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EDITORIAL COMMENT

Risks and Benefits of Concomitant Tricuspid Surgery at the Time of Mitral Intervention*

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Operative repair of the tricuspid valve at time of left heart surgery remains a challenging clinical decision for surgeons. The additional operative steps may treat right heart failure at the expense of losing native cardiac conduction by injury to the atrioventricular node. For patients with moderate or less tricuspid regurgitation (TR) with concomitant mitral disease, this risk-benefit analysis is even more challenging. As a result, current practices vary by surgeon and institution with minimal evidence-based consensus.

SEE PAGE 1656

In this issue of the *Journal of the American College of Cardiology*, Iribarne et al[1] studied the risk of permanent pacemaker (PPM) implantation during isolated mitral valve repair (MVr) vs MVr with concomitant tricuspid valve annuloplasty (MVr + TA). Through a retrospective cohort study, patients who underwent MVr and MVr + TA between 2004 and 2019 in New York and California were identified and further stratified by the necessity of PPM within 90 days of the index operation. With a study size of 32,736 patients (28,003 with MVr and 4,733 with MVr + TA), this series is—to the best of our knowledge—the largest focused on PPM after mitral valve surgery (MVS). Patients with concomitant TA were found to have almost double the rate of PPM implantation (14.0% vs 7.7%). Perhaps most notably, after an average of 6.6 years of postoperative follow-up, the cohort requiring PPMs were found to have increased risk of mortality, infective endocarditis, and heart failure hospitalizations, suggesting that the clinical course after PPM implantation is not insignificant.

Prior literature has shown that concomitant TA at time of MVS is not associated with increased operative mortality.[2] Accordingly, the 2020 American College of Cardiology/American Heart Association guidelines provide a Class 1b recommendation to intervene on severe TR at time of left-sided valve surgery.[3] For patients with moderate or less severe TR, the evidence is decidedly more vague. In the recent randomized control trial by Gammie et al[4] studying 2-year outcomes after intervening on non-severe TR at the time of MVS, survival between the 2 cohorts was similar, but progression of TR was significantly lower in the MVS + TA group, although limited only to 2 years of follow-up.[4] The mortality signals reported here by Iribarne et al[1] are limited by the state data sets because the severity of both mitral and tricuspid disease is unknown. Therefore, these findings may further support existing guidelines or be contradictory to the increasing body of literature regarding interventions for nonsevere TR. Nevertheless, given the ability to prevent TR progression—and the associated morbidity and mortality of right heart failure—it is becoming increasingly common to perform concomitant TA in our surgical practice.

Mortality signal aside, the rates of PPM requirement amongst both MVS and MVS + TA cannot be ignored. Iribarne et al[1] report an incidence of PPM

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placement of nearly 8% among isolated MVS within 90 days, a rather sobering incidence rate. In the previously mentioned randomized control trial, PPM implantation at 2-year follow-up was only 2.5% among the isolated MVS group.[4] This directly highlights the difference between trial and real-world experiences, and the importance of studying both. Gammie et al[4] found a significantly higher PPM incidence in the MVS + TA cohort (14.1%); similarly, in an international registry of minimally invasive MVS, concomitant TA was found to be an independent risk factor for pacemaker implantation postoperatively (9.0% vs 5.8%).[5] Although it was reassuring to read that this risk decreased by >4% between 2004 and 2019 in the current study, the association of TA and PPM need must be appreciated by all surgeons and cardiologists.[1] Surgical volume considerations should also be noted; the incidence of PPM implantation was significantly lower in high-volume centers (>50 MVr per year), emphasizing the impact of operative factors in PPM need.[1] In our own institutional database of nearly 3,400 patients, we previously reported that the use of a mitral annuloplasty full ring prosthesis confers a higher risk of PPM when compared with band annuloplasty in patients undergoing isolated MVS.[6]

Although all patients are presumably informed about the risk of postoperative dysrhythmias and potential PPM requirement, the associated morbidity and mortality afforded by the need for PPM remains poorly understood. Iribarne et al[1] showed PPMs to be associated with a higher long-term mortality risk, incidence of infective endocarditis, and more heart failure hospitalizations. In a study of Medicare beneficiaries who underwent isolated tricuspid valve surgery, PPM implantation was associated with a higher risk of heart failure readmission, but no differences were seen with regard to mortality or endocarditis.[7] To further complicate the picture, intracardiac pacemaker and cardioverter-defibrillator leads have been shown to impact TR severity, leading to further hemodynamic and clinical consequences.[8] Ultimately, it remains unknown if PPM is a cause or rather a surrogate of increased mortality in this population, but the signal described by the authors is noteworthy.

The current authors successfully and elegantly highlight the dilemma faced by cardiothoracic surgeons when faced with the opportunity to treat tricuspid disease at time of mitral surgery. Ultimately, randomized controlled trials and long-term follow-up are required to fully balance the benefit of TR reduction with the risk of complications such as postoperative PPM necessity. These important future findings will certainly inform preoperative discussions with patients, interdisciplinary medical decision-making, and surgical practice worldwide.

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REFERENCES

1. Iribarne A, Alabbadi SH, Moskowitz AJ, et al. Permanent pacemaker implantation and long-term outcomes of patients undergoing concomitant mitral and tricuspid valve surgery. *J Am Coll Cardiol*. 2024;83(17):1656–1668.

2. Badhwar V, Rankin JS, He M, et al. Performing concomitant tricuspid valve repair at the time of mitral valve operations is not associated with increased operative mortality. *Ann Thorac Surg*. 2017;103:587–593. https://doi.org/10.1016/j.athoracsur.2016.06.004

3. Writing Committee Members, Otto CM, Nishimura RA, et al. 2020 ACC/AHA guideline for the management of patients with valvular heart disease: A report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2021;77:e25–e197. https://doi.org/10.1016/j.jtcvs.2021.04.002

4. Gammie JS, Chu MWA, Falk V, et al. Concomitant tricuspid repair in patients with degenerative mitral regurgitation. *N Engl J Med*. 2022;386:327–339. https://doi.org/10.1056/NEJMoa2115961

5. Faerber G, Berretta P, Nguyen TC, et al. Pacemaker implantation after concomitant tricuspid valve repair in patients undergoing minimally invasive mitral valve surgery: results from the Mini-Mitral International Registry. *JTCVS Open*. 2023;17:64–71. https://doi.org/10.1016/j.xjon.2023.10.036

6. Helmers MR, Shin M, Iyengar A, et al. Permanent pacemaker implantation following mitral valve surgery: a retrospective cohort study of risk factors and long-term outcomes. *Eur J Cardiothorac Surg*. 2021;60:140–147. https://doi.org/10.1093/ejcts/ezab091

7. Kassab J, Harb SC, Desai MY, et al. Incidence, risk factors, and outcomes associated with permanent pacemaker implantation following tricuspid valve surgery. *J Am Heart Assoc*. 2024;13:e032760. https://doi.org/10.1161/JAHA.123.032760

8. Chang JD, Manning WJ, Ebrille E, Zimetbaum PJ. Tricuspid valve dysfunction following pacemaker or cardioverter-defibrillator implantation. *J Am Coll Cardiol*. 2017;69:2331–2341. https://doi.org/10.1016/j.jacc.2017.02.055

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