINS		9.8%	
	>0.30	11.6%	6.5
POISE	MI (sympt or asympt)	9.7-12.5%	2
	Elevated biomarker	2.2%	8

JAMA. 2012;307(21):2295-2304

IMPLICATIONS FOR PRACTICE

IF:

- 2/3 of periop MIs are asymptomatic (no ischemic Sx) & mortality is similar with or without ischemic Sx
- Most MIs occur within first 48 hours of surgery
- Most deaths within several days of MI

MAYBE we should:

- Recommend routine troponins after major surgery to identify and Rx asymptomatic MIs or "MINS"

IMPLICATIONS FOR PRACTICE

BUT, we don't know:

- which patients or surgeries are most likely to have abnormalities
  - CAD/CVA/PAD, >65 y/o, "major surgery"?
- what to do with the results
  - Meds, monitoring, etc ???
- whether these changes/interventions will improve outcome
  - ASA/statin may have helped in POISE

STRATEGIES FOR MANAGING PTS WITH INCREASED POSTOP TROPONIN OR MI

- More frequent monitoring of vital signs
- Observation in a monitored setting (tele, CCU, ICU)
- Screening and correction of potential contributing factors (hypoxia, anemia, tachycardia, hypertension/hypotension)
- Optimal intravascular volume management
- Cardiac medications (ASA, BB, statin, ACEI, anticoagulant)
- Cardiac cath & possible revascularization

Bottom line: Will these interventions improve outcome???

WE DON'T KNOW!

TROPONIN ELEVATION ≠ MI

- Non-specific test of illness
- Stronger association with all-cause mortality than MI
- The fact that postop troponin elevation is common, is associated with an increased risk of death, and that clinical symptoms will not identify these patients is NOT enough.
- If we are to screen asymptomatic patients, we need:
  - Risk score (pretest probability) for pts and procedures
  - Threshold for intervention
  - Prospective studies that the intervention works

BEFORE ORDERING A TEST

- Will it change the care of my patient?
  - If asymptomatic w/o EKG changes, troponin is non-specific and provides no direction of care; need to treat patients individually
- What are the probability and potential adverse consequences of a false-positive result?
  - Concern that management for plaque rupture (Type 1 MI) events (antiplatelet therapy, anticoagulation, cardiac catheterization) would be given to patients with hemodynamic (type 2 MI) events
  - Unlikely to benefit and may cause harm (bleeding)
- Is the patient in potential danger short-term if I don't do the test?
  - Emergency ortho study with CV care for troponin + pts: no change in in-hosp CV outcomes or 1-year mortality, but only 1 in 6 received cardiac meds

Perioperative Surveillance

Surveillance and Management for Perioperative MI

Recommendations	COR	LOE
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
	IIb	B

Perioperative Surveillance

Surveillance and Management for Perioperative MI (cont'd)

Recommendations	COR	LOE
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

Perioperative Surveillance

Surveillance and Management for Perioperative MI (cont'd)

Recommendations	Class[a]	Level[b]
The measurement of natriuretic peptides and high-sensitivity troponin after surgery may be considered in high-risk patients to improve risk stratification.	IIb	B

European Heart Journal
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ESC/ESA GUIDELINES

CONCLUSION

- Until a specific strategy or demonstrated beneficial treatment is identified, the possibility of doing harm by applying an incorrect treatment and the potential for diverting attention from a true cause of an adverse event make routine troponin measurement more likely to cause harm than to provide benefit, and it should not be used as a screening modality at this time.

Beckman, Circulation, 2013

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