

EDITORIAL COMMENT

Prior Coronary Revascularization and Risk of Noncardiac Surgery*

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The prevalence of cardiovascular disease and the number of noncardiac surgical procedures performed are progressively increasing in the United States fueled by an aging population (1). Given the high prevalence of coronary artery disease (CAD), patients with CAD and prior percutaneous coronary intervention (PCI) frequently undergo noncardiac surgery. Optimal pre-operative evaluation and management of these patients requires a thoughtful, evidence-based approach. In general, these patients, like every patient scheduled to undergo noncardiac surgery, should have a comprehensive assessment of the risk of a perioperative cardiac event as an important step in reducing perioperative morbidity and mortality. The perioperative evaluation should be a multidisciplinary effort with good communication between the patient, primary care physician, anesthesiologist, cardiologist, and surgeon. It starts with a careful history, physical examination, review of appropriate laboratory data, and baseline electrocardiogram. In particular, the focus is to identify active cardiac conditions that may have developed in the months preceding noncardiac surgery. The overall goal of appropriate pre-operative evaluation and therapy in these individuals with established CAD is not only to improve immediate periprocedural outcomes but also to improve the long-term clinical outcome.

Given these goals, it should be noted that routine stress testing is not indicated in individuals with prior PCI undergoing noncardiac surgery solely because of

the surgery if there is no other clinical indication for testing. Routine screening with noninvasive stress testing is actually a class III indication in the current guidelines (2) and is not considered useful for patients at low risk for noncardiac surgery. Stress testing is recommended as a class IIb for patients with an increased risk and unknown functional capacity to assess for functional capacity if it might change management.

In this issue of *JACC: Cardiovascular Interventions*, Armstrong et al. (3) sought to assess whether incomplete coronary revascularization among patients with CAD and prior PCI is associated with a higher risk of major adverse cardiovascular events and myocardial infarction (MI) among patients undergoing noncardiac surgery. Not surprisingly, the authors show that incomplete revascularization among patients with CAD is associated with an increased risk of MI after noncardiac surgery. It is important to point out that there were several important differences in the baseline characteristics among the patients who had complete versus incomplete revascularization. Those having incomplete revascularization were more likely to have had a MI in the prior 6 months, more likely to have a history of congestive heart failure, more likely to have diabetes, and more likely to have a greater burden of atherosclerotic disease.

Although it is well-established that patients with CAD and prior PCI who undergo noncardiac surgery have a significantly increased risk of post-operative adverse events when compared with the general population (4), the salutary effects of coronary revascularization either complete or incomplete is questionable/unproven. Another important observation from these data is a significant time interaction, with the risk of post-operative MI being greatest among patients with incomplete revascularization who underwent noncardiac surgery within 6 weeks of the PCI. Recent MI has for many years been shown to

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be a risk marker for cardiac events after noncardiac surgery. It seems reasonable that patients post PCI should have surgery delayed for at least 6 weeks and ideally 6 months post PCI with drug-eluting stents as recommended in the current American College of Cardiology guidelines (5). It is also important to understand that the retrospective study by Armstrong et al. (3) does not prove a causal association between complete revascularization and a reduction in cardiovascular risk after noncardiac surgery. In fact, randomized data suggest otherwise. The CARP study (Coronary-Artery Revascularization before Elective Major Vascular Surgery) (6) randomly assigned patients at increased risk for perioperative cardiac complications and clinically significant CAD to undergo either revascularization or no revascularization before elective major vascular surgery. At 2.7 years after randomization, mortality in the revascularization group was 22% and in the no revascularization group 23% (relative risk, 0.98; 95% confidence interval, 0.70 to 1.37; $p = 0.92$). Within 30 days after the vascular operation, a post-operative MI, defined by elevated troponin levels, occurred in 12% of the revascularization group and 14% of the no revascularization group ($p = 0.37$). Overall, coronary artery revascularization before elective surgery did not alter the long-term outcome significantly (6). The 2014 American College of Cardiology/American Heart Association Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery (2) based on all available evidence states that it is not recommended that routine coronary revascularization be performed before noncardiac surgery exclusively to reduce perioperative cardiac events and in fact gives it a class III recommendation. The authors' suggestion that risk stratification using cardiac stress testing in a subset of patients with residual angiographic stenosis may be a way to impact post-operative morbidity by intensification of medical therapy or further revascularization before surgery is speculative. There is no evidence that in stable patients either intensifying treatment or additional revascularization (if feasible) before noncardiac surgery is beneficial, and it may possibly cause harm.

The study done by Armstrong et al. (3) should be interpreted as showing that prior CAD and recent PCI is

a marker for poorer outcomes and should not be construed as justification that patients with prior PCI and either complete or incomplete revascularization should undergo routine stress testing. Rather than performing unnecessary stress testing routinely in patients with prior PCI, every attempt should be made to use guideline-based medical therapy in the perioperative period which may include antiplatelet therapies, statins, and beta-blockers in appropriate patients. Additional studies are indicated to investigate the effects of complete or incomplete revascularization in patients with stable CAD. The ISCHEMIA trial (International Study of Comparative Health Effectiveness With Medical and Invasive Approaches) (7) will help to determine the best management strategy for higher risk patients with stable ischemic heart disease. This multicenter randomized controlled trial with a target enrollment of approximately 5,000 patients with at least moderate ischemia on stress imaging will assign patients at random to a routine invasive strategy with cardiac catheterization followed by revascularization plus optimal medical therapy or to a conservative strategy of optimal medical therapy, with catheterization and revascularization reserved for those who fail optimal medical therapy (7). This study, although not directly addressing the subset of patients undergoing noncardiac surgery, will provide important insight into optimal managements for higher risk patients with stable ischemic heart disease and at least moderate ischemia.

Finally, it is important to avoid premature discontinuation of dual antiplatelet therapy before noncardiac surgery. It is recommended to delay elective surgery for at least 6 months after the implantation of drug-eluting stents. Adherence to the American College of Cardiology/American Heart Association guidelines for cardiac risk assessment before noncardiac surgery leads to more appropriate use of pre-operative stress testing and optimal therapy while preserving a low rate of cardiac complications and is recommended (8).

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