

See Article page 1910.



Commentary: Sometimes less is more: The minimally invasive argument for ventricular assist devices

James A. Brown, MA,^a and Ibrahim Sultan, MD^{a,b}

Minimally invasive approaches to implanting left ventricular assist devices (LVADs) may potentially improve outcomes in patients requiring mechanical circulatory support for advanced heart failure, particularly for patients with extensive comorbidities.¹ Although conventional sternotomy continues to remain the gold standard, LVAD implantation via combined hemi-sternotomy and mini-thoracotomy has been shown to be safe and feasible, enabled by miniaturized devices such as the HeartMate 3 (Abbott, Abbott Park, Ill) and the HeartWare HVAD (Medtronic, Framingham, Mass).² However, the superiority of the minimally invasive approach has not yet been established vis-à-vis conventional sternotomy.

In this issue of the *Journal*, Jawad and colleagues³ demonstrate that the minimally invasive approach was associated with reduced postoperative bleeding and duration of hospital stay, as compared with conventional sternotomy. Moreover, in their propensity-matched cohort, there was no significant difference in survival through 2 years of follow-up. This observational study represents the largest series that explicitly compares both approaches, and it is a welcome addition to the heart failure literature.

The “minimally invasive” approach does have its advantages. By perhaps limiting surgical trauma, the minimally invasive approach appears to reduce postoperative bleeding

a-

From the ^aDivision of Cardiac Surgery, Department of Cardiothoracic Surgery, University of Pittsburgh, and ^bHeart and Vascular Institute, University of Pittsburgh Medical Center, Pittsburgh, Pa.

Disclosures: I.S. receives institutional research support from Medtronic and AtriCure. J.A.B. 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 Dec 14, 2020; revisions received Dec 14, 2020; accepted for publication Dec 15, 2020; available ahead of print Dec 25, 2020.

Address for reprints: Ibrahim Sultan, MD, Division of Cardiac Surgery, Department of Cardiothoracic Surgery, University of Pittsburgh, UPMC 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;164:1920-1
0022-5223/\$36.00

Copyright © 2020 by The American Association for Thoracic Surgery
<https://doi.org/10.1016/j.jtcvs.2020.12.070>



Ibrahim Sultan, MD, and James A. Brown, MA

CENTRAL MESSAGE

Minimally invasive VAD implantation may be associated with reduced bleeding and hospital stay, as compared with conventional sternotomy, without significant difference in short-term mortality.

and length of hospital stay. A particular strength of the study design is that anticoagulation regimens were identical for all patients and the type of implanted device was similarly distributed across each group, suggesting that the reduction in bleeding may be attributable to the operative approach itself. Mini-thoracotomy may be especially beneficial for patients with previous sternotomy, although this study was not designed to demonstrate that specific benefit. Uniquely important to heart failure surgery, the minimally invasive approach arguably mitigates the risk of right ventricular (RV) dysfunction after VAD implantation by limiting unrestricted RV distention that may arise from opening the pericardium via the median sternotomy approach.⁴ Indeed, there were nonsignificant trends toward improved rates of RV dysfunction and less severity of RV dysfunction, findings that may have been limited by sample size. However, rates of RVAD implantation were similar across each approach.

Despite these potential benefits, the study’s results should be viewed with caution. As is well known, propensity matching is only as good as the measured variables included in the algorithm. Importantly, this study was unable to measure the proportion of concomitant procedures, especially aortic valve replacement and patent foramen ovale closure. Moreover, before matching, confounding factors were disproportionately distributed across each arm of this study’s cohort. Notably, the minimally invasive group had significantly greater INTERMACS (Interagency Registry

for Mechanically Assisted Circulatory Support) scores and more off-pump VAD implantations, suggesting a lower-risk group. While mortality was similar across each group, propensity-matching methods only imperfectly overcome selection bias. Next, it must be noted that postoperative strokes were greater in the minimally invasive group, although the difference only displayed a nonsignificant trend after propensity matching. Interestingly, the matched cohort was well balanced for device type and preoperative extracorporeal membrane oxygenation, suggesting that stroke differences may be partly attributable to operative approach, although sample size may have limited the ability to detect a true difference. Admittedly, the LATERAL trial has shown comparable stroke rates for mini-thoracotomy, as compared with conventional sternotomy, although the LATERAL trial was a single-arm study and cannot therefore conclusively demonstrate superiority for neurologic outcomes after VAD implantation via thoracotomy.⁵ Finally, it is important to note that the minimally invasive approach is slightly technically more challenging than conventional sternotomy, and the majority of cases in this study were performed by 2 surgeons who have accrued extensive, early experience with the minimally invasive approach.

Thus, the generalizability of this study's findings remains uncertain.

Nevertheless, the authors should be congratulated for their work in minimally invasive techniques as well as for their well-designed, well-executed study. Minimally invasive approaches harbor significant promise, especially for the most complex patients with heart failure. In the era of increasing LVAD referrals, this is a timely study that will likely be vindicated by future prospective studies.

References

1. Kilic A, Sultan I, Yuh DD, Shah AS, Baumgartner WA, Cameron DE, et al. Ventricular assist device implantation in the elderly: nationwide outcomes in the United States. *J Card Surg*. 2013;28:183-9.
2. Saeed D, Sixt S, Albert A, Lichtenberg A. Minimally invasive off-pump implantation of HeartMate 3 left ventricular assist device. *J Thorac Cardiovasc Surg*. 2016;152:1446-7.
3. Jawad K, Sipahi F, Koziarz A, Huhn S, Kalampokas N, Albert A, et al. Less-invasive ventricular assist device implantation: a multicenter study. *J Thorac Cardiovasc Surg*. 2022;164:1910-8.e4.
4. Sultan I, Kilic A, Kilic A. Short term circulatory and right ventricle support in cardiogenic shock: ECMO, Tandem Heart, CentriMag and Impella. *Heart Fail Clin*. 2018;14:579-83.
5. McGee E Jr, Danter M, Strueber M, Mahr C, Mokadam NA, Wieselthaler G, et al. Evaluation of a lateral thoracotomy implant approach for a centrifugal-flow left ventricular assist device: the LATERAL clinical trial. *J Heart Lung Transplant*. 2019;38:344-51.