See Article page 1890.

Commentary: The high cost of low output

Derek Serna-Gallegos, MD, and Ibrahim Sultan, MD

Postcardiotomy low cardiac output syndrome has been shown to affect all cardiac surgical procedures and is associated with significant morbidity and mortality. Much effort has been made to attempt to identify these patients preoperatively to improve outcomes or to avoid the syndrome altogether. Most previous studies have focused on low cardiac output syndrome after an isolated procedure at a single institution.¹⁻³ Duncan and colleagues⁴ evaluate postcardiotomy low cardiac output syndrome in a large administrative dataset using the Premier database. Low cardiac output syndrome was defined as the need for mechanical circulatory support during or within 5 postoperative days or hemodynamic instability requiring continued pharmacologic support with ≥ 2 inotropic medications on postoperative day 1. The goal of this study was 2-fold: first they set out to provide guidance on the identification of patients at risk for postcardiotomy low cardiac output syndrome and second they attempt to evaluate the costs and resource utilization associated with this postoperative diagnosis. The authors have chosen to focus their research effort on a very important problem that has, no doubt, plagued every cardiac surgery practice since the very first operations were performed and they should be commended for their work.

This study, using the administrative database, identified 59,810 patients from 164 hospitals in the United States and evaluated outcomes after isolated coronary artery bypass grafting (CABG), CABG and aortic valve replacement

Derek Serna-Gallegos, MD (left), and Ibrahim Sultan, MD (right)

CENTRAL MESSAGE

Postcardiotomy low cardiac output syndrome leads to increased morbidity and mortality with higher resource utilization and increased costs.

(AVR), isolated AVR, CABG and mitral valve replacement/repair (MVR), isolated MVR or any combination valve surgery. Overall, 6067 patients (10.1%) of the entire cohort was found to have postcardiotomy low cardiac output syndrome. Incidence was highest for CABG + MVR and lowest for isolated AVR. Patient risk factors included women, age >75 years, prior cardiac surgery, greater number of comorbidities, cardiogenic shock on presentation, and heart failure present on admission. Most cardiac surgeons will not be surprised by these conclusions because many of these risk factors would immediately place the patient in a high-risk category even without formal published findings to suggest that they are high risk. However, there is value to quantifying variations in being high-risk and this study provides that type of information with the 2 extremes of incidence being isolated AVR demonstrating an incidence of 6.2% versus the 27.1% incidence of low cardiac output syndrome after CABG and MVR (with or without tricuspid/AVR). The study also demonstrates that not surprisingly, 61% of patients who died did experience low cardiac output syndrome.

Efficiency in hospital resource use has become an important topic and is the impetus for innumerable administrative efforts at hospitals across the world. Although resource utilization may not be the primary driving factor in patient care, it is nonetheless an important consideration. Postcardiotomy low cardiac output syndrome patients had a significantly higher overall and intensive care unit length of stay, higher 30-, 60-, and 90-day adjusted all-cause readmission

From the Division of Cardiac Surgery, Department of Cardiothoracic Surgery, University of Pittsburgh, Pittsburgh, Pa; and Center for Thoracic Aortic Disease, Heart and Vascular Institute, University of Pittsburgh Medical Center, Pittsburgh, Pa.

Disclosures: The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication July 4, 2020; revisions received July 4, 2020; accepted for publication July 6, 2020; available ahead of print July 15, 2020.

Address for reprints: Ibrahim Sultan, MD, Division of Cardiac Surgery, Department of Cardiothoracic Surgery, University of Pittsburgh, Center for Thoracic Aortic Disease, Heart and Vascular Institute, University of Pittsburgh Medical Center, 5200 Centre Ave, Suite 715, Pittsburgh, PA 15232 (E-mail: sultani@upmc.edu).

J Thorac Cardiovasc Surg 2022;163:1899-900

0022-5223/\$36.00

Copyright © 2020 by The American Association for Thoracic Surgery

<https://doi.org/10.1016/j.jtcvs.2020.07.027>

rates leading to higher adjusted inpatient hospital costs at 30-, 60-, and 90-day follow-up. Quantifying the differences in hospital resource utilization should not necessarily lead to radical changes in patient care principles, but it is important to understand the full scope of what it takes to care for these patients.

Use of an administrative database has several inherent limitations, particularly in a study such as this where comorbidities and other patient characteristics are of paramount importance. The identification of these clinical diagnoses using International Classification of Diseases-Clinical Modifications codes can be problematic and not accurately capture the exact cohort that is desired. As the authors state, only mortality within the index hospitalization is captured in the Premier database and only readmissions to the same index hospital are captured—this

could cause very inaccurate readmission data. Even after consideration of the limitations of the Premier database, this study has merit in evaluating the risk factors for postcardiotomy low cardiac output syndrome and in quantifying its hospital resource utilization profile.

References

1. Maganti M, Badiwala M, Sheikh A, Scully H, Feindel C, David TE, et al. Predictors of low cardiac output syndrome after isolated mitral valve surgery. *J Thorac Cardiovasc Surg.* 2010;140:790-6.
2. Algami KD, Maganti M, Yau TM. Predictors of low cardiac output syndrome after isolated coronary artery bypass surgery: trends over 20 years. *Ann Thorac Surg.* 2011;92:1678-84.
3. Sultan I, Habrheuer A, Wallen T, Siki M, Szeto W, Bavaria JE, et al. The role of extracorporeal membrane oxygenator therapy in the setting of type A aortic dissection. *J Card Surg.* 2017;32:822-5.
4. Duncan AE, Kartashov A, Robinson S, Randall D, Zhang K, Luber J, et al. Risk factors, resource utilization and cost of postoperative low cardiac output syndrome. *J Thorac Cardiovasc Surg.* 2022;163:1890-8.e10.

See Article page 1890.

Commentary: The high cost of low output

Rachel Eikelboom, MD,^a and
Rakesh C. Arora, MD, PhD, FRCSC^{a,b}

The lack of a universal definition of low cardiac output syndrome (LCOS) poses a significant barrier for clinicians and researchers investigating this common and highly morbid complication of cardiac surgery. Duncan and colleagues¹ present a study of the incidence, predictors, cost, and clinical implications of LCOS in adult cardiac surgery patients.

Rachel Eikelboom, MD, and Rakesh C. Arora, MD, PhD, FRCSC, FACS

CENTRAL MESSAGE

Low cardiac output syndrome after cardiac surgery is common and has poor clinical outcomes despite pharmacologic and mechanical circulatory support. We must identify high-risk patients and optimize their perioperative care.

Previous literature is largely limited to single-center and retrospective reports. Furthermore, these studies often span up to 20 years, encompassing a wide range of evolving surgical and critical care practices.

The present study is large, multicenter, and contemporary. The authors define LCOS as hemodynamic instability

From the ^aDepartment of Surgery, Max Rady College of Medicine, Winnipeg, Manitoba, Canada; and ^bCardiac Sciences Program, St Boniface Hospital, Winnipeg, Manitoba, Canada.

Disclosures: Dr Arora has received an unrestricted educational grant from Pfizer Canada Inc, and honoraria from Mallinckrodt Pharmaceuticals for work unrelated to this article. The other author reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

Received for publication Aug 12, 2020; revisions received Aug 12, 2020; accepted for publication Aug 12, 2020; available ahead of print Aug 15, 2020.

Address for reprints: Rakesh C. Arora, MD, PhD, FRCSC, Section of Cardiac Surgery, Department of Surgery, University of Manitoba, St Boniface General Hospital, CR3015-369 Tache Ave, Winnipeg, Manitoba R2H 2A7 Canada (E-mail: rakeshcarora@gmail.com).

J Thorac Cardiovasc Surg 2022;163:1900-1
0022-5223/\$36.00

Copyright © 2020 by The American Association for Thoracic Surgery
<https://doi.org/10.1016/j.jtcvs.2020.08.037>