

# Need for Elective PCI Prior to Noncardiac Surgery: High Risk Through the Eyes of the Beholder

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It has been estimated that nearly 1 million adverse cardiac events occur each year following noncardiac operations.<sup>1</sup> Having a myocardial infarction (MI) after surgery, even when the only manifestation is an isolated biomarker (ie, troponin) elevation, increases the risk of long-term death.<sup>2,3</sup> The risk of having a serious cardiac complication within 30 days of a noncardiac operation can be predicted by the number of cardiac risk factors enumerated in the Revised Cardiac Risk Index.<sup>4</sup> Patients with a Revised Cardiac Risk Index of  $\geq 2$  have a  $\geq 5\%$  risk of a serious cardiac complication and, therefore, are deemed high-risk surgical candidates.<sup>5</sup>

Two key observations gave credence to the notion that prophylactic revascularization might reduce cardiac complications after noncardiac surgery. One was a landmark angiographic study by Hertz et al, among 1000 patients with peripheral arterial disease in need of a vascular operation, that showed CAD is highly prevalent in this population, with 92% showing some form of CAD and 25% showing “surgically correctable” CAD.<sup>6</sup> The second was a retrospective subgroup analysis of 1834 patients with peripheral arterial disease enrolled in the Coronary Artery Surgery Study (CASS) registry that showed patients who underwent CABG surgery had better survival at 4 years relative to patients who were medically treated (88% versus 73%,  $P < 0.01$ ).<sup>7</sup>

These early observations were hampered by lack of randomization and standardization of medical and interventional therapies, selection bias, assessment of limited end

points by unblinded operators, and, perhaps more important, no effort to quantify the risk of delaying a potentially life-saving operation (ie, abdominal aneurysm repair).

The Coronary Artery Revascularization Prophylaxis (CARP) trial was the first randomized, multicenter study designed to assess the role of prophylactic revascularization in patients with CAD undergoing elective vascular operations.<sup>8</sup> Over 4 years of intake, 510 patients were randomized to either coronary artery prophylactic revascularization or no revascularization prior to elective vascular surgery. The power of the CARP trial, at a 2-sided  $\alpha$  level of 0.05 for the primary outcome of long-term mortality, was 90%. The CARP trial was executed at 18 US Department of Veterans Affairs medical centers, and the population included was primarily composed of men. The surgical indications were an expanding AAA in 33% or advanced lower extremity arterial occlusive disease in 67%. Among the patients assigned to a strategy of preoperative coronary artery revascularization, PCI, which involved bare-metal stents, was performed in 59% and CABG surgery was performed in 41% of the cohort. The median time from randomization to vascular surgery was 54 days in the coronary revascularization group and 18 days in the no-revascularization group ( $P < 0.001$ ). At a median time of 2.7 years following randomization, mortality was 22% in the revascularization group and 23% in the no-revascularization group ( $P = 0.92$ ; with relative risk of 0.98 and a 95% confidence interval of 0.70 to 1.37). Within 30 days following vascular surgery, mortality was 3.1% in the coronary revascularization group and 3.4% in the no-revascularization group ( $P = 0.87$ ). MI, defined by a rise and fall of a cardiac biomarker following vascular surgery, occurred in 11.6% of the revascularization group and 14.3% of the no-revascularization group ( $P = 0.37$ ). The main conclusion of the CARP trial was that among patients undergoing elective vascular surgery, a strategy of preoperative coronary artery revascularization prior to elective vascular surgery does not improve short- or long-term clinical outcomes.

The Dutch Echocardiographic Cardiac Risk Evaluation Applying Stress Echocardiography (DECREASE-V) pilot study assessed the role of prophylactic revascularization prior to high-risk vascular surgery in patients with extensive myocar-

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dial ischemia. At 1 year after vascular surgery, the composite of death or MI was 49% in the coronary revascularization group and 44.2% in the no-revascularization group ( $P=0.48$ ).<sup>9</sup> Taken together, these studies suggest that prophylactic revascularization is not effective when performed for the sole purpose of reducing cardiac complications after vascular surgery.

In the current issue of the *Journal of the American Heart Association*, Muthappan et al present data from the Blue Cross Blue Shield of Michigan Cardiovascular Consortium (BMC2) registry regarding the use of prophylactic PCI prior to noncardiac surgery.<sup>10</sup> The take-home messages of this paper are as follows: (1) a small percentage ( $\approx 4\%$ ) of patients undergoing elective PCI in this data set do so for the sole, unproven purpose of reducing surgical risk; (2) in general, these patients are more likely to have multiple comorbid conditions and to receive a bare-metal stent relative to patients who receive PCI for other reasons; and (3) the in-hospital unadjusted major adverse event rate was 3.3% when PCI was performed prior to noncardiac surgery and 2.31% when PCI was performed for other indications ( $P<0.01$ ).

Several important questions need to be addressed to interpret the findings of the present study. What was the surgical procedure that followed the index PCI? The authors refer to high-risk noncardiac surgery throughout the manuscript but provide no information regarding the types of surgery or the Revised Cardiac Risk Index. What was the mean delay between the PCI procedure and the surgery? Time from stent to surgery was correlated with MACE in a cohort study involving 28 029 veterans undergoing a noncardiac operation within 24 months of a PCI procedure,<sup>11</sup> with the highest event rate reported when surgery was performed within 6 weeks of PCI (11%) and the lowest when surgery was performed beyond 12 months (3.5%). How many diagnostic coronary angiograms were performed as part of the workup for high-risk noncardiac surgery and, of that group, how many proceeded to prophylactic bypass surgery? Why, in light of current evidence to the contrary, did the operators agree to perform diagnostic coronary angiography and, once the disease was defined, proceed with elective PCI prior to surgery? Because the authors excluded patients with recent MI, cardiac arrest, and/or shock, and considering that the prevalence of an unprotected left main coronary artery stenosis was only 3% in the PCI group, one has to wonder why the decision to proceed with PCI prior to elective noncardiac surgery seemed so compelling in these patients. High-risk subsets of patients, including anatomic risks with a left main stenosis and clinical risks with unstable angina, were excluded from the CARP trial, but registry data suggest that revascularization may be appropriate prior to the reference vascular operation.<sup>12</sup> A subgroup analysis of

the CARP trial also showed that patients with large anterior wall ischemia undergoing open AAA repair might benefit from prophylactic revascularization, but more data are needed.<sup>13</sup> It should be noted that open AAA surgery has been largely replaced by endovascular repairs in the United States and is associated with decreased risk of perioperative death.<sup>14</sup>

Finally, the fact that only 4% of PCIs were performed for this reason may seem reassuring to the authors, but the fact that there was no change in behavior between 2003 and 2009—at a time when the results of 2 randomized controlled trials and a revision of the guidelines advocated for fewer procedures—is concerning. A more important question is how often providers believe that elective noncardiac surgeries should be preceded by a coronary revascularization procedure when the overwhelming evidence suggests that the intervention will not modify perioperative risk but will delay and possibly prevent the needed operation. If outcome therapy is deemed important, perhaps fewer PCIs prior to high-risk noncardiac surgery can be viewed as the goal.

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## Disclosures

None.

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