EDITORIAL

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Postoperative troponin surveillance: A diagnostic dilemma

A MAJOR GOAL of perioperative medicine is to prevent, detect, and treat postoperative complications—in particular, cardiovascular complications. In the Perioperative Ischemic Evaluation (POISE) study,[1] the 30-day mortality rate was four times higher in patients who had a perioperative myocardial infarction (MI) than in those who did not.[1] Yet fewer than half of patients who have a postoperative MI have ischemic symptoms, suggesting that routine monitoring of cardiac biomarkers could detect these events and allow early intervention.

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From 10% to 20% of patients have troponin elevations after noncardiac surgery.[2] But until recently, many of these elevations were thought to be of minor importance and were ignored unless the patient met diagnostic criteria for MI. A new entity called MINS (myocardial injury after noncardiac surgery)[3] was defined as a troponin level exceeding the upper limit of normal with or without ischemic symptoms or electrocardiographic changes and excluding noncardiac causes such as stroke, sepsis, and pulmonary embolism. Because elevations of troponin at any level have been associated with increased 30-day mortality rates, the question of the value of routine screening of asymptomatic postoperative patients for troponin elevation has been raised.

In this issue of *Cleveland Clinic Journal of Medicine*, Horr et al[4] review the controversy of postoperative screening using troponin measurement and propose an algorithm for management.

doi:10.3949/ccjm.82a.15113

QUESTIONS TO CONSIDER

Before recommending screening asymptomatic patients for troponin elevation, we need to consider a number of questions:

- Which patients should be screened?
- How should troponin elevations be treated?
- Would casting a wider net improve outcomes?
- What are the possible harms of troponin screening?

The bottom line is, will postoperative troponin screening change management and result in improved outcomes?

Postoperative troponin elevations are linked to bad outcomes, but should we screen everyone?

WHICH PATIENTS SHOULD BE SCREENED?

Why routine screening may be indicated

Elevated or even just detectable troponin levels are associated with adverse outcomes. A systematic review and meta-analysis of 3,318 patients[2] demonstrated that high troponin levels after noncardiac surgery were independently associated with a risk of death three times higher than in patients with normal troponin levels.

In the Vascular Events in Noncardiac Surgery Patients Cohort Evaluation (VISION) study,[5] troponin T was measured in 15,133 patients after surgery. The overall mortality rate was 1.9%, and the higher the peak troponin T level the higher the risk of death.

In a single-center Canadian retrospective cohort analysis of 51,701 consecutive patients by Beattie et al,[6] the peak postoperative level of troponin I improved the ability of a multivariable model to predict the risk of death. As in the VISION study, the mortality rate rose with the troponin level.[6]

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In a study by van Waes et al[7] in 2,232 consecutive noncardiac surgery patients over age 60 at intermediate to high risk, the all-cause mortality rate was 3%, and troponin I was elevated in 19% of patients. As in VISION and the Canadian retrospective study, the mortality rate increased with the troponin level.

Why routine screening may not help

In VISION,[5] the probability of detecting myocardial injury was three times higher if patients were screened for 3 days after surgery than if they were tested only if clinical signs or symptoms indicated it.

However, in deciding whether to screen troponin levels in postoperative patients, we must take into account the patient's clinical risk as well as the risk of the surgical procedure. Troponin elevation in low-risk patients is associated with a low mortality rate, and troponin elevations often are secondary to causes other than myocardial ischemia. In the study by van Waes et al,[7] the association was stronger with all-cause mortality than with myocardial infarction, and in VISION[5] there were more nonvascular deaths than vascular deaths, suggesting that troponin elevation is a nonspecific marker of adverse events.

Lacking evidence, we can only speculate whether troponin screening helps or harms

Beattie et al[6] found that the probability that a patient's postoperative troponin level would be elevated increased as the patient's clinical risk increased, but the yield was very low and the mortality rate was less than 1% in patients in risk classes 1 through 3 (of a possible 5 classes). In risk class 4, troponin I was elevated in 21.8%, and the mortality rate was 2.5%; in risk class 5 troponin I was elevated in 18.6%, and the mortality rate was 11.9%. Analyzing the data according to the type of surgery, mortality rates were highest in patients undergoing vascular surgery, neurosurgery, general surgery, and thoracic procedures, with all-cause mortality rates ranging from 2.6% to 5.2%.[6]

Screening should depend on risk

If postoperative troponin screening is to be recommended, it should not be routine for all patients but should be restricted to those with high clinical risk and those undergoing high-risk surgical procedures.

Rodseth and Devereaux[8] recommended routine postoperative troponin measurement not only after vascular surgery, but also after high-risk surgery (general, neurosurgery, emergency surgery), as well as in patients over age 65 and patients with established atherosclerotic disease or risk factors for it. However, I believe this latter group may not be at high enough risk to justify routine screening.

Beattie et al[6] advocated limiting postoperative troponin screening to patients with at least a moderate risk of MI and also suggested an international consensus conference to define criteria for postoperative MI, populations who should have routine postoperative screening, and consensus on treatment of patients with troponin elevations but not meeting the criteria for MI. Without this consensus on treatment, it is unclear if protocols for universal postoperative screening would improve outcomes.

For these reasons, the 2014 joint guidelines of the American College of Cardiology and American Heart Association[9] (ACC/AHA) stated that the benefit of postoperative screening of troponin levels in patients with a high perioperative risk of MI but no signs or symptoms of myocardial ischemia or MI is "uncertain in the absence of established risks and benefits of a defined management strategy." This recommendation was given a class IIb rating (may be considered) and level of evidence B (usefulness or efficacy less well established). On the other hand, the guidelines recommend measuring troponin levels if signs or symptoms suggest myocardial ischemia or MI (class I recommendation, level of evidence A) but state there is no benefit in routine screening of unselected patients without signs or symptoms of ischemia (class III recommendation, level of evidence B).

HOW SHOULD ELEVATIONS BE TREATED?

Because a troponin elevation in a patient without signs or symptoms of ischemia does not predict a specific type of death, physicians need to treat patients individually. Perioperative ischemia and inflammation could lead to injury of other organs, and death could result from multiorgan injury rather than from myocardial injury. Treating these troponin elevations in the same way we treat MI—ie, with antiplatelet therapy and anticoagulation—

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may result in increased bleeding or unnecessary cardiac catheterization, and starting beta-blockers in the perioperative period may be harmful. Because it is unclear how to manage these patients, cardiac medications have not routinely been given in previous studies.

POISE provided some evidence that patients with postoperative MI who were given aspirin and a statin did better.[1] And the results of a smaller study[10] suggested that intensification of drug therapy (aspirin, statin, beta-blocker, angiotensin-converting enzyme inhibitor) in patients with postoperative troponin I elevations was associated with improved outcomes at 1 year. If the bleeding risk is low, I believe that there is potential benefit in prescribing aspirin and statins for these patients.

CASTING A WIDER NET

Further complicating matters in the near future is the issue of using fifth-generation high-sensitivity troponin T assays. The European Society of Cardiology guidelines[11] are somewhat more liberal than the ACC/AHA guidelines, stating that measuring high-sensitivity troponin after surgery "may be considered in high-risk patients to improve risk stratification." This is a class IIB recommendation, level of evidence B.

With fifth-generation high-sensitivity troponin assays, troponin may be elevated in as many as 20% of patients preoperatively and 40% postoperatively, significantly increasing the number of patients said to have a complication. Besides potentially subjecting these patients to unproven treatments, such results would give the false impression that hospitals and surgeons using the screening tools actually had higher complication rates than those that did not screen.

POSSIBLE HARMS OF SCREENING

Elevated postoperative troponin may identify patients at higher risk of any adverse event but not specifically of cardiac-specific events. In an editorial, Beckman[12] stated that routine measurement of troponin "is more likely to cause harm than to provide benefit and should not be used as a screening modality" because of the lack of a proven beneficial treatment strategy, because of the possible harm from applying the standard treatment for type 1 MI, and because it could divert attention from a true cause of an adverse event to a false one—ie, from a nonvascular condition to MI.[11]

There is clearly a need for clinical trials to determine which treatment, if any, can improve outcomes in these patients, and several trials have been started. But until we have evidence, we can only speculate as to whether screening postoperative patients for troponin elevation is beneficial or detrimental.

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