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Editorial

Outcome After Cardiac Surgery: The Devil Is in the Details

Cardiac surgery entails sick patients undergoing major operations. Numerous preoperative, intraoperative, and postoperative factors profoundly influence outcome after cardiac surgery in complex ways (Table 1).[1-5] Furthermore, cardiac surgery is associated with unique postoperative morbidities not found after noncardiac surgery, mostly from use of cardiopulmonary bypass (Table 1). Traditionally, mortality rates (usually at 30 days) for all surgical procedures (noncardiac and cardiac) have been used to evaluate numerous things: the procedure itself, surgeon, hospital, etc.[6,7] More recently, 30-day mortality rates increasingly are being used in the context of value-based healthcare assessment and public reporting, providing benchmarking data to various stakeholders (patients, surgeons, hospitals, policymakers, payers) and influencing reimbursement.[6] Is this fair? The author assumes most clinicians agree that it is not. Just because a patient is alive 30 days after any surgery does not mean they are well (morbidity), nor does it predict improved long-term quality of life or survival.

In this issue of the *Journal of Cardiothoracic and Vascular Anesthesia*, Brovman et al. from Tufts Medical Center (Boston, MA) evaluated the relationship between 30-day mortality and longer-term mortality in cardiac surgical patients.[8] Using the Centers for Medicare and Medicaid Limited Services Data Set National Database, they retrospectively assessed 37,036 patients who underwent isolated coronary artery bypass grafting (CABG) at 394 different hospitals between April 1, 2016, and March 31, 2017 (one year). Hospitals reporting fewer than 50 cases during this period were excluded to limit potential bias due to low surgical volume. Mortality was reported for each patient at 30, 60, and 90 days, and at one year. Each hospital's mortality percentile was calculated at the four points. Regarding hospitals in the top quartile at 30 days, only roughly half remained there at one year. Similarly, regarding hospitals in the bottom quartile at 30 days, only roughly half remained there at one year.

The few strengths of this analysis are obvious: large number of patients, single procedure type, numerous hospitals, and avoidance of low surgical volume hospitals. The numerous weaknesses of this analysis are just as obvious: retrospective analysis of a limited administrative database,[9] no preoperative risk assessment, no information on use/non-use of cardiopulmonary bypass, no postoperative morbidity assessment, and no postoperative hospital readmission assessment. However, the data presented seemed to indicate that when comparing hospitals' performance of isolated CABG, 30-day mortality rates only are correlated poorly (if at all) to one-year mortality rates. This really comes as no surprise. Abundant literature exists supporting the notion that "early" morbidity/mortality does not correlate with "late" morbidity/mortality after numerous types of noncardiac and cardiac surgery.[5,10-13]

What is fascinating in the presented data, the authors did not even address. They initially assessed 53,730 patients/1,154 hospitals yet appropriately excluded hospitals reporting fewer than 50 cases/year to limit potential bias due to low surgical volume, leaving the 37,036 patients/394 hospitals analyzed. The number of low surgical volume hospitals excluded is staggering: 760 hospitals, performing 16,694 isolated CABG surgeries.

The clear relationship between surgeon/hospital volume and outcome after cardiac surgery has been known for quite some time.[14-20] Recently published very large database analyses clearly indicated a strong relationship between surgeon/hospital volume and morbidity, mortality, hospital length-of-stay, cost, and 30-day readmission rate in patients undergoing CABG.[14,15] The hospital volume threshold appeared to be somewhere between 50 and 100 CABG operations annually, and currently it is estimated that about a third of all CABG surgery performed in the United States are in such low-volume hospitals.[15] These facts support policies regionalizing CABG at high-volume hospitals and likely extend to more complex cardiac surgeries as well (valve surgery, heart/lung transplant, mechanical assistance, etc.).[14]

Brovman et al. are to be congratulated for providing additional evidence that "early outcome" (however defined) after cardiac surgery does not predict "late outcome" (however defined). Clearly, using 30-day mortality rates to assess hospitals' quality of perioperative cardiac surgical care and

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Table 1
Factors Influencing Outcome After Cardiac Surgery

Preoperative Factors
Age/sex/body habitus
Patient risk profile
Medications
Coexisting disease
Previous surgeries
Elective versus emergent
Intraoperative factors
Procedure performed
Quality of procedure performed
Surgeon
Use/non-use of cardiopulmonary bypass
Cardiopulmonary bypass time
Blood product usage
Postoperative factors
Neurologic dysfunction
Cardiac dysfunction
Hemodynamic abnormalities
Atrial fibrillation
Pulmonary dysfunction
Renal dysfunction
Bleeding abnormalities
Perioperative factors
Hospital Annual Volume

influence reimbursement is simplistic and inappropriate. Some even have implied that "gaming" of the system occurs, such as delaying decisions to withdraw life-sustaining therapies to influence reimbursement.[10] Outcome after cardiac surgery is influenced by numerous factors and those listed in the table only scratch the surface. Clearly, surgeon volume/hospital volume profoundly influences outcome after cardiac surgery, yet, literally, thousands of cardiac surgeries are being performed by low-volume centers every year in the United States. Perhaps it is time to somehow influence (as always, through reimbursement) regionalizing cardiac surgery procedures at high-volume hospitals to improve outcome (thus, ultimately decreasing cost) instead of assessing quality of care and distributing reimbursement through crude, simplistic 30-day mortality rates.

Declaration of Competing Interest

None

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