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Cardiac biomarker levels strongly predict outcome of bypass surgery

Marker levels less useful for post-procedure heart attack diagnosis, current diagnostic standards may need reconsideration

Levels of a biomarker used in the diagnosis of heart attacks are almost universally elevated in patients who have undergone coronary-artery bypass grafting (CABG) and, when markedly elevated, are powerfully prognostic, a team of researchers from the Massachusetts General Hospital (MGH) Heart Center has found. Their report implies that, while measurement of cardiac troponin T (cTnT) can help determine patient prognosis, current consensus recommendations regarding the use of cTnT to diagnosis post-CABG heart attack (myocardial infarction) probably should be reconsidered. The paper appears in the September 8 issue of *Circulation* and has been released online,

"Although postoperative concentrations of cTnT were powerfully predictive of the risk of complications and death after CABG, we found the currently recommended cut-points for diagnosing myocardial infarction are far too low," says James Januzzi, MD, director of the MGH Cardiac Intensive Care Unit, the study's senior author. "But use of cTnT to predict overall postoperative risk does look very promising."

Patients recovering from bypass surgery, in which blood supply to the heart muscle is rerouted around one or more blocked coronary arteries, are at risk for a number of postoperative complications, including heart attack. Current standards for the diagnosis of post-operative myocardial infarction include consideration of symptoms such as chest pain, electrocardiogram changes and the results of biomarker tests. However, since patients recovering from cardiac surgery inevitably experience chest pain and the results of postoperative electrocardiograms are often unclear, clinicians may heavily rely on biomarkers like cTnT to diagnose post-CABG heart attacks.

An earlier study of the prognostic role of cTnT in cardiac surgery patients found that extreme elevations of the enzyme strongly predicted the risk of complications and death in the year following surgery. But that study examined a mixture of post-cardiac-surgery patients and also did not consider diagnostic guidelines outlined in a 2007 consensus statement from four organizations, including the American Heart Association and the American College of Cardiology.

The current study was designed to specifically evaluate the usefulness of cTnT in the diagnosis of post-CABG heart attack and to examine factors associated with postoperative cTnT elevation and how well cTnT levels predicted postoperative complications in general. Measurements of cTnT levels were taken from almost 850 CABG patients immediately after their procedures and 6, 8, 18 and 24 hours later. Those levels were then analyzed based on several factors related to the patients' original illness, surgery, and short- and long-term outcomes.

The results indicated that cTnT levels were elevated in virtually all post-CABG patients, although only 2 percent actually met postoperative myocardial infarction criteria. Factors predicting cTnT elevation included the complexity of the initial coronary artery blockages, the number of grafts that were placed and the patients' immediate postoperative condition. While the near-universality of cTnT elevation made it a less useful indicator of heart attack, cTnT levels 10 times higher than the current consensus guidelines powerfully and independently predicted the risk of death and other postoperative complications, adding to the predictive power of risk-scoring models such as that developed by the Society for Thoracic Surgery.

"These findings imply that the diagnosis of regional post-CABG myocardial infarction should continue to be based largely on clinical judgment and angiographic demonstration of postoperative closure of a bypass graft, which is fortunately a rare situation," says Januzzi, who is an associate professor of Medicine at Harvard Medical School. "On the other hand, excessive diffuse myocardial injury – as reflected by significant cTnT elevation – may be more common than suspected; and cTnT does an excellent job of identifying those patients destined for complication in the postoperative period. This makes a strong case that troponin testing should be incorporated into overall post-CABG risk assessment, independent of its use for MI diagnosis."

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Sandy Green, MD, and Rene Quiroz, MD, MGH Cardiology; and Arvind Agnihotri, MD, MGH Cardiac Surgery. Support for the study included grants from the Dennis and Marilyn Barry Fund for Cardiac Research, the Interuniversity Cardiology Institute of the Netherlands and the Balson Scholar Fund.

Massachusetts General Hospital (www.massgeneral.org), established in 1811, is the original and largest teaching hospital of Harvard Medical School. The MGH conducts the largest hospital-based research program in the United States, with an annual research budget of almost \$550 million and major research centers in AIDS, cardiovascular research, cancer, computational and integrative biology, cutaneous biology, human genetics, medical imaging, neurodegenerative disorders, regenerative medicine, systems biology, transplantation biology and photomedicine.
