Update in Perioperative Medicine

Steven L. Cohn, MD, FACP, SFHM

Gerald W. Smetana, MD, FACP

Suparna Dutta, MD

Update in Perioperative Medicine

- Literature searches Jan-Dec 2015
- Consensus decision on relevant articles impacting practice
- 3 areas – cardiac, pulmonary, everything else
- "Show and tell", "just the facts" presentation
- No questions

- Cardiac section:
  - Risk indices
  - Medical Rx (BB, statin, ARB)
  - Revascularization

Disclosures

- None relevant to this presentation

The effect of adding functional classification to ASA status for predicting 30-day mortality.

- Retrospective observational cohort VA SQIP - 12,324 pts

- ASA class + A (functional independent) or B (dependent)

- Odds ratios for mortality in group A favored survival over group B in each ASA class (.14,.29,.50 - II,III,IV)

- **Functional capacity was an independent predictor of mortality within each ASA class** & should be considered for incorporation into the routine preop evaluation.
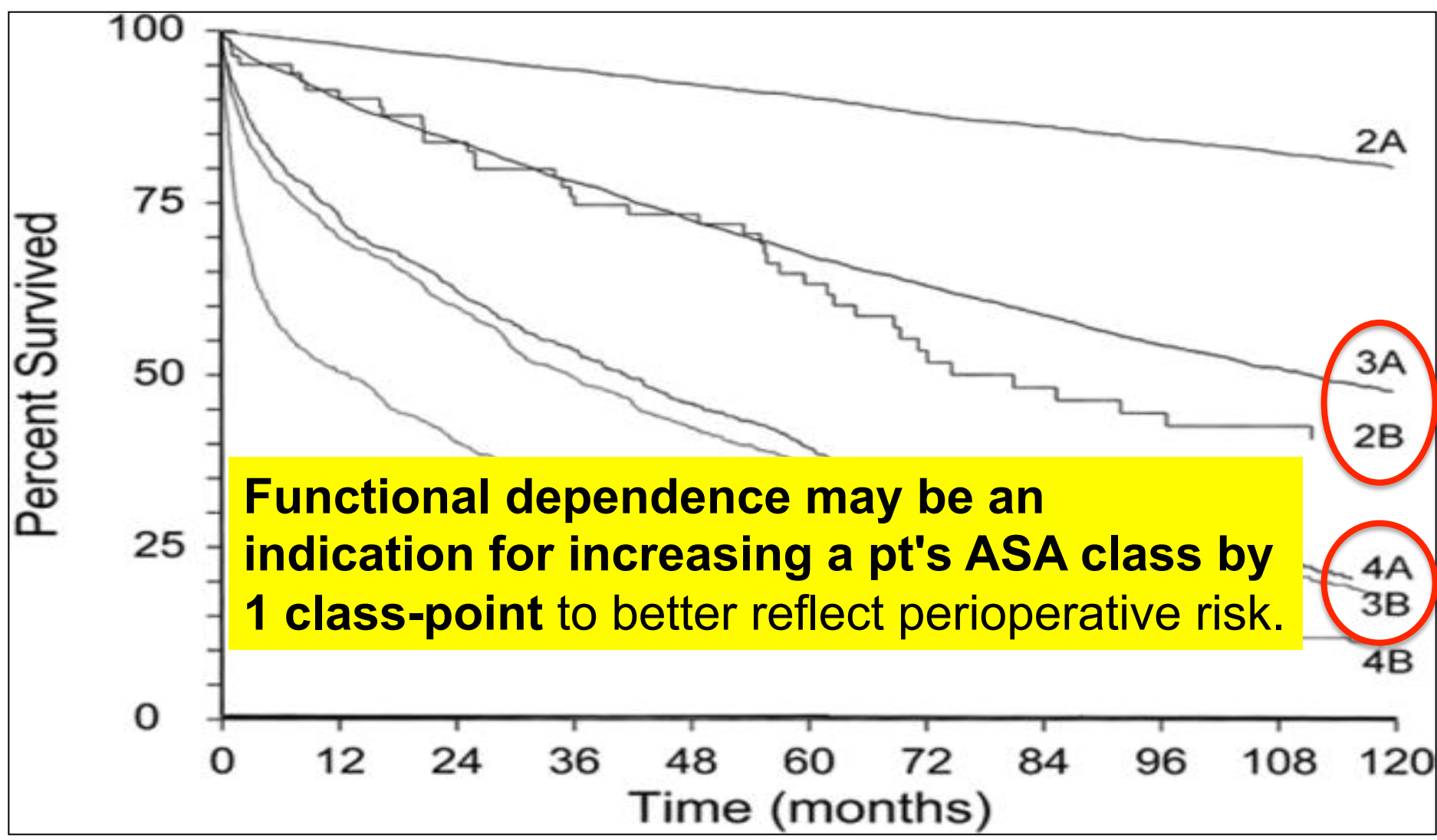
The effect of adding **functional classification** to ASA status for predicting 30-day mortality.

Visnjevac O et al. Anesth Analg. 2015 Jul;121(1):110-6. PMID: 26086512

Functional dependence may be an indication for increasing a pt's ASA class by 1 class-point to better reflect perioperative risk.

- Retrospective observational study – Denmark
- 275/447,352 (.5%) event rate
  - Different end point (MI, CVA, card death) and inclusion criteria - age (>25)
- **Comparable outcomes in each class**
- **Increased event rates with increasing age within each class**
  - 80% were Class I; negative predictive value >98%
  - 6.8% MACE if >85 yrs and RCRI>1
- **Validated RCRI**

Age-specific performance of the revised cardiac risk index for predicting cardiovascular risk in elective noncardiac surgery.

Table 2. Comparison of Danish Data With the Original RCRI Data

| | Danish Cohort | Reported in Original Article | |
| | | Derivation Cohort | Validation Cohort |
	n=447 352	n=2893	n=1422
Age, mean (SD)	55 (16)	66 (10)	66 (9)
Male sex, %	43	47	51
Crude events			
RCRI class			
I	742/357 396 (0.2%)	5/1071 (0.5%)	2/488 (0.4%)
II	755/74 889 (1.0%)	14/1106 (1.3%)	5/567 (0.9%)
III	521/11 921 (4%)	18/506 (4%)	17/258 (7%)
IV	257/3146 (8%)	19/210 (9%)	12/109 (11%)
C statistic	0.761	0.759	0.806

Event rates were comparable to the original RCRI cohorts.

Table 3. Observed Major Adverse Cardiovascular Events Rates in Different Age Groups

RCRI Class	Age Groups, y				
	≤55	56–65	66–75	76–85	>85
n total	214 776	96 793	81 936	43 491	10 356
I	70/184 890 (0.04%)	95/76 585 (0.12%)	191/60 314 (0.32%)	261/29 108 (0.90%)	125/6499 (1.92%)
II	55/27 886 (0.20%)	122/16 878 (0.72%)	209/16 954 (1.23%)	230/10 465 (2.20%)	139/2706 (5.14%)
III	34/1674 (2.03%)	77/2706 (2.85%)	145/3653 (3.97%)	178/3008 (5.92%)	87/880 (9.89%)
IV	10/326 (3.07%)	29/624 (8.98%)	80/1015 (7.88%)	100/910 (10.99%)	38/271 (9.77%)
C statistic	0.739 (0.700–0.778)	0.772 (0.745–0.779)	0.746 (0.726–0.766)	0.701 (0.681–0.720)	0.683 (0.657–0.710)

C statistic with 95% confidence intervals refers to logistic regression modeling with RCRI class as continuous variable. RCRI indicates revised cardiac risk index.

MACE increased with age in each RCRI class.

Effect of preoperative angina pectoris on cardiac outcomes in patients with previous myocardial infarction undergoing major noncardiac surgery (data from ACS-NSQIP).

- Retrospective ACS-NSQIP database study

- 1658 pts with MI <6 mos before NCS

- Subgroups – with or without angina

- Primary outcome (MI/cardiac arrest) 5.8%

- MICA higher in pts with angina (8.4% vs 5%;p=0.035)
  - Higher re-intervention rates and LOS

- **Angina is an independent predictor for postop MI** (OR 2.49 [1.20-5.58]

- Caution against over-reliance of RCRI in pts with IHD (c-statistic only 0.59)

Effect of preoperative angina pectoris on cardiac outcomes in patients with previous myocardial infarction undergoing major noncardiac surgery (data from ACS-NSQIP).
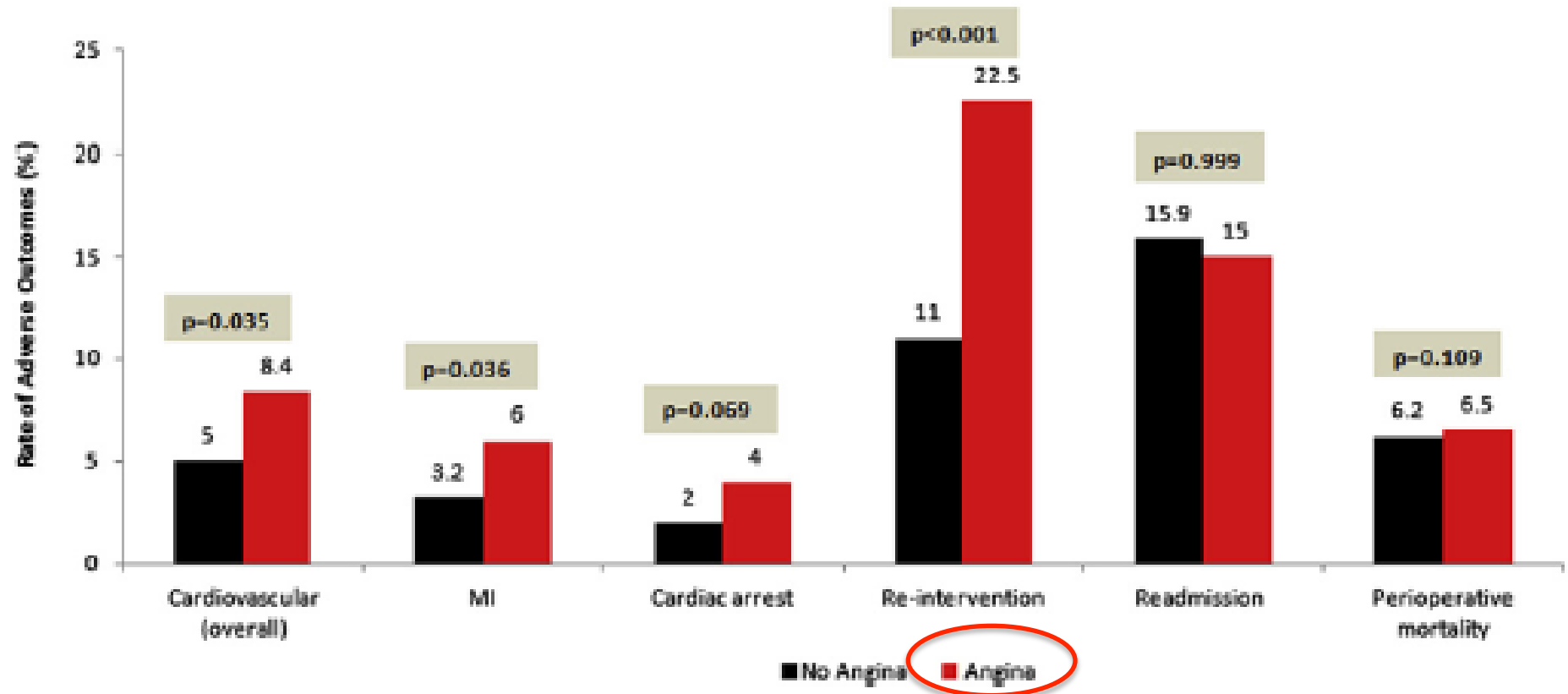
Pandey A et al. Am J Cardiol. 2015 115(8):1080-4. PMID: 25708862

Bar Plot: Rates of 30-Day Adverse Outcomes

MI + angina increased risk of postop MI

Proposed research plan for the derivation of a new Cardiac Risk Index.

- Need new "best standard" CV risk prediction model
- Use RCRI clinical risk factors with the following modifications:
  - GFR instead of serum creatinine
  - Age
  - Functional capacity
  - Hx of PVD
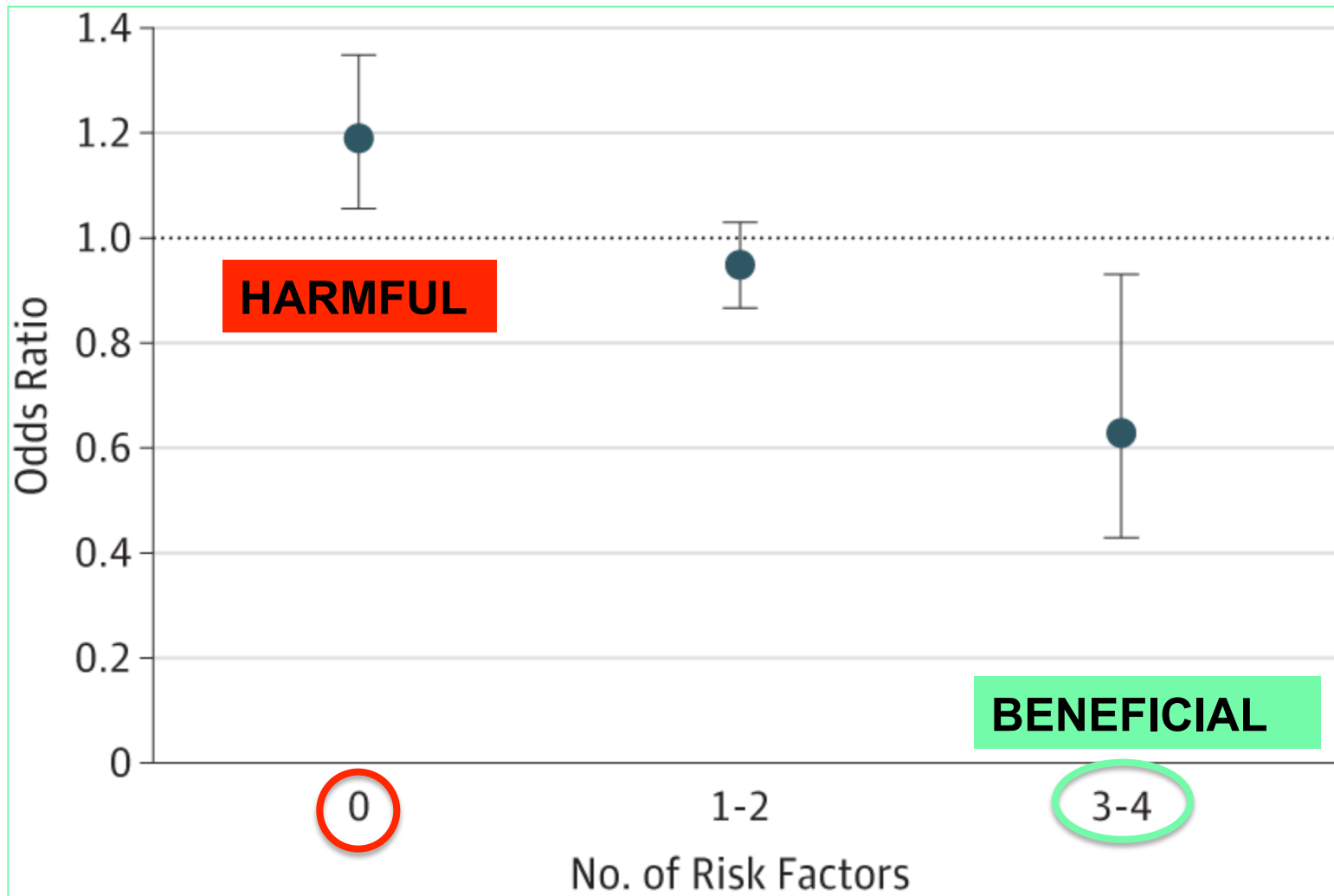 - Specific surgical procedural category

β-Blockade and Operative Mortality in Noncardiac Surgery: Harmful or Helpful?.

- Retrospective observational study – VA – 326,489 pts
  - 314,114 NCS; 12,375 cardiac surgery
- 4-point cardiac risk score
  - CAD, DM, renal failure, surgery in a major body cavity
- For NCS, BB was associated with **Odds Ratio for mortality** that was:
  - **<u>Lower in pts with 3-4 risk factors</u>** (0.63; CI 0.43-0.93)
  - **No different with 1-2 risk factors**
  - **Higher with no risk factors** (1.19; CI 1.06-1.35)

β-Blockade and Operative Mortality in Noncardiac Surgery: Harmful or Helpful?.
Friedell ML et al. JAMA Surg. 2015 150(7):658-63 PMID: 26017188

β-Blocker-Associated Risks in Patients With Uncomplicated Hypertension Undergoing Noncardiac Surgery.

- Retrospective association study – Denmark
- 55,320 pts with **uncomplicated HTN on 2-3 drugs** - NCS
  - **Excluded** IHD, HF, AF, CVA, PVD and others
- Outcomes: 30-day MACE, all-cause mortality
- 14,644 pts on beta-blockers; 40,676 on other BP meds
- **30-day MACE and mortality were higher with BB** (p<.001):
  - 1.32% vs 0.84% MACE (CV death-not nonfatal CVA or MI)
  - 1.93% vs 1.32% Mortality
  - No difference between atenolol and metoprolol regimens
 - No difference in 3-drug regimens

β-Blocker-Associated Risks in Patients With Uncomplicated Hypertension Undergoing Noncardiac Surgery.

Jorgensen ME et al. JAMA Intern Med. 2015 175(12):1923-31. PMID: 26436291

Figure 2. Main Model, Risks of Major Adverse Cardiovascular Events (MACEs) and Mortality by Antihypertensive Drug Regimen

A 30-day MACEs

Subgroups	OR (95% CI)	Events/ Sample Size
RAS inhibitors + thiazides	1 [Reference]	161/20745
β-blocker + RAS inhibitors	2.16 (1.54-3.04)	46/2789
β-blocker + calcium antagonists	2.17 (1.48-3.17)	35/1878
β-blocker + thiazides	1.56 (1.10-2.22)	41/3427
β-blocker + 2 others	1.22 (0.90-1.64)	71/6550
RAS inhibitors + calcium antagonists	1.12 (0.82-1.54)	55/6055
RAS inhibitors, thiazides, and calcium antagonists	0.97 (0.73-1.29)	77/9248
Calcium antagonists + thiazides	1.02 (0.73-1.44)	49/4628
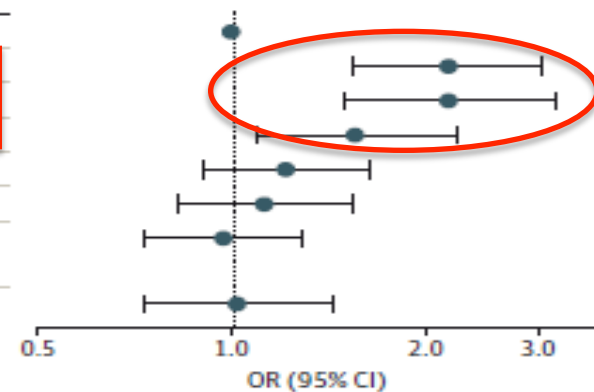
B 30-day all-cause mortality

Subgroups	OR (95% CI)	Events/ Sample Size
RAS inhibitors + thiazides	1 [Reference]	256/20745
β-blocker + RAS inhibitors	1.79 (1.33-2.42)	58/2789
β-blocker + calcium antagonists	1.68 (1.20-2.35)	44/1878
β-blocker + thiazides	1.65 (1.24-2.18)	73/3427
β-blocker + 2 others	1.31 (1.03-1.67)	107/6550
RAS inhibitors + calcium antagonists	1.15 (0.89-1.48)	93/6055
RAS inhibitors, thiazides, and calcium antagonists	0.82 (0.64-1.05)	95/9248
Calcium antagonists + thiazides	1.24 (0.96-1.60)	94/4628
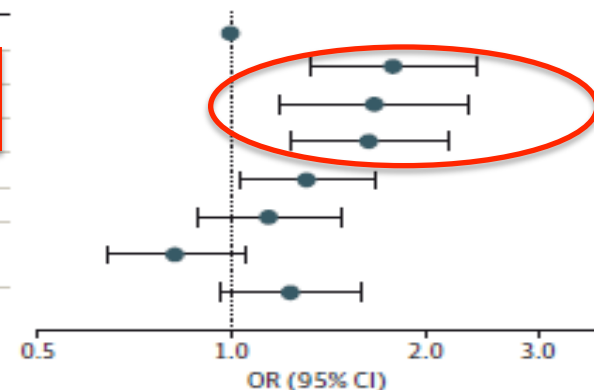
2-drug BB combo associated with increased MACE/mortality.

Meta-analysis of the effects of statins on perioperative outcomes in vascular and endovascular surgery.

Antoniou et GA al. J Vasc Surg. 2015 61(2):519-532. PMID: 25498191

- Meta-analysis: vascular and endovascular surgery
  - 4 RCTs (n=675); 20 observ or case-control (n=22,861)

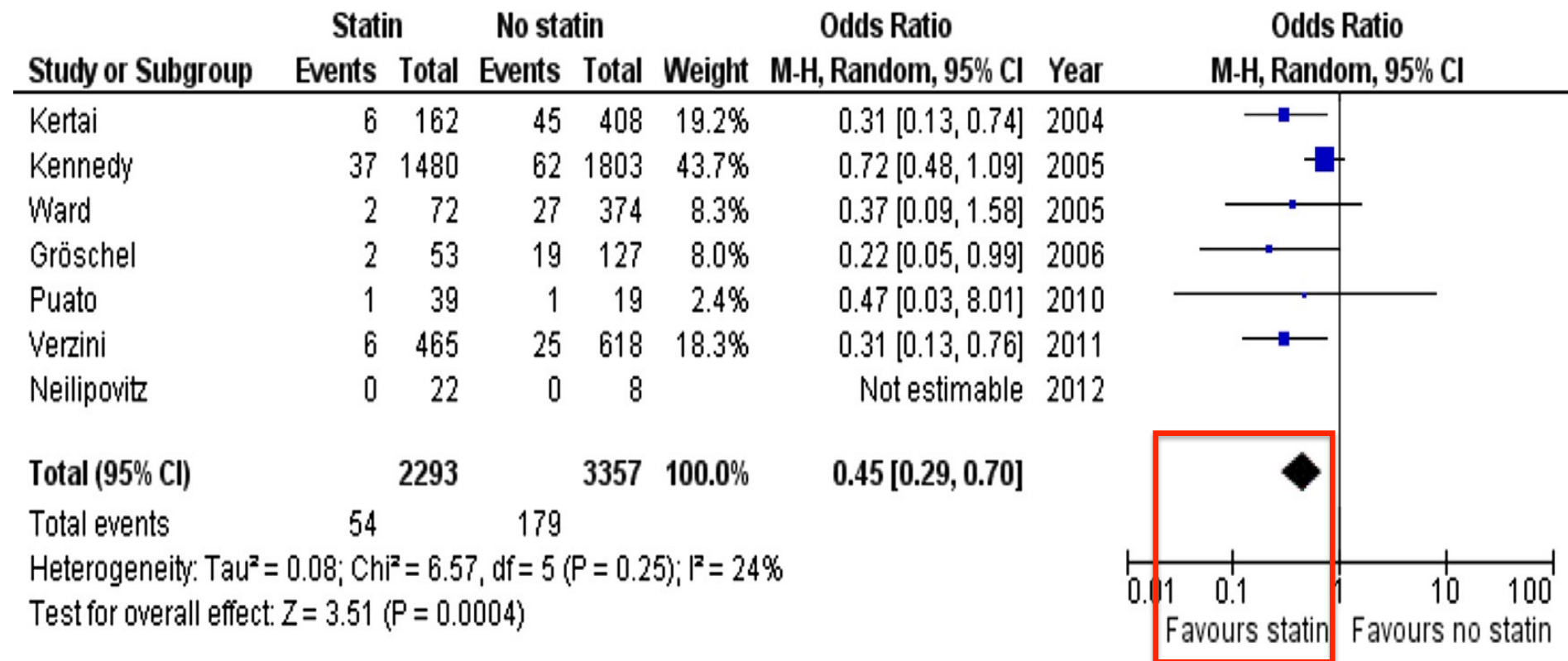|	Odd Ratio (OR)	CI
All-cause mortality	0.54	0.38-0.78
MI	0.62	0.45-087
Stroke	0.51	0.39-0.67
Composite (MI/stroke/death)	0.45	0.29-0.70

- No significant differences for CV mortality or kidney injury

Meta-analysis of the effects of **statins** on perioperative outcomes in vascular and endovascular surgery.
Antoniou et GA al. J Vasc Surg. 2015 61(2):519-532. PMID: 25498191

Composite of death/MI/stroke

Study or Subgroup	Statin Events	Total	No statin Events	Total	Weight	Odds Ratio M-H, Random, 95% CI	Year	Odds Ratio M-H, Random, 95% CI
Kertai	6	162	45	408	19.2%	0.31 [0.13, 0.74]	2004	
Kennedy	37	1480	62	1803	43.7%	0.72 [0.48, 1.09]	2005	
Ward	2	72	27	374	8.3%	0.37 [0.09, 1.58]	2005	
Gröschel	2	53	19	127	8.0%	0.22 [0.05, 0.99]	2006	
Puato	1	39	1	19	2.4%	0.47 [0.03, 8.01]	2010	
Verzini	6	465	25	618	18.3%	0.31 [0.13, 0.76]	2011	
Neilipovitz	0	22	0	8		Not estimable	2012	
Total (95% CI)		2293		3357	100.0%	**0.45 [0.29, 0.70]**		
Total events	54		179					

Heterogeneity: Tau² = 0.08; Chi² = 6.57, df = 5 (P = 0.25); I² = 24%
Test for overall effect: Z = 3.51 (P = 0.0004)

0.01   0.1   1   10   100
Favours statin   Favours no statin

Statin use was associated with beneficial outcomes in vascular surgery.

Association between pre-operative statin use and major cardiovascular complications among patients undergoing non-cardiac surgery: the VISION study.
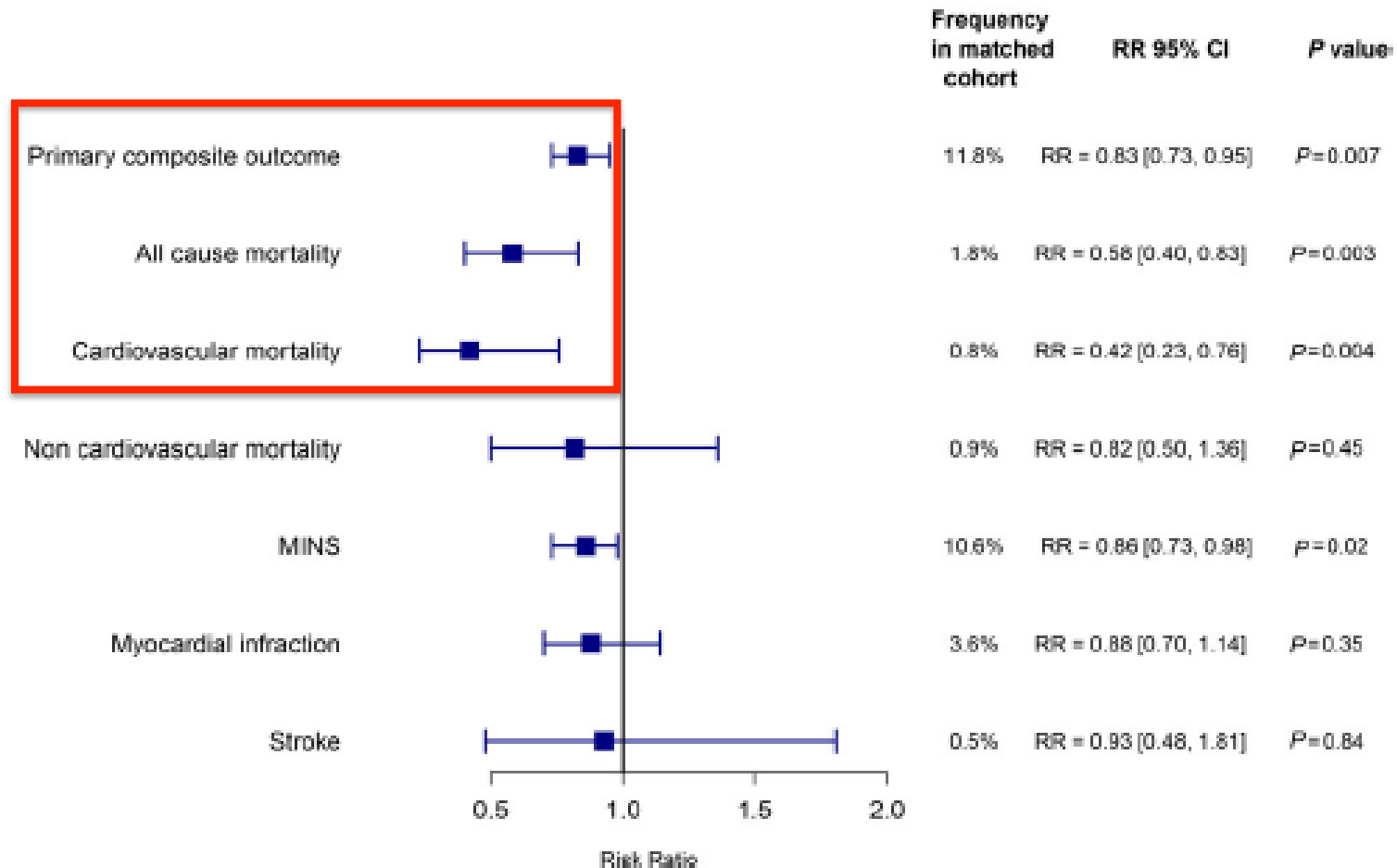
- Intl prospective cohort study – 15,478 pts
  - Matched population: 2845 statin; 4492 control

- Primary outcome: composite - all-cause mortality, MINS, CVA

	Relative risk (RR)	CI
Composite	**0.83**	0.73-0.95
All-cause mortality	**0.58**	0.40-0.83
CV mortality	**0.42**	0.23-0.76
MINS	**0.86**	0.73-0.98

- No difference for MI or stroke

Preop statin use was associated with lower CV outcomes at 30 days.

Association between Withholding Angiotensin Receptor Blockers in the Early Postoperative Period and 30-day Mortality: A Cohort Study of the Veterans Affairs Healthcare System.

- Retrospective cohort study – VA; 30,173 surg admissions
- 10,205 pts did not resume ARB by day 2; 19,968 did resume
- Primary outcome: 30-day mortality

Withheld ARB	HR	CI
Unadj hazard ratio (HR)	2.45	2.08-2.89
Adjusted HR	1.74	1.47-2.06
Propensity-matched subset (19,49)	1.47	1.22-1.78

Withholding ARBs postop is associated with increased 30-day mortality, especially in younger patients.

# Drug-eluting stents versus bare metal stents prior to noncardiac surgery.

- Retrospective observational study – Massachusetts
- Admin claims database: 8415 pts NCS <1yr after PCI
  - 1838 BMS matched with 3565 DES pts
- Primary outcome: 30-day mortality or MI
  - Net clinical outcome: death, MI, or bleeding

Unadjusted DES vs BMS in matched cohort	OR	CI	P value
30-d death or MI (primary)	0.74	0.58-0.94	0.01
Death, MI, bleeding (net)	0.84	0.67-1.04	0.10

Drug-eluting stents versus bare metal stents prior to noncardiac surgery.

Bangalore S et al. Catheter Cardiovasc Interv. 2015 85(4):533-41. PMID25059742
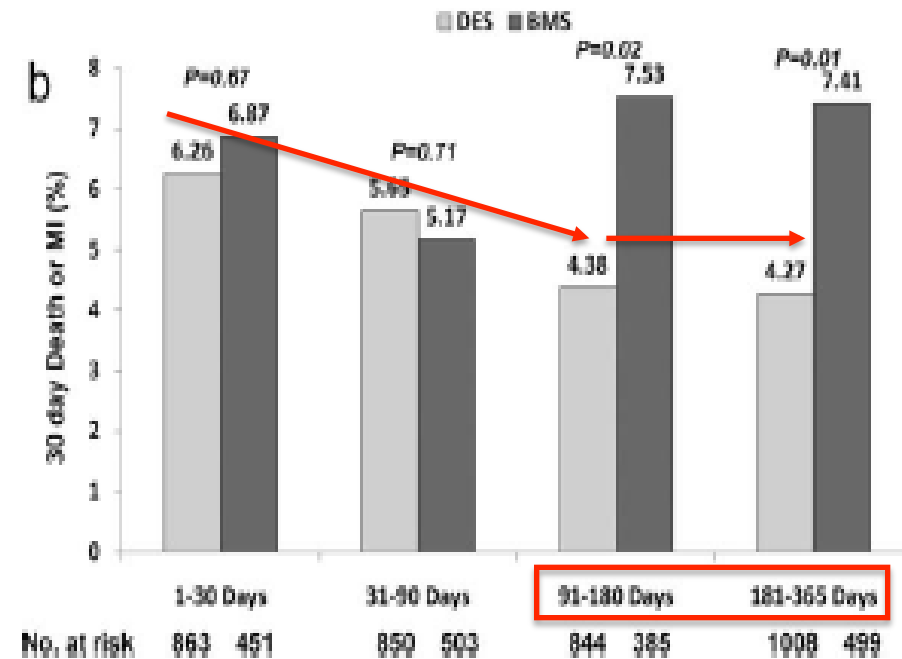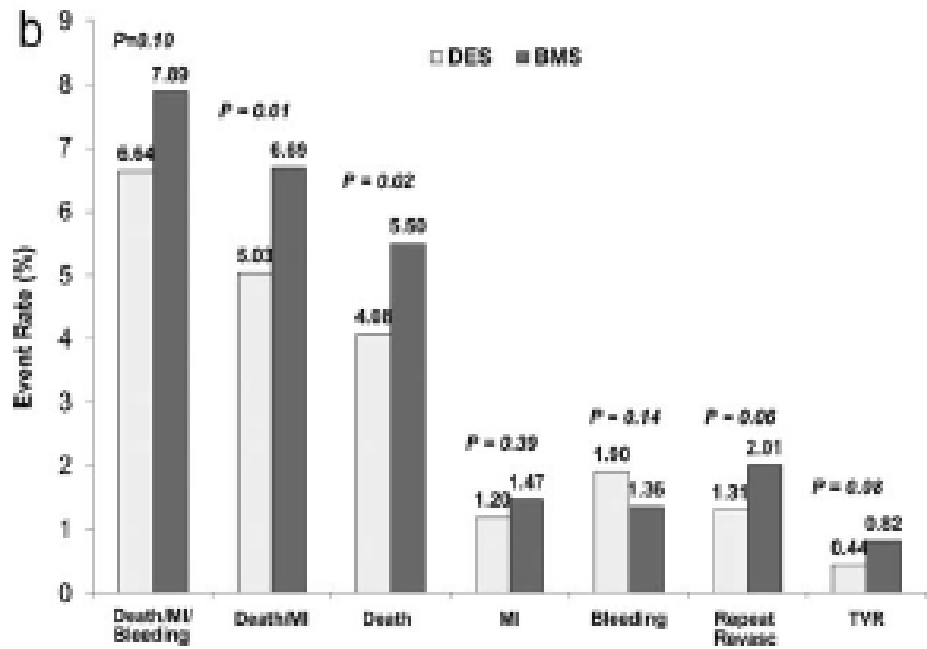
- **DES not associated with higher adverse events.**
- **Lower rate of adverse events with NCS after 90 d after <u>DES</u> implantation.**
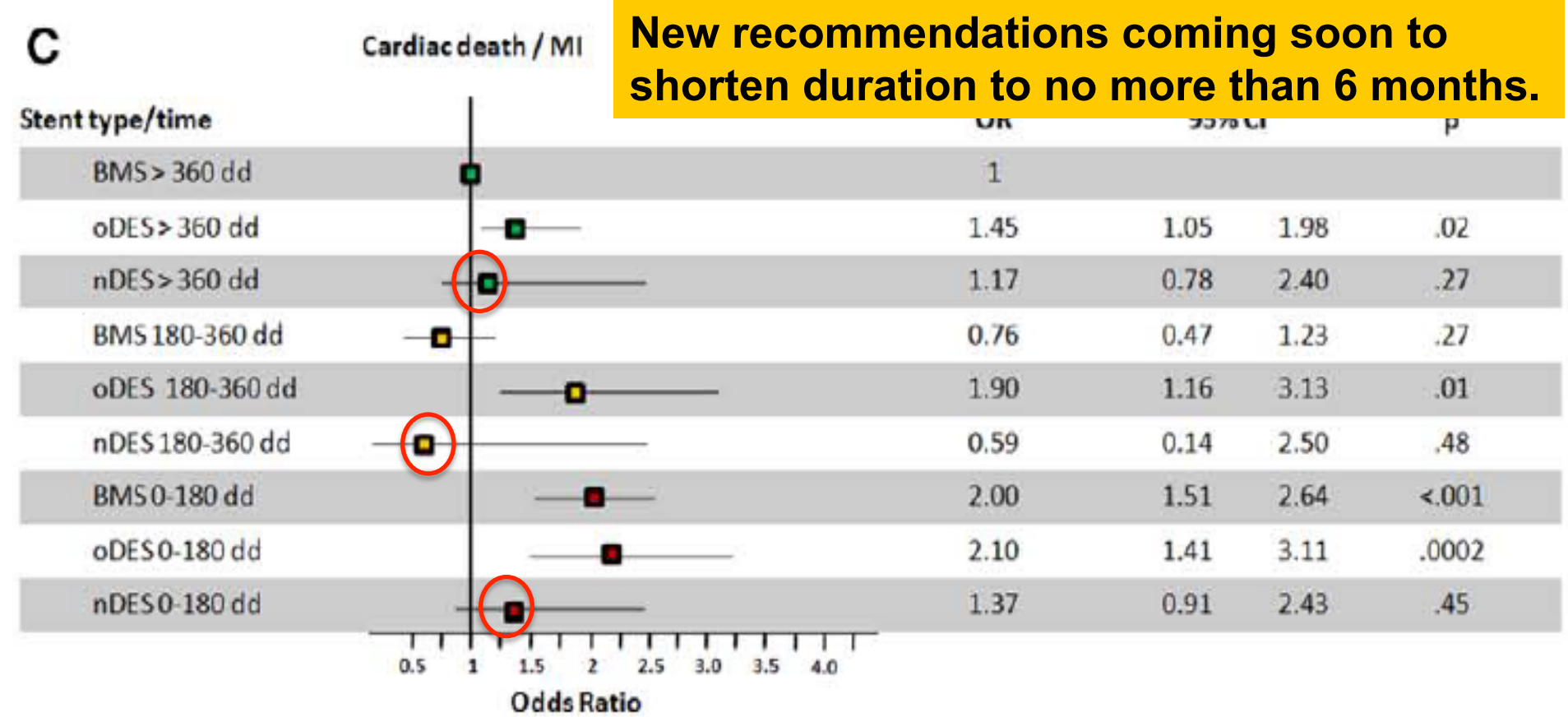
Risk of Adverse Cardiac and Bleeding Events Following Cardiac and Noncardiac Surgery in Pts With Coronary Stents: How Important Is the Interplay Between Stent Type and Time From Stenting to Surgery?

- Retrospective analysis – Italian registry of 39,362 PCI pts
  - 17,226 subsequently had cardiac or noncardiac surgery
- Outcome: 30-day cardiac death (2.5%), MI (1.5%), serious bleeding (6.4%)
  - Having surgery increased risk of cardiac death 1.58x
- Stent type and time from PCI to surgery were associated with risk of death/MI
- Older DES were associated with higher risk than newer DES
- Surgery 6-12 months after PCI had lower risk than 0-6 mos

Risk of Adverse Cardiac and Bleeding Events Following Cardiac and Noncardiac Surgery in Pts With Coronary Stents: How Important Is the Interplay Between Stent Type and Time From Stenting to Surgery?

Saia F et al. Circ Cardiovasc Qual Outcomes. 2015 9(1):39-47. PMID: 26646819

New recommendations coming soon to shorten duration to no more than 6 months.

C — Cardiac death / MI

Stent type/time	OR	95% CI		p
BMS > 360 dd	1			
oDES > 360 dd	1.45	1.05	1.98	.02
nDES > 360 dd	1.17	0.78	2.40	.27
BMS 180-360 dd	0.76	0.47	1.23	.27
oDES 180-360 dd	1.90	1.16	3.13	.01
nDES 180-360 dd	0.59	0.14	2.50	.48
BMS 0-180 dd	2.00	1.51	2.64	<.001
oDES 0-180 dd	2.10	1.41	3.11	.0002
nDES 0-180 dd	1.37	0.91	2.43	.45

Odds Ratio

Ischemic risk is inversely related with time from PCI to surgery and is influenced by stent type.

Cardiac Risk Review Articles

- **Cardiac Risk of Noncardiac Surgery.**

  Patel AY, Eagle KA, Vaishnava P.

  J Am Coll Cardiol. 2015 66(19):2140-8.

  PMID: 26541926

- **Cardiac Complications in Patients Undergoing Major Noncardiac Surgery.**

  Devereaux PJ, Sessler DI.

  N Engl J Med. 2015 373(23):2258-69.

   PMID: 26630144

Steven L. Cohn, MD, FACP, SFHM

Medical Director – UHealth Preoperative Assessment Center
Director – Medical Consultation Services
University of Miami Hospital & Jackson Memorial Hospital
Professor of Clinical Medicine
University of Miami Miller School of Medicine

scohn@med.miami.edu

Perioperative Medicine Summit 2016 Update in Perioperative Pulmonary Care

Gerald W. Smetana, M.D.

Division of General Medicine and Primary Care

Beth Israel Deaconess Medical Center

Professor of Medicine

Harvard Medical School

PERISCOPE Substudy: A Validated Risk Index to Predict Respiratory Failure

- ARISCAT/Canet study population
- 63 European Hospitals
- N=5384
- Respiratory failure = hypoxemia requiring O2, noninvasive ventilation, or intubation
- Secondary outcomes of ICU admission, LOS, and mortality

Respiratory Failure Increased In-Hospital Mortality
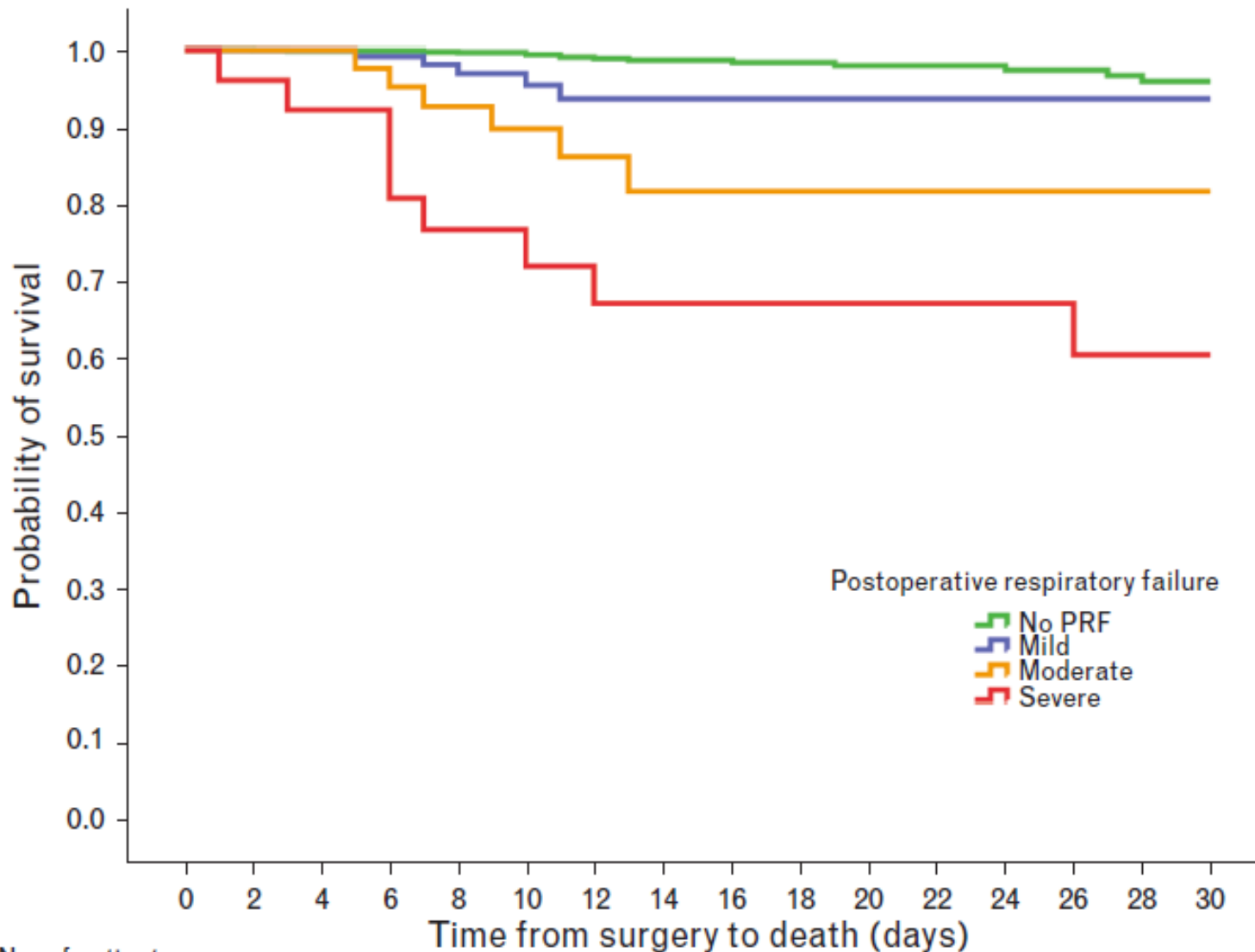
Independent Predictors	Adjusted OR	Risk Score
Preoperative O2 sat		
• ≥ 96	1	
• 91-95	2.0	7
• ≤ 90	2.7	10
Respiratory symptoms	2.7	10
History of CHF		
• No	0	
• NYHA 1	1.3	3
• NYHA 2-4	2.2	8
Chronic liver disease	2.1	7
Emergency surgery	3.1	12
Closed thoracic or upper abdominal	1.3	3
Open intraabdominal	1.9	7
Open thoracic	3.3	12
Surgery 2-3 hours	1.6	5
Surgery > 3 hours	2.7	10

Test Characteristics Using Cut-offs of 12 (intermediate risk) and 23 (high risk)

	Cut-off ≥ 12	Cut-off ≥ 23
Sensitivity	85%	56%
Specificity	63%	89%
Positive likelihood ratio	2.3	5.3
Negative likelihood ratio	0.2	0.5

Implications for Practice

- Respiratory failure index in PERISCOPE performs as well as ARISCAT index for all PPCs

- Includes easily available risk measures

- A useful addition to the Gupta Respiratory Failure Index and the ACS Surgical Risk Calculator

Cochrane 2015: Preop Inspiratory Muscle Training Reduces Atelectasis and Pneumonia before Cardiac and Abdominal Surgery

Pneumonia
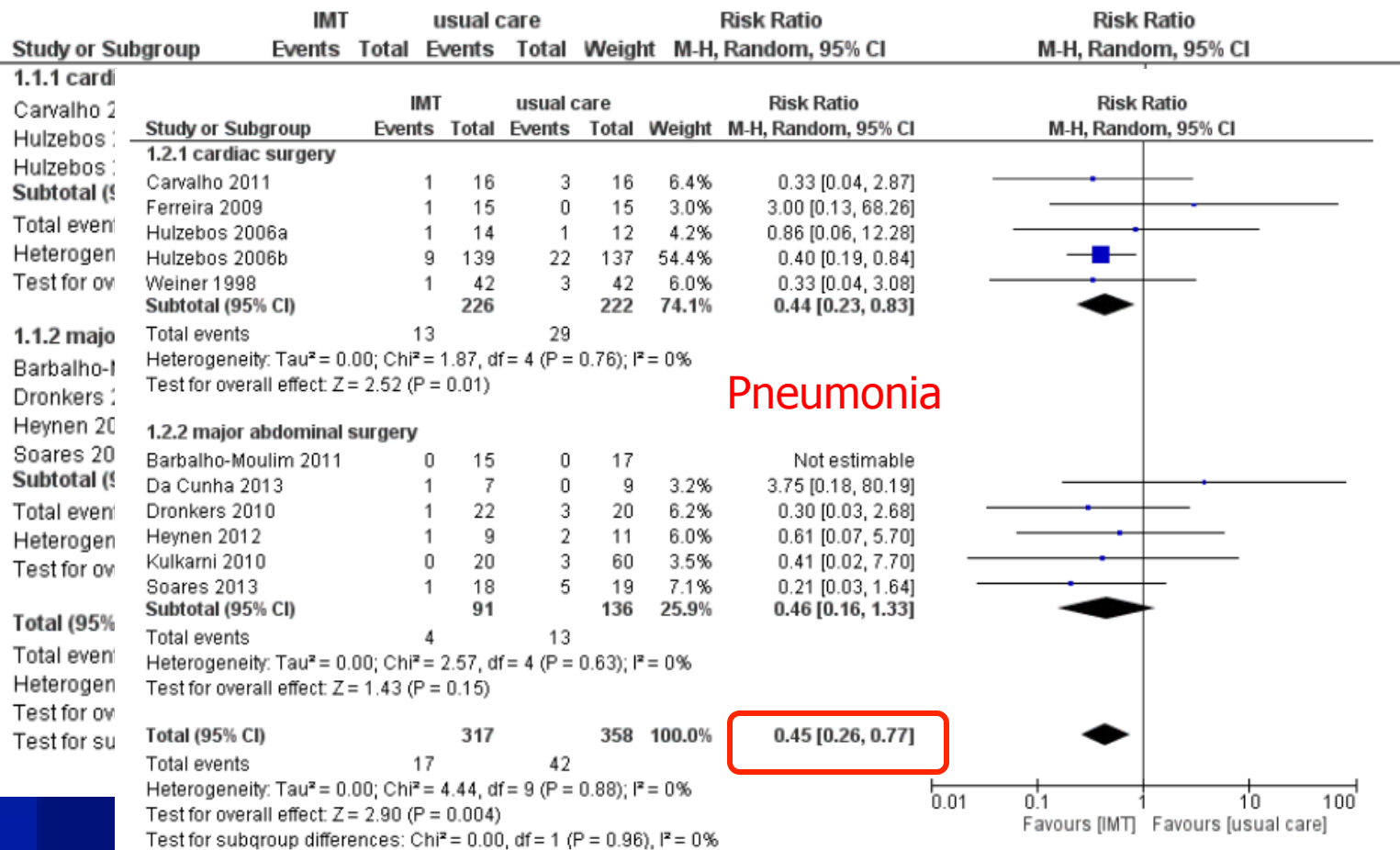
Implications for Practice

- Adds to evidence confirming the value of preoperative IMT

- Recommend IMT before high risk procedures in patients with additional PPC risk factors

- Each center will need a "champion" respiratory therapist to lead this effort and conduct preop training sessions properly

Registry Study of Intraoperative Protective Ventilation

- 69,265 consecutive noncardiac surgery patients in 3 hospitals in MA
- Protective ventilation =
    1. Median PEEP $\geq$ 5 cm. H_2O
    2. Median tidal volume < 10 ml/kg predicted
    3. Median plateau pressure of < 30 cm. H_2O
- Composite outcome: pulmonary edema, respiratory failure, pneumonia reintubation

Protective Intraoperative Ventilation Reduced PPCs

- All patients:
  - Adjusted OR 0.90 (CI 0.82-0.98)
- Propensity score matched cohorts:
  - Adjusted OR 0.89 (CI 0.83-0.97)
- Also marginally reduced LOS
- No effect on in-hospital mortality

Analysis of Individual Elements
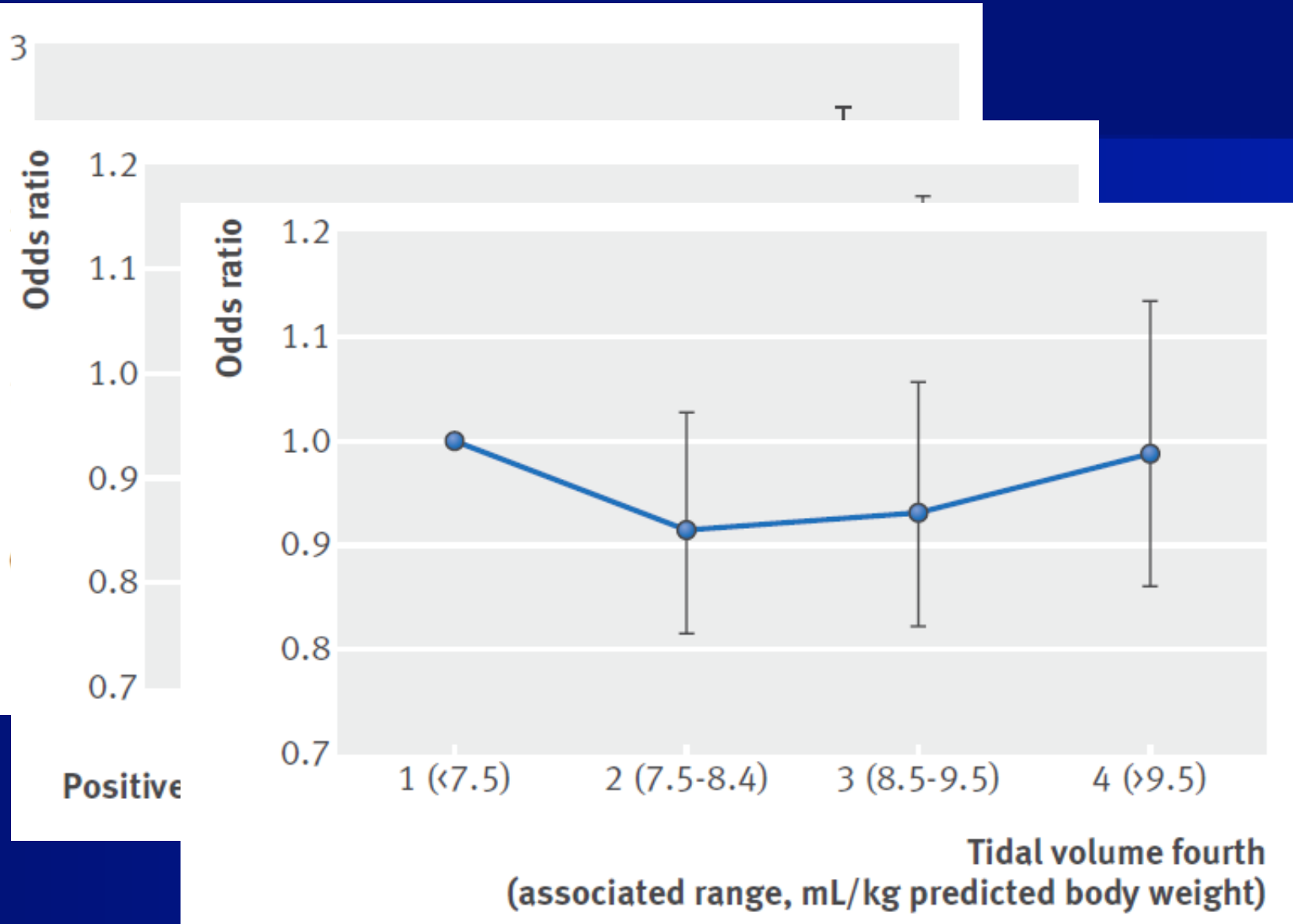
Implications for Practice

- Even greater effect on PPCs noted in 2015 Cochrane review:
  - Pneumonia OR 0.44
  - Respiratory failure OR 0.33
  - No difference in mortality
- Lung protective ventilation should be preferred when possible for high risk patients and surgeries

Is Obesity a Risk Factor for PPCs or other Adverse Outcomes?

- NSQIP database
- N=141,802
- 16 major surgery types
- Univariate and regression models
- Studied relationship between BMI and adverse postop outcomes

Underweight Patients Had More PPCs.
No Effect of Obesity on PPC, MACE, VTE
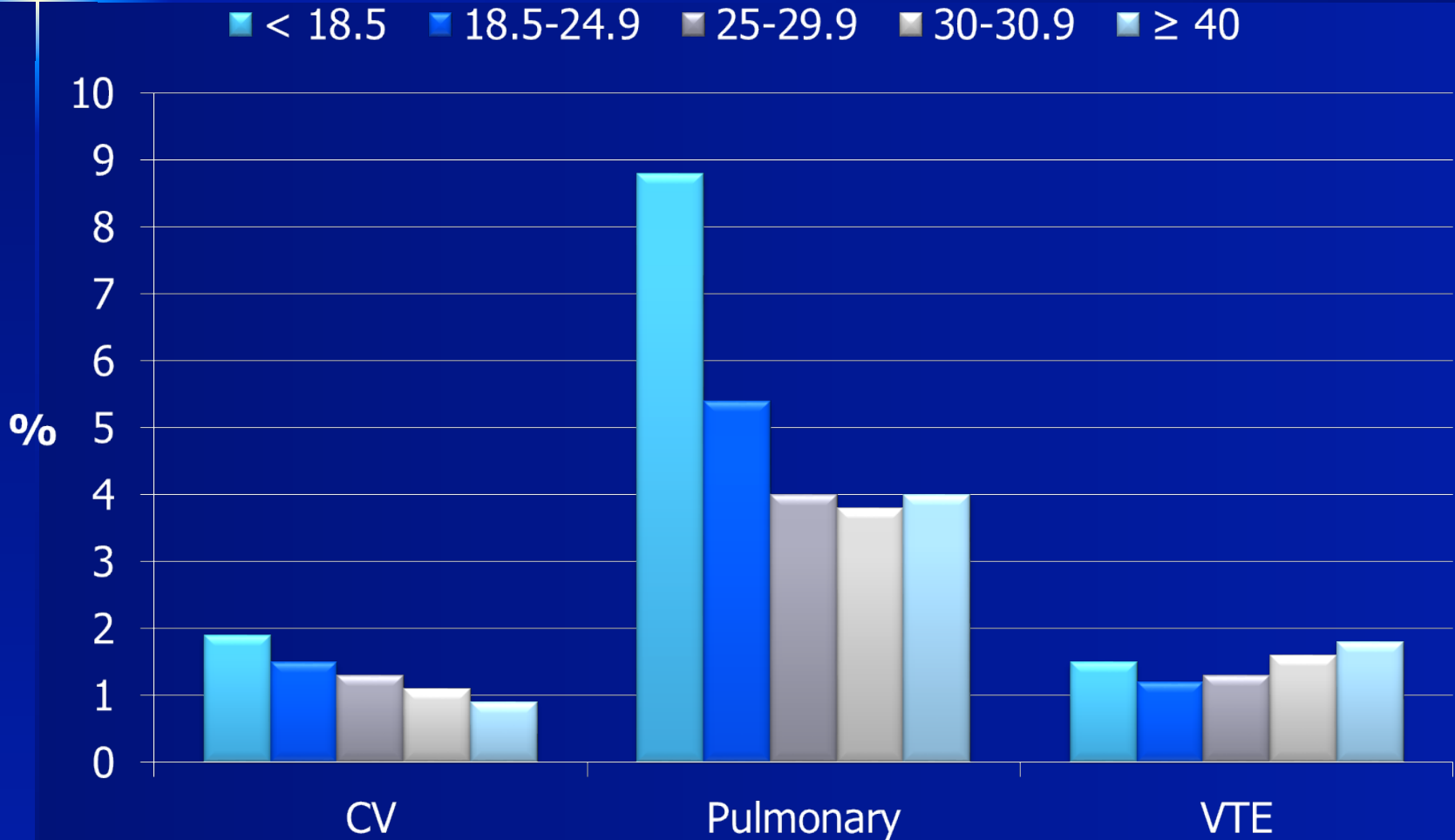
# Obesity is not A Risk Factor for PPCs in Noncardiac Surgery

- In MV adjusted analysis of 16 separate surgery types:
- Underweight risk factor for PPC in 6 of 6 procedures
- Morbid obesity risk factor for PPC in only 2 of 16 procedures (CABG, valve surgery)
- No impact of obesity on PPC rates in any noncardiac surgery type
- Conclusion: Reconfirms earlier ACP conclusions

Six Minute Walk Test as a Tool to Stratify Risk

- 117 patients undergoing thoracic or upper abdominal surgery
- Measured how far patient can walk in 6 minutes
- Also obtained spirometry in all patients
- Composite outcome
- Spirometry did not correlate with # or grade of postop complications

Six Minute Walk Test Correlated with Mean Complication Grade
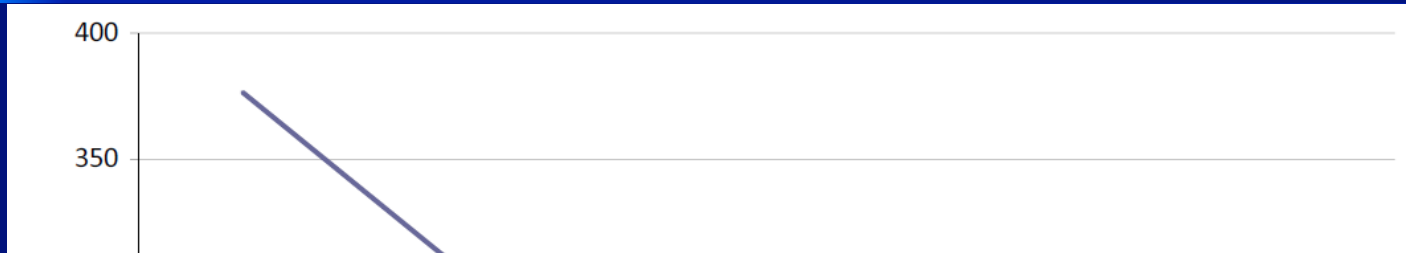
Conclusion: Six Minute Walk Test may be another simple tool to estimate fitness and risk for overall complication severity. Further study with larger sample size needed to determine role in predicting PPC or other specific complications.
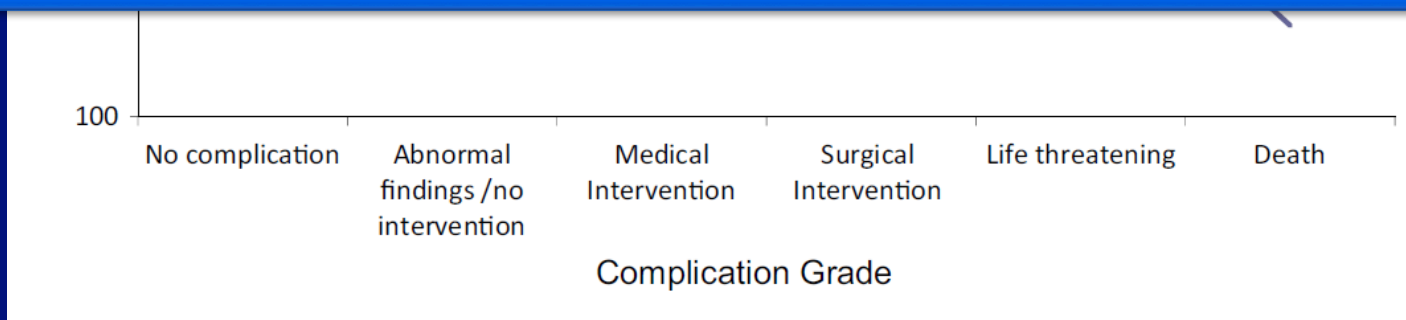
Impact of Smoking on Outcomes After Major Surgery

- Yes, another NSQIP study…
- N= 141,802
- Current smoker = any time in past year
- Former smoker = more than one year of cessation
- Studied individual outcomes and conducted MV analysis

Unadjusted PPC Rates Similar for Former and Current Smokers
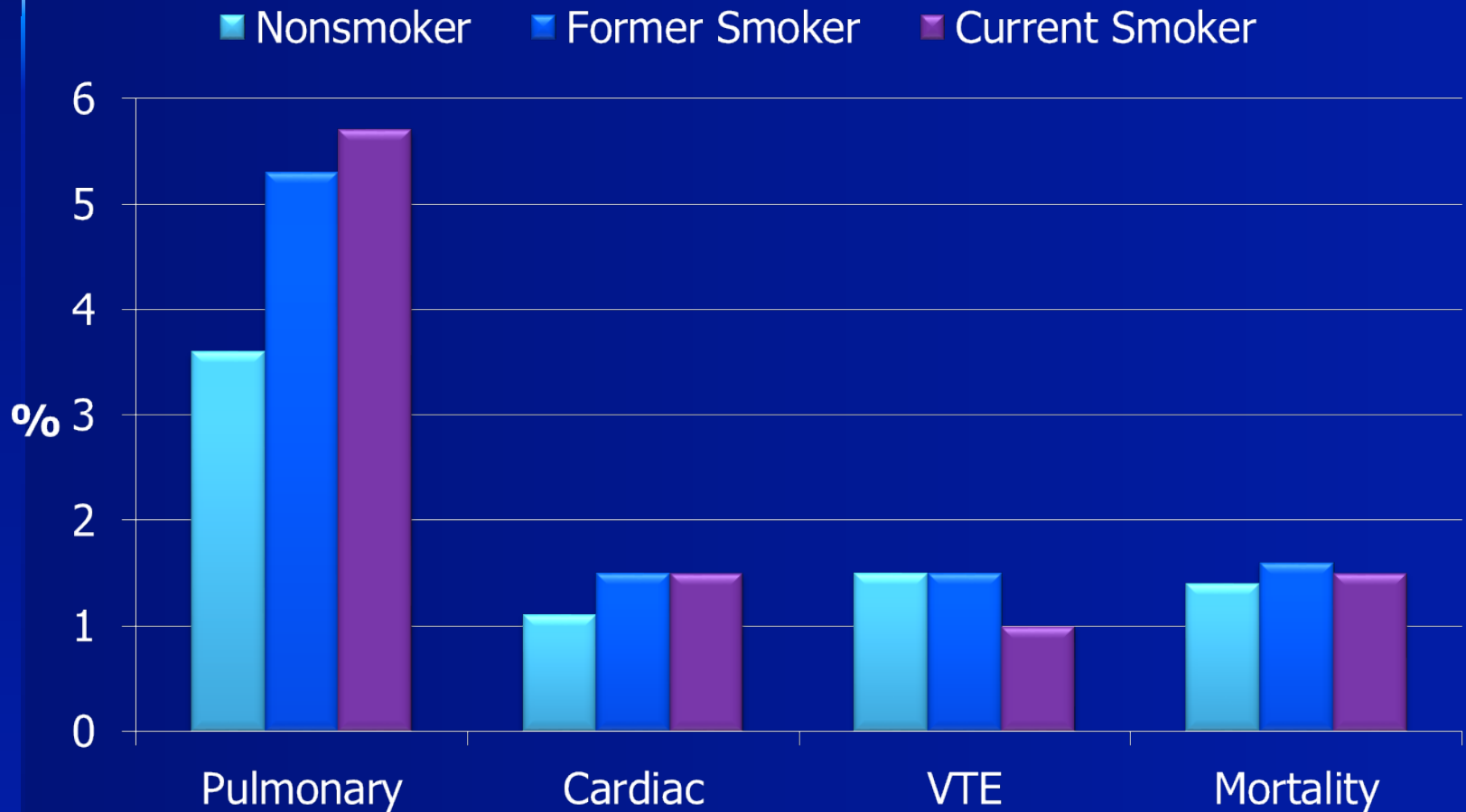
Multivariable Adjusted Analyses:

- Higher odds of PPCs for 10 of 16 surgery types: CEA, CABG, LE vascular, AAA, esophagectomy, gastrectomy, pancreas, colectomy, prostate, pneumonectomy

- OR ranges: 1.4-4.4

- Conclusion:

  - Impact of smoking modest

  - Influences PPC rates primarily in surgeries with higher baseline PPC expectations

Updates in Perioperative Medicine: 2015-2016

Suparna Dutta MD MPH
Assistant Professor of Medicine
Division of Hospital Medicine
Rush University
College of Medicine

#hashtagedition

#periop2016
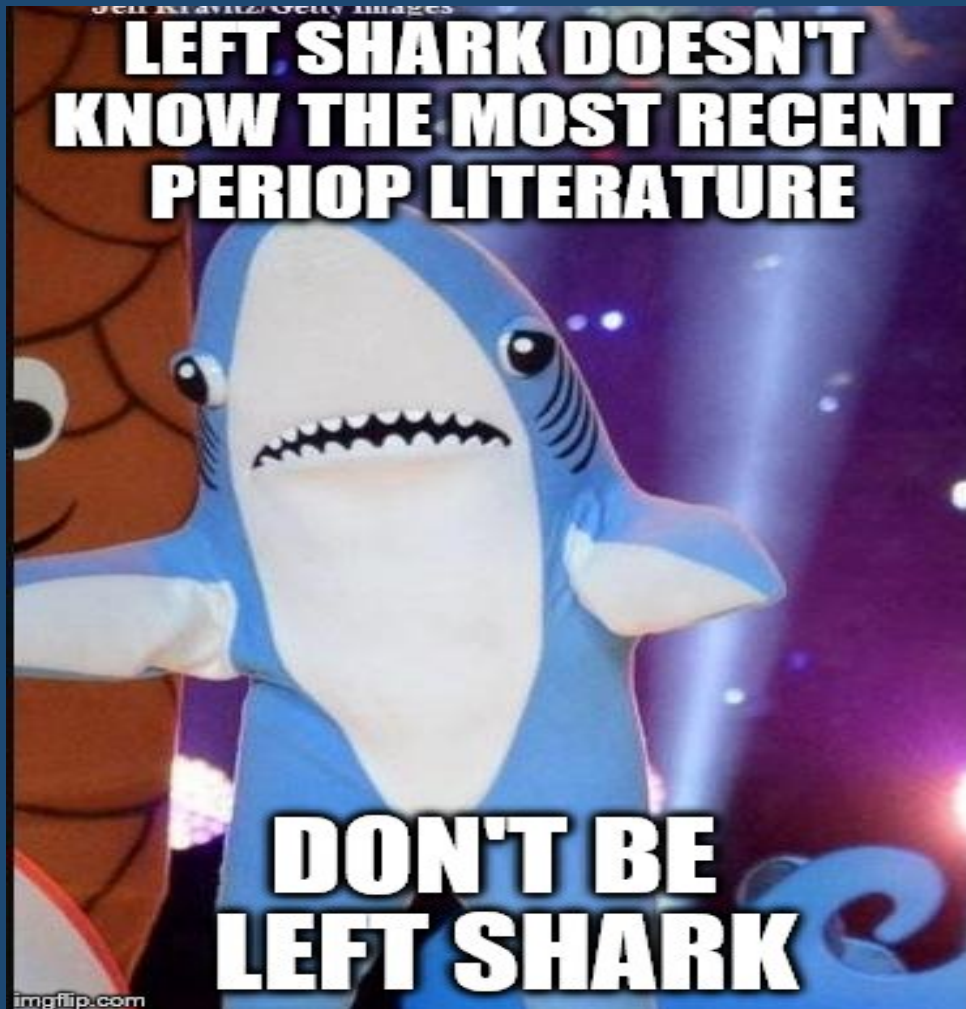
#ourfirstpatientis

75 year old little green male seen in preop clinic 10 days before his scheduled hemicolectomy for colon cancer

- PMH: **CAD s/p PCI with DES 7 months ago**, DM, p-afib, CVA in past, OA, and OSA not compliant with CPAP
- Meds: ASA, **clopidogrel**, insulin, enalapril, atorvastatin, **dabigatran**
- He has lost 20 pounds in the past 3 months
- Functional status limited by pain in hips, difficulty climbing flight of stairs
- O/E: BP 140/80, P 80, R16; no significant abnormalities
- Labs: BUN/Cr 20/0.9, albumin 2.0, H/H 9/27
- *Is preoperative bridging indicated for his anticoagulation?*
- *What should we do with this clopidogrel?*

Perioperative bridging anticoagulation in patients with atrial fibrillation
Douketis et al. N Engl J Med 2015;373:823-833.

- **Aim:** to examine whether bridging anticoagulation is necessary during perioperative warfarin cessation
- **Methods:** randomized, double blind, placebo controlled trial, n = 1884 pts
- **Outcomes:** arterial thromboembolism, bleeding
- **Results:** mean age = 71 yrs., average CHADS2 score = 2.3
- No significant difference between bridged/nonbridged for arterial thromboembolism
- Significant difference in r[a...] major bleeding

	Non-bridge (#)	Bridge (#)	P-value
Arterial TE	4	3	0.73
CVA	2	3	0.01
Major bleed	12	29	0.005
Death	5	4	0.88

A strategy of discontinuing warfarin treatment without use of bridging anticoagulation appears to be noninferior to bridging
Bridging conferred a risk of major bleed nearly triple the risk of no bridging

Perioperative management of dabigatran
Schulman et al. Circulation 2015;132:167-173

- *Aim:* to determine the optimal perioperative management of NOACs
- *Methods:* multicenter, prospective cohort trial
- n = 553 pts at 7 centers
- *Outcomes:* major bleeding, arterial thromboembolism
- *Results:* 10 patients (1.8%; OR 0.62) with major bleeding event, 1 thromboembolic event (0.2%)

CrCl	½ life (h)	Time last dose (d) Standard	Time Last dose (d) High
>80	13	AM Day -1	AM Day -2
>50 <80	15	AM Day -1	AM Day -2
>30 <50	18	AM Day -2	AM Day -4
		AM Day -4	AM Day -6

No indication for bridging with dabigatran
Protocol using surgical bleed risk and dabigatran pharmacokinetics safe and easy to use

The evaluation of clopidogrel use in perioperative general surgery patients: a prospective randomized control trial
Chu et al. The American J Surgery 2015.

- **Aim:** to evaluate the bleeding risk with maintenance of clopidogrel during general surgery

- **Methods:** prospective RCT, n = 39, elective general surgery

- **Outcomes:** perioperative bleeding resulting in blood product transfusion; readmission, 90d mortality

- **Results:** no adverse events in either group

	Total N = 43	Group A N = 21	Group B N = 22	P-value
Procedure EBL (ml)	61.8	73.6	52.1	0.49
Change in Hct (%)	-2	-3	-1	0.13
Avg. LOS (days)	2.3	2.2	2.4	0.89
Blood	0	0	0	0

Patients undergoing common elective general surgical procedures can be safely maintained on clopidogrel

#whatdoidowiththisinfo

- **Bridging is associated with higher overall bleeding and adverse event rates**
  - We still do not know which population of patients may be high risk enough to warrant bridging
- **Likely no need for bridging with NOACs**
  - When to stop includes pt's renal function, surgical bleed risk
  - Routine coagulation assays do not reflect degree of anticoagulation

Perioperative thrombotic risk

Risk stratum	Indication for anticoagulant therapy		
	Mechanical heart valve	**Atrial fibrillation**	**VTE**
Very high thrombotic risk*	Any mitral valve prosthesis. Any caged-ball or tilting disc aortic valve prosthesis. Recent (within six months) stroke or transient ischemic attack	CHA_2DS_2-VASc score of ≥6 (or $CHADS_2$ score of 5-6). Recent (within three months) stroke or transient ischemic attack. Rheumatic valvular heart disease	Recent (within three months) VTE. Severe thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities)
High thrombotic risk	Bileaflet aortic valve prosthesis and one or more of the of following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age >75 years	CHA_2DS_2-VASc score of 4-5 or $CHADS_2$ score of 3-4	VTE within the past 3 to 12 months. Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation). Recurrent VTE. Active cancer (treated within six months or palliative)
Moderate thrombotic risk	Bileaflet aortic valve prosthesis without atrial fibrillation and no other risk factors for stroke	CHA_2DS_2-VASc score of 2-3 or $CHADS_2$ score of 0-2 (assuming no prior stroke or transient ischemic attack)	VTE >12 months previous and no other risk factors

Refer to UpToDate topics on perioperative anticoagulation management for details.

VTE: venous thromboembolism; $CHADS_2$: congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, and stroke or transient ischemic attack; CHA_2DS_2-VASc: congestive heart failure, hypertension, age ≥75 years (2 points), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (2 points), vascular disease (peripheral artery disease, myocardial infarction, or aortic plaque), age 65-74 years, sex category female.
* Very high risk patients may also include those with a prior stroke or transient ischemic attack occurring >3 months before the planned surgery and a CHA_2DS_2-VASc score <6 (or $CHADS_2$ score <5), those with prior thromboembolism during temporary interruption of anticoagulation, or those undergoing certain types of surgery associated with an increased risk for stroke or other thromboembolism (eg, cardiac valve replacement, carotid endarterectomy, major vascular surgery).

Modified from Douketis JD, Spyropoulos AC, Spencer FA, et al. Perioperative management of antithrombotic therapy: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest 2012; 141(2 Suppl):e326S. Copyright © 2012. Reproduced with permission from the American College of Chest Physicians.

UpToDate®

#thisisanawfullylongclinicvisit

- 75 year old male seen in preop clinic 10 days before his scheduled hemicolectomy for colon cancer
- PMH: CAD s/p PCI with DES 7 months ago, DM, p-afib, CVA in past, OA, and OSA not compliant with CPAP
- Meds: ASA, clopidogrel, insulin, enalapril, atorvastatin, dabigatran
- O/E: BP is 140/80, P 80, R16; no significant abnormalities
- Labs: Glucose 210 BUN/Cr 20/0.9 alb 2.0; H/H 9/27
- *Should we worry about his anemia?*
- *Would a blood transfusion help him or hurt him postoperatively?*

Liberal or restrictive transfusion after cardiac surgery
Murphy et al. N Engl J Med 2015;273:997-1008.

- **Aim:** evaluate the effects of a restrictive threshold for transfusion after cardiac surgery

- **Methods:** multicenter, parallel group trial

- n = 1007 pts, 17 centers

- **Outcomes:** serious infection and/ or ischemic event; MI within 3 months, death

- **Results:** Primary outcome: OR 1.11, p = 0.3 ; Death: HR 1.64, p = 0.045

Outcome	Restrictive	Liberal	OR	P
overall	33.5%	33%	1.11	0.3
ischemic	15.7%	14%	1.16	0.26
infection	25.4%	25.2%	1.02	0.83
90d mortality	4.2	2.6	1.64	0.04
LOS	7d	7d	1	0.94

Restrictive transfusion threshold after cardiac surgery not superior to a liberal threshold

Different from previous observational analyses

Harms associated with single unit perioperative transfusion: retrospective population based analysis.
Whitlock et al. BMJ 2015;350:h3037.

- **Aim:** to determine whether perioperative transfusion in OR is associated with CVA/MI
- **Methods:** retrospective cohort
- n = 346 hospitals, 1, 583,819 adults, noncardiac, nonvascular surgery
- **Outcomes:** CVA/MI within 30 days
- **Results:** Transfusion of just one unit was associated with OR 2.33 for CVA/MI, increased OR with 4 or more units

| #pRBCs	OR CVA/MI	P-value
1	2.33	<0.001
2	2.37	<0.001
3	3.13	<0.001
>4	4.87	<0.001

Points to relative safety of restrictive transfusion protocols in ICU and periop settings, may be best to avoid transfusion if possible
Most notably in noncardiac surgery

The important role of intravenous iron in perioperative patient blood management in major abdominal surgery
Froessler et al. Ann Surg 2016

- **Aim:** to determine if preoperative IV iron improves outcomes in abdominal surgery
- **Methods:** RCT, n = 72 patients with IDA
- **Outcomes:** incidence of allogeneic blood transfusion (ABT), LOS, M & M
- **Results:** 60% reduction in ABT in IV iron compared with usual care
- IV iron group with of stay (7 vs 9.7d,
- Higher Hb 4 week (0.8 g/dl increase 0.01)
- No difference in N

Administration of IV iron decreases need for blood transfusion, decreases LOS, improves iron stores

LOS (days)

%transfused

change in Hb 4 weeks post surgery

IV iron   no IV iron
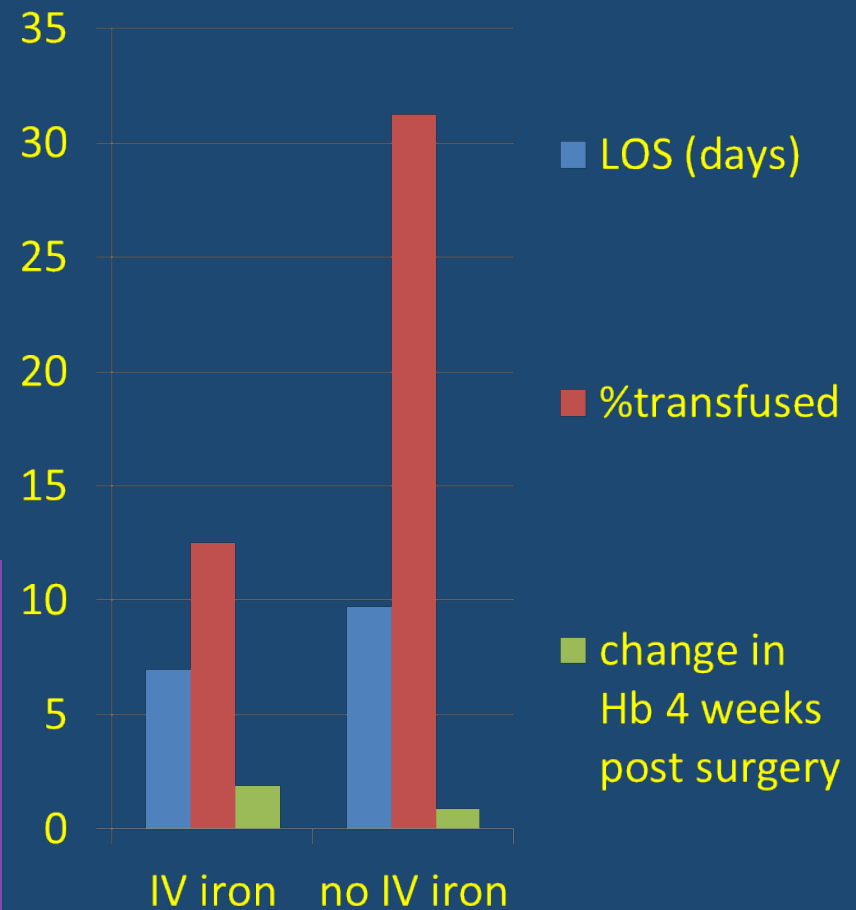
#whatdoidowiththisinfo

- Still mixed evidence on risk/benefit of blood transfusion

- Differences may be related to type of surgery (cardiac vs noncardiac)

- IV iron appears to be an alternative that can help avoid transfusion and improve Hb

YEAH
SCIENCE!
memegenerator.net

#kidneysaremyfavoriteorgans

- 75 year old male seen in preop clinic 10 days before his scheduled hemicolectomy for colon cancer
- PMH: CAD s/p PCI with DES 7 months ago, DM, p-afib, CVA in past, OA, and OSA not compliant with CPAP
- Meds: ASA, clopidogrel, insulin, enalapril, atorvastatin, dabigatran
- He has lost 20 pounds in the past 3 months
- Functional status limited by pain in hips, difficulty climbing flight of stairs
- O/E: BP 140/80, P 80, R16; no significant abnormalities
- Labs: BUN/Cr 20/0.9, albumin 2.0, H/H 9/27
- *Is he at increased risk for developing AKI postoperatively?*
- *What markers should we be examining to determine his risk?*

Risk of postoperative acute kidney injury in patients undergoing orthopaedic surgery
Bell et al. BMJ 2015;351:h5639

- *Aim:* to quantify the risk of AKI after orthopaedic surgery
- *Methods:* retrospective cohort
- *Outcomes:* development of any severity AKI in postop week 1; 90d, 1 year long term survival
- *Results:* using regression analysis, able to identify independent pred
- Model's predictiv performance: C st
- Survival poorer in even with mild (st

Older age
Male sex
DM
prescribed drugs
Lower eGFR
ACE/ARB use
ASA class

Meier plot of overall survival in patients with injury compared with no acute kidney injury

- No acute kidney injury
- Acute kidney injury
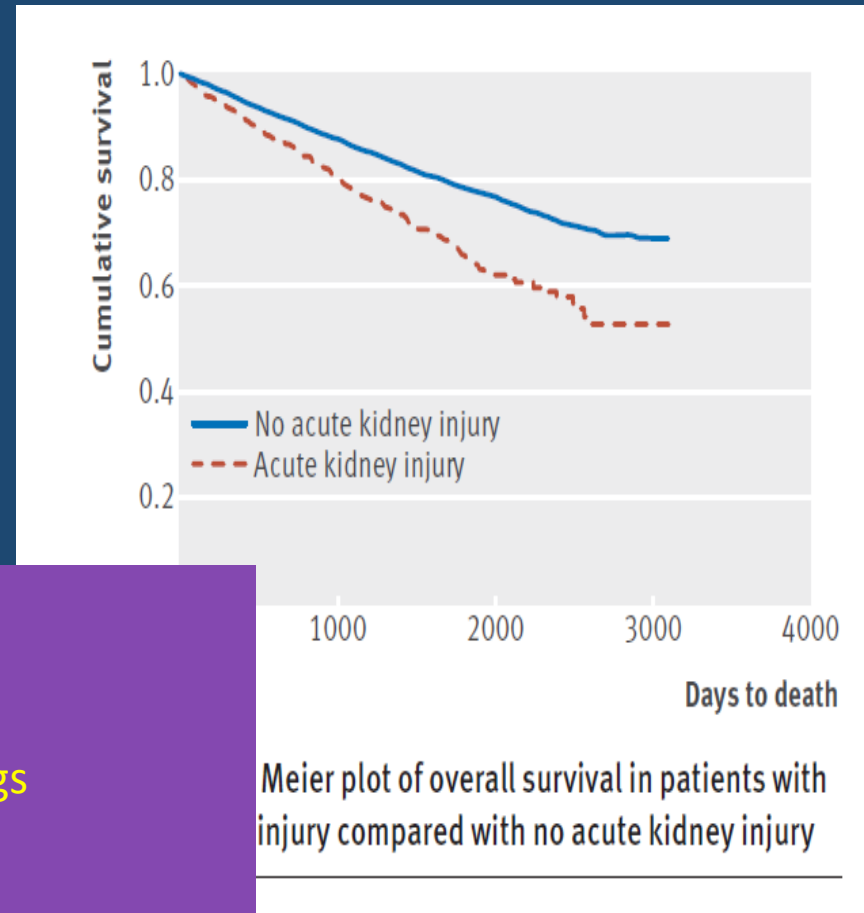
Comparison of plasma and urine biomarker performance in acute kidney injury
Schley et al. PLoS ONE 10(12):e0145042

- **Aim:** to evaluate new renal biomarkers to increase specificity early diagnosis of AKI

- **Methods:** prospective cohort, n = 110 adults undergoing cardiac surgery

- **Outcomes:** AKI within 72 hours after surgery

- **Results:** plasma markers with better discriminative performance

- Urine discriminative powers improve when concentrations normalized to Ucr

- Clinical scoring systems not inferior to biomarkers

	4h AUC	24h AUC
NGAL, plasma	0.83	0.84
Cystatin C, plasma	0.76	0.8
Cr, plasma	0.72	0.83
MIG, plasma	0.74	0.76
E-selectin, u	0.67	0.52

Best diagnostic performance
4h after surgery:
Plasma NGAL
Cystatin C
Pre-existing CKD limited
performance of biomarkers
in both plasma and urine

#whatdoidowiththisinfo

- Age, ASA status, DM, polypharmacy can be risk predictors for development of AKI in noncardiac surgery
- Development of AKI is associated with increased LOS, adverse events, and mortality
- Preoperative creatinine may be a poor marker for underlying renal insufficiency, especially stage 1 or 2 CKD
- Even mild reduction in eGFR associated with worse postoperative outcomes
- New biomarkers hold promise for faster detection of kidney injury as compared to creatinine
- Plasma markers appear to have better efficacy than urine biomarkers

YOU USED SERUM CR FOR PREOP RISK STRATIFICATION INSTEAD OF NGAL
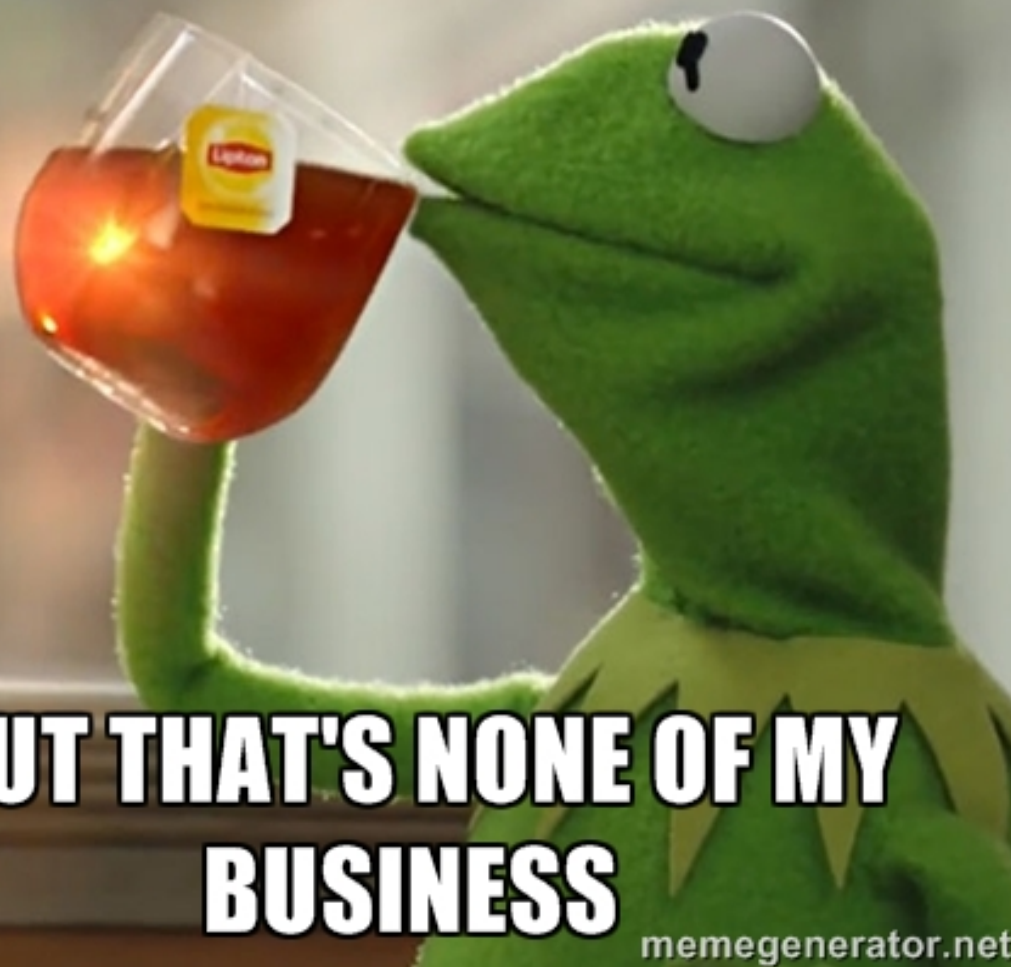
BUT THAT'S NONE OF MY BUSINESS

#ohnohefell #forcewasnotwithhim

- 75 year old male seen in preop clinic after hemicolectomy; returned home after surgery, s/p fall and L hip fracture. Ortho recommending L ORIF.
- PMH: CAD s/p PCI with DES 7 months ago, **DM**, p-afib, CVA in past, OA, and OSA not compliant with CPAP
- Meds: ASA, clopidogrel, insulin, enalapril, atorvastatin, dabigatran
- O/E: BP is 140/80, P 80, R16; no significant abnormalities
- Labs: **Glucose 210** BUN/Cr 20/0.9 alb 2.0; H/H 9/27, **nares MSSA positive**
- *Is he at increased risk of adverse outcomes because of his diabetes and elevated BS in clinic?*
- *Is there any way we can reliably prevent SSIs after orthopedic infections?*

Perioperative hyperglycemic and risk of adverse events among patients with and without diabetes
Kotagal et al. Ann Surg 2015;261(1):97-103.

- **Aim:** to evaluate the association between diabetes status, perioperative hyperglycemia, and adverse events

- **Methods:** retrospective cohort, noncardiac surgery, n = 53 hospitals; 40,836 patients

- **Outcomes:** composite adverse event metric (cardiac, noncardiac, and death)

- **Results:** No DM: OR for adverse events increase with BS in DM: no significant increase with BS increase
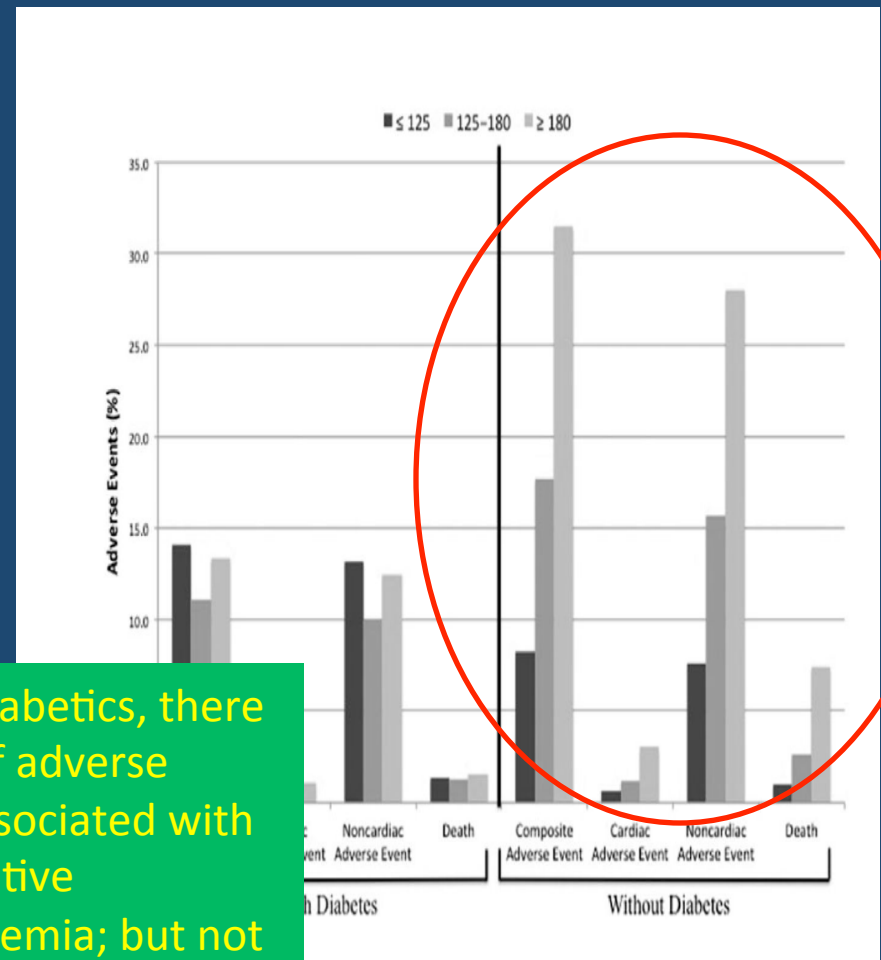
For nondiabetics, there is a risk of adverse events associated with perioperative hyperglycemia; but not in diabetic patients

Association of a bundled intervention with surgical site infections among patients undergoing cardiac, hip, or knee surgery
Schweizer et al. JAMA 2015;313(21):2162-2171.

- **Aim:** to evaluate whether implementation of a evidence based bundle is associated with lower risk of S aureus SSIs

- **Methods:** multicenter prospective cohort, pts undergoing cardiac, hip, knee surgery

- **Outcomes:** complex S aureus SSIs

- **Results:** 101 comp[lex] SSIs pre-interventi[on] during interventio[n]

- Bundle adherence [was] full and 44% partia[l]

	Pre-intervention	During intervention
# complex S aureus SSIs	101	29
Hip/knee arthroplasties		RR 0.48 (0.29-0.8)
Cardiac [surg]ery		RR 0.86 (0.47-1.57)

	RR
[Comp]lete bundle [adhe]rence	0.26 (0.1-0.69)
[Parti]al or no adherence	0.8 (0.49-1.31)

Complex S aureus SSIs decreased when using prevention bundle for hip, knee surgeries
Results contingent on complete adherence to bundle

#whatdoidowiththisinfo

- Hyperglycemia not predictive of adverse postsurgical events in diabetics
- May be more predictive in nondiabetics as is a manifestation of stress response
- Complete adherence to an evidence based bundle for prevention of S aureus (both MRSA and MSSA) SSIs can be very effective, but requires a multidisciplinary, team, coordinated approach

YEAH, IF YOU COULD GO AHEAD AND NOT ORDER A PREOP A1C...

THAT WOULD BE GREAT

#gettingoldisnoteasy

- 75 year old male seen in preop clinic after hemicolectomy; returned home after surgery, s/p fall and L hip fracture. **Ortho recommending L ORIF**.
- PMH: CAD s/p PCI with DES 7 months ago, DM, p-afib, CVA in past, OA, and OSA not compliant with CPAP
- Meds: ASA, clopidogrel, insulin, enalapril, atorvastatin, dabigatran
- **He has lost 20 pounds in the past 3 months**
- **Functional status limited by pain in hips, difficulty climbing flight of stairs**
- O/E: BP 140/80, P 80, R16; L hip externally rotated and painful ROM
- Labs: BUN/Cr 20/0.9, **albumin 2.0**, H/H 9/27
- *How quickly does surgery need to be done for his hip fracture?*
- *Can we estimate his perioperative risk based on his frailty?*
- *Is he at risk for perioperative delirium?*

Length of hospital stay after hip fracture and risk of early mortality after discharge
Nikkel et al. BMJ 2015;351:h6246

- *Aim:* evaluate the connection between length of stay in hospital for hip fracture and risk of death
- *Methods:* retrospective cohort study, n = 188,208 pts admitted with hip fractures in New York State
- *Outcomes:* mortality rate at 30 days post discharge
- *Results:* hospital stays of 11-14d for hip fracture associated with increased OR death
- Longer time to surgery = longer length of stay
- Other risks associated with early mortality included:
- Older age
- Metastatic disease
- Non-surgical management

	OR for 30d mortality	P-value
> 2 days to surgery	1.11	<0.001
LOS 11-14d	1.32	<0.001
LOS > 14d	2.03	<0.001
dementia	2.02	<0.001
Femoral neck fx	1.01	0.7
with ons	1.02	0.8

Decreased length of hospital stay for hip fracture associated with reduced rates of early mortality

Factors predicting perioperative delirium and acute exacerbation of behavioral and psychological symptoms of dementia based no admission data in elderly patients with proximal femoral fractures
Tanaka et al. Geriatric Gerontol Int 2015.

- **Aim:** to examine factors predicting the onset of perioperative deliriume

- **Methods:** n = 152 patients undergoing surgery, retrospective cohort

- **Outcomes:** onset of perioperative delirium

- **Results:** Dementia, serum albumin level, and periphe WBC count identified as independent predictive fa

- Serum albumin < 3.7 g/dl; count< 1200/ul, history of dementia with increased risk

	Incidence of perioperative delirium
0 risk factors	7.7
1 risk factor	25.8
2 risk factors	31.7
3 risk factors	91.3

	OR	95% CI	P-value
Dementia	3.55	1.35-9.3	0.01
Albumin	0.17	0.03-0.86	0.03
WBC	1	1-1	0.01

Three easy markers can be used to predict onset of perioperative delirium and exacerbations of dementia

Pre-surgical geriatric syndromes, frailty, and risks for postoperative delirium in older patients undergoing gastrointestinal surgery
Chen et al. J Gastrointest Surg 2015;19:927-934.

- **Aim:** to identify and evaluate red flags for pre-surgical geriatric conditions prior to surgery
- **Methods:** prospective cohort, n = 379 geriatric patients, GI surgery
- **Outcomes:** presence of geriatric conditions
- **Results:** patients with or without geriatric conditions discriminated with sensitivity (67%), specificity (84%), and PPV (77%) by 8 red flags
- 45.7% pts scheduled for surgery had at least one pre-surgical geria...

These red flags can be considered for screening to determine if pts warrant recommended preoperative geriatric assessments

	OR	P-value
Age > 75	2.86	<0.001
Eating soft food	3.63	0.001
Reported HTN	2.8	0.001
Weight loss > 3 kg in 3 mos	4.79	<0.001
Fair/weak grip strength	2.53	0.001
sleeplessness	2.57	0.001
Perceived health	1.88	0.025
Short term inability to recall 3 words	1.81	0.025

#whatdoidowiththisinfo

- Longer time in hospital and longer time to surgery for hip fracture associated with poorer outcomes

- For planned procedures, screening patients via physical exam and basic labs for geriatric syndromes, including delirium, can prevent adverse postoperative outcomes

THERE IS NO SUCH THING..

AS MEDICAL CLEARANCE!