approach and should be considered in patient selection. Similarly, as demonstrated by the authors, pleural complications are expected to be higher with the RT approach.

The transcatheter aortic valve replacement (TAVR) revolution decreased significantly the rates of open isolated AVR procedures. In most centers, open AVR is currently performed in young, mainly bicuspid patients, combined with other cardiac procedures or in patients not suitable for TAVR. Isolated AVR patients amenable to minimally invasive AVR procedures will be less-often encountered, although failed TAVR patients will generate a new clientele with specific surgical challenges, especially for minimally invasive surgical approaches. Although new instrumentation such as automated knot-tying devices may facilitate RT procedures, the learning curve is steeper than with MS

and mandates careful preoperative planning and surgical expertise to ensure acceptable clinical outcomes. Randomized trials comparing minimally invasive AVR approaches to standard sternotomy are essential to assess the advantages and limitations of each technique. Bonacchi and colleagues¹ have to be congratulated for their contribution to the evolving field of AVR.

References

1. Bonacchi M, Dokollari A, Parise O, Sani G, Prifti E, Bisleri G, et al. Ministernotomy compared with right anterior minithoracotomy for aortic valve surgery. *J Thorac Cardiovasc Surg*. 2023;165:1022-32.e2.
2. Balmforth D, Harky A, Lall K, Uppal R. Is ministernotomy superior to right anterior minithoracotomy in minimally invasive aortic valve replacement. *Interact Cardiovasc Thorac Surg*. 2017;25:818-21.
3. Glauber M, Ferrarini M, Miceli A. Minimally invasive aortic valve surgery: state of the art and future directions. *Ann Cardiothorac Surg*. 2015;4:26-32.

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Commentary: Is minimally invasive cardiac surgery a Chimera?

Vicente Orozco-Sevilla, MD,^{a,b,c} and
Tomas A. Salerno, MD^d

Minimally invasive aortic valve replacement (AVR) is gaining in popularity among patients, surgeons, and referring physicians. It is unclear whether mini-sternotomy (MS) or right anterior mini-thoracotomy (MT) results in less pain, fewer transfusions, shorter hospital stays with faster

Vicente Orozco-Sevilla, MD, and Tomas A. Salerno, MD

CENTRAL MESSAGE

Although mini-sternotomy and right anterior mini-thoracotomy are gaining popularity, conventional median sternotomy remains the gold standard for any AVR procedure.

recoveries, and even lower 30-day mortality, when compared with conventional median sternotomy.^{1,2} There are currently no guidelines or recommendations to guide the surgeon in determining which approach/incision to use, ie, MS, MT, or conventional median sternotomy. The majority of cardiac surgeons and trainees have no training in, or exposure to, MS or MT. This procedure is not difficult, but it does necessitate the acquisition of new and

From the ^aDivision of Cardiothoracic Surgery, Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, Tex; ^bSection of Adult Cardiac Surgery, Department of Cardiovascular Surgery, Texas Heart Institute, Houston, Tex; ^cCHI St Luke's Health-Baylor St Luke's Medical Center, Houston, Tex; and ^dDivision of Cardiothoracic Surgery, Miller School of Medicine, University of Miami, and Jackson Memorial Hospital, Miami, Fla.

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Address for reprints: Tomas A. Salerno, MD, Division of Cardiothoracic Surgery, University of Miami School of Medicine (R-114), 1611 NW 12th Ave, Miami, FL 33136 (E-mail: tsalerno@med.miami.edu).

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specialized skills, as well as a steep learning curve. In addition, most cardiac surgeons perform a limited number of aortic valve procedures per year and may, understandably, be hesitant to change. For the aforementioned reasons, greater-volume centers continue to promote this procedure, which does not translate into regular clinical practice. There are reports in the literature as to the benefits of a less-invasive approach. Finally, conventional median sternotomy for AVR has been shown to produce excellent long-term results and remains the gold standard for any AVR procedures.³

In this issue of the *Journal*, Bonacchi and colleagues⁴ compared data from 2419 patients undergoing isolated AVR. A propensity score match was performed in patients undergoing either MS or MT from this group, with 986 patients in each group. Their findings revealed that MS was associated with shorter operative times, shorter intensive care unit and hospital stays, and lower 30-day mortality. The MS group also had better actuarial survival after 20 years of follow-up. However, given that the only variable was the incision, no plausible explanation for the difference in long-term outcomes was provided. Furthermore, MT was found to be an independent risk factor for both early- and long-term mortality. Additionally, this study found that MT was associated with longer operative times, the need for a full sternotomy, re-exploration for bleeding, increased groin complications due to femoral vessel cannulation, and decreased respiratory recovery due to pleural space violation. Despite their retrospective nature and limitations, these findings demonstrated real-world data from different centers, with surgeons who may have different volumes of AVR, experience, skills, and preferences for one or the other approach. Unfortunately, the authors did not compare conventional sternotomy results with MS and MT, despite the fact that they listed a large number of AVR performed using that method. If data were

available, it is possible that median sternotomy performed better than MS and MT. We look forward to these authors' further analysis of the aforementioned comparison. Regardless, in today's world of cardiac surgery, transcatheter aortic valve replacement (TAVR) is the true minimally invasive procedure, in which the heart-lung machine is not used.⁵ TAVR was linked to a lower risk of acute kidney injury and shorter period of hospitalization in a recent meta-analysis by Sayed and colleagues.⁶ Despite this, it was associated with greater risk of mid-term mortality and paravalvular leak. Some proponents of this method argue that the true comparison should be between MT and TAVR,⁷ but more randomized prospective controlled clinical trials are needed. This will be especially important for the surgical/interventional treatment of low-risk patients with aortic stenosis. The findings of this study could alter the approaches that a heart team can offer patients to manage aortic valvular diseases.

References

1. Hancock HC, Maier RH, Kasim A, Mason J, Murphy G, Goodwin A, et al. Mini-sternotomy versus conventional sternotomy for aortic valve replacement: a randomised controlled trial. *BMJ Open*. 2021;11:e041398.
2. Paparella D, Malvindi PG, Santarpino G, Moscarelli M, Guida P, Fattouch K, et al. Full sternotomy and minimal access approaches for surgical aortic valve replacement: a multicentre propensity-matched study. *Eur J Cardiothorac Surg*. 2020;57:709-16.
3. Di Eusanio M, Fortuna D, Cristell D, Pugliese P, Nicolini F, Pacini D, et al. Contemporary outcomes of conventional aortic valve replacement in 638 octogenarians: insights from an Italian Regional Cardiac Surgery Registry (RERIC). *Eur J Cardiothorac Surg*. 2012;41:1247-52; discussion 52-3.
4. Bonacchi M, Dokollari A, Parise O, Sani G, Prifti E, Bisleri G, et al. Ministernotomy compared with right anterior minithoracotomy for aortic valve surgery. *J Thorac Cardiovasc Surg*. 2023;165:1022-32.e2.
5. Calafiore AM, Angelini GD, Bergsland J, Salerno TA. Minimally invasive coronary artery bypass grafting. *Ann Thorac Surg*. 1996;62:1545-8.
6. Sayed A, Almotawally S, Wilson K, Munir M, Bendary A, Ramzy A, et al. Minimally invasive surgery versus transcatheter aortic valve replacement: a systematic review and meta-analysis. *Open Heart*. 2021;8:e001535.
7. Ramlawi B, Bedeir K, Lamelas J. Aortic valve surgery: minimally invasive options. *Methodist DeBakey Cardiovasc J*. 2016;12:27-32.