

- diagnostic criteria, characteristics, predictors, and 30-day outcomes. *Anesthesiology*. 2014;120:564–578.
3. Devereaux PJ, Chan MTV, Alonso-Coello P, et al. Association between postoperative troponin levels and 30-day mortality among patients undergoing noncardiac surgery. *JAMA Am Med Assoc*. 2012;307:2295–2304.
  4. Mauermann E, Puelacher C, Lurati Buse G. Myocardial injury after noncardiac surgery. *Curr Opin Anaesthesiol*. 2016;29:403–412.
  5. Eikelboom JW, Kearon C, Guyatt G, et al. perioperative aspirin for prevention of venous thromboembolism: the perioperative ischemia evaluation-2 trial and a pooled analysis of the randomized trials. *Anesthesiology*. 2016;125:1121–1129.
  6. Myles P, Leslie K, Fanca M, et al. The safety of addition of nitrous oxide to general anaesthesia in at-risk patients having major non-cardiac surgery (ENIGMA-II): a randomised, single-blind trial. *Lancet*. 2014;384:1446–1454.
  7. Gorgun E, Lan BY, Aydinli HH, et al. Troponin elevation after colorectal surgery. *Ann Surg*. 2016;264:605–611.
  8. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40:373–383.

major vascular than complications than those treated with placebo (hazard ratio: 0.72, 95% confidence interval: 0.55-0.93;  $P$  0.0115). It is worth considering that not every postoperative elevation in troponin is due to myocardial ischemia (ie, sepsis, pulmonary embolism, myocarditis, or cardioversion). Therefore, it is not clear if patients *all* with postoperative troponin elevations in Nyame's study would have benefited from cardiovascular “optimized medical therapy” or dabigatran.

The findings of the study by Nyame et al. gives an insight on the long-term prognostic value of abnormal postoperative troponin measurements. They also open an opportunity to discover new biomarkers or more sensitive techniques (high sensitivity troponin assays) to detect small changes in troponins that could be used in patients “normal” troponins.

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## References

1. Rose J, Weiser TG, Hider P, Wilson L, Gruen RL, Bickler SW. Estimated need for surgery worldwide based on prevalence of diseases: a modelling strategy for the WHO Global Health Estimate. *Lancet Global Health*. 2015;3:S13–S20.
2. Sessler DI, Devereaux PJ. Perioperative troponin screening. *Anesth Analg*. 2016;123:359–360.
3. Association between postoperative troponin levels and 30-Day mortality among patients undergoing noncardiac surgery. *JAMA*. 2012;307.
4. Devereaux PJ, Duceppe E, Guyatt G, et al. Dabigatran in patients with myocardial injury after non-cardiac surgery (MANAGE): an international, randomised, placebo-controlled trial. *Lancet*. 2018;391:2325–2334.
5. Botto F, Alonso-Coello P, Chan MTV, et al. Myocardial injury after noncardiac surgery. *Anesthesiology*. 2014;120:564–578.
6. Landesberg G, Shatz V, Akopnik I, et al. Association of cardiac troponin, CK-MB, and postoperative myocardial ischemia with long-term survival after major vascular surgery. *J Am Coll Cardiol*. 2003;42:1547–1554.
7. Maile MD, Jewell ES, Engoren MC. Timing of preoperative troponin elevations and postoperative mortality after noncardiac surgery. *Anesth Analg*. 2016;123:135–140.
8. Nagele P, Brown F, Gage BF, et al. High-sensitivity cardiac troponin T in prediction and diagnosis of myocardial infarction and long-term mortality after noncardiac surgery. *Am Heart J*. 2013;166:325–332. e321.

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## EDITORIAL COMMENT



Surgery plays a fundamental role in the care of millions of patients worldwide, each year.<sup>1,2</sup> Unfortunately, cardiovascular events occurring after surgery remain as one of the leading cause of morbidity and mortality after major non-cardiac surgery. The results of several large studies demonstrate that a higher than “normal” postoperative troponin concentrations in the absence of a clinical diagnosis of myocardial infarct (also known as myocardial injury after non-cardiac surgery, MINS) is an independent risk factor of short and long term morbidity and mortality.<sup>3–6</sup>

In this issue of the journal, Nyame et al. elegantly demonstrated in a large cohort of urological patients ( $n = 8,310$ ) who underwent non-cardiac surgery that those subjects who had abnormal postoperative (30 days) troponin levels (3.6%) also had a significantly worse 5 years overall survival (70.6%) than those individuals with normal troponin concentrations (81.7%) and patients in whom troponins were not measured (90.4%). In my opinion, the reader should carefully consider that the cohort of patients involved in Nyame's study represents a predominantly cancer population of patients in whom troponin levels were not routinely measured after surgery but as a result of changes in the patients' medical conditions. In that regards, Nyame's study studies' patients significantly differ from subjects in the VISION trial in whom troponins were routinely measured postoperatively and in 8% of them MINS was detected. This fact does not underscore the relevance of Nyame et al. findings, but again it indicates that routine testing appears appropriate. I think that it is also important to consider that the authors of the manuscript published in this issue of the journal did not provide data on preoperative troponin values which can be increased in up to 40% of the patients undergoing major non-cardiac surgery.<sup>7,8</sup> The relevance of an abnormal preoperative troponin resides in the fact that the risk of postoperative mortality is 2two-folds or higher than in patients with normal troponin concentrations.<sup>7</sup>

The treatment of patients with postoperative troponin elevations appears to be indicated. In the MANAGE trial, patients with MINS who were allocated to receive dabigatran had fewer

## AUTHOR REPLY



If it were tracked by the CDC, mortality after non-cardiac surgery would rank among the top 4 causes of mortality in the United States.<sup>1</sup> The aim of our study was to assess the association between postoperative troponin levels, and both short- and intermediate- term mortality in urologic patients undergoing major operations. This baseline information was needed as background information for a quality project to assess the role of routine troponin screening in our department. As such, there are a few inherent biases that were pointed out in this excellent

editorial highlighting the role that troponins may play as a biomarker to predict mortality in our surgical patients.

We certainly have a selection bias towards oncologic patients, which is a reflection of the case mix at our institution and the author's decision to select the patient who underwent major urologic surgeries. To address for confounding influence of this selection bias, we controlled for both age and comorbidity in our multivariate analysis. It is also important to note that this high risk population is who we wanted to screen at our institution, as they possessed the most probable opportunity for successful intervention.

The editorial also highlights an important distinction of our study from the VISION and myocardial injury after non-cardiac surgery (MINS) trials,<sup>2,3</sup> which is that our troponins were drawn for cause following surgery. This means that the patients had troponin levels drawn for either an overt cardiopulmonary symptom or a diagnostic abnormality such as an arrhythmia on telemetry. Roughly 16% of the patients we selected during our study period had a positive troponin, and it is unclear how troponin blood draws from asymptomatic patients in our cohort would alter our findings.

The role of troponin as a biomarker for predicting mortality in urologic patients is interesting. Almassi and colleagues demonstrated that current procedures for assessing preoperative cardiac risk often lead to unnecessary referrals and diagnostic testing with little impact on patient outcomes.<sup>4</sup> More data is needed to understand how preoperative troponin screening can be used to better risk stratify cardiovascular health beyond the American College of Cardiology risk strata in patients undergoing urologic procedures. Unfortunately, we do not perform preoperative screening at our institution and did not include them in our prospective cohort study.

Lastly, it is unclear how to utilize the results of a positive screening troponin. Although the MANAGE trial showed a reduction in major vascular complications after non-cardiac surgery in patients' placed on anticoagulation<sup>5</sup>; the POISE trial

demonstrated no benefit to anti-platelet therapy in reducing mortality in patients' undergoing major non-cardiac surgery.<sup>6</sup> In our own institutional practice, we chose to simply initiate a referral to cardiology in the form of an inpatient consult. We have completed the one-year screening trial in our department and look forward to sharing our results with the urologic community later this year.

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## References

1. Bartels K, Karhausen J, Clamby ET, Grenz A, Eltzschig HK. Perioperative organ injury. *Anesthesiology*. 2013;119:1474–1489.
2. Botto F, Alonso-Coello P, Chan MT, et al. Myocardial injury after noncardiac surgery: a large, international, prospective cohort study establishing diagnostic criteria, characteristics, predictors, and 30-day outcomes. *Anesthesiology*. 2014;120:564–578.
3. Devereaux PJ, Chan MT, Alonso-Coello P, et al. Association between postoperative troponin levels and 30-day mortality among patients undergoing noncardiac surgery. *JAMA*. 2012;307:2295–2304.
4. Almassi N, Ponziano M, Goldman HB, Klein EA, Stephenson AJ, Krishnamurthi V. Reducing overutilization of preoperative medical referrals among patients undergoing radical cystectomy using an evidence-based algorithm. *Urology*. 2018;114:71–76.
5. Devereaux PJ, Duceppe E, Guyatt G, et al. Dabigatran in patients with myocardial injury after noncardiac surgery (MANAGE): an international, randomised, placebo-controlled trial. *Lancet*. 2018;391:2325–2334.
6. Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in patients undergoing noncardiac surgery. *N Engl J Med*. 2014;370:1494–1503.

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