

See Article page 125.



Commentary: Should prophylactic tricuspid annuloplasty be routinely performed? If so, how? The jury is still out

Simon C. Y. Chow, FRCS, and Song Wan, MD, FRCS

Most surgeons no longer leave moderate or greater functional tricuspid regurgitation (FTR) untreated while they are dealing with left-sided valve pathologies. Nonetheless, despite the growing interest and a burgeoning body of evidence, significant knowledge gaps exist regarding the etiology, mechanisms, and appropriate treatment of FTR. Opinion leaders in the field of reconstructive valve surgery, Dreyfus and colleagues¹ first highlighted the importance of ongoing tricuspid annular dilatation and progressive FTR after successful mitral valve repair. Yet controversy remains some 16 years later over the indication, or annular diameter threshold, for concomitant tricuspid annuloplasty (TA) during mitral valve surgery, especially in cases with no or less-than-moderate FTR.

Dreyfus and colleagues² summarize data from 441 patients undergoing mitral valve repair for degenerative mitral regurgitation with stringent adherence to guideline-directed FTR management. Patients with a tricuspid annular diameter ≥ 40 mm ($n = 234$), regardless of the severity of TR (71% with no or mild TR, 27% with moderate TR, and 2% with severe TR), underwent TA. The overall postoperative 10-year incidence of moderate-or-greater TR was 7.1% (whereas in the groups with vs without TA the rate was 4% and 10%, respectively). No short- or long-term intergroup survival differences were observed. Their findings underscore 2 opposing views. On 1 hand, the addition of TA does not increase the risk of perioperative mortality.

From the Division of Cardiothoracic Surgery, Department of Surgery, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong, China.

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.

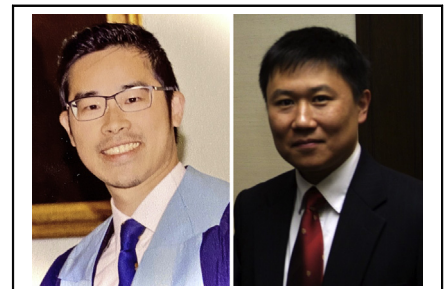
Received for publication Aug 4, 2021; revisions received Aug 4, 2021; accepted for publication Aug 6, 2021; available ahead of print Aug 26, 2021.

Address for reprints: Song Wan, MD, FRCS, Division of Cardiothoracic Surgery, Department of Surgery, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong, China (E-mail: swan@surgery.cuhk.edu.hk).

JTCVS Open 2021;7:139-40
2666-2736

Copyright © 2021 The Author(s). Published by Elsevier Inc. on behalf of The American Association for Thoracic Surgery. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

<https://doi.org/10.1016/j.xjon.2021.08.010>



Simon C. Y. Chow, FRCS, and Song Wan, MD, FRCS

CENTRAL MESSAGE

In patients undergoing mitral operation with no or mild functional tricuspid regurgitation, using an annular diameter ≥ 40 mm as an indication of concomitant tricuspid annuloplasty remains controversial.

On the other hand, the incidence of late significant TR remains low in patients with unrepaired mild TR. Similarly, Chikwe and colleagues³ found that in patients with mild-or-less TR and a mean tricuspid annular diameter of 35.6 mm, in the absence of concomitant TA during mitral valve repair, the freedom from moderate TR was 91% at 7 years. David and colleagues⁴ reported a concomitant TA incidence of 4.7% in 1176 patients undergoing mitral repair. In those with no preoperative TR, the subsequent development of moderate TR occurred in only 11.5% of patients over a 15-year follow-up period.⁴ In patients undergoing mitral repair with mild-or-less TR and a mean tricuspid annular diameter of 33.8 mm, McCarthy and colleagues⁵ reported an 8% incidence of progression to moderate-or-greater TR at 4 years of postoperative follow-up. In this context, does a 6% difference in TR progression rate at 10 years justify prophylactic TA in patients with no or mild TR and an annular diameter of 40 mm? Considering the poor prognosis of significant TR and the high operative risk of repeated tricuspid surgery, adding a low-risk prophylactic TA makes sense, although this finding is not always substantiated in other studies. Lee and colleagues⁶ recently reported that prophylactic TA in patients with mild TR during mitral repair did not confer any benefits in terms of survival or progression of TR over a mean follow-up of 9.6 years. McCarthy and

colleagues⁵ noted a greater likelihood of TR progression in patients with a tricuspid annular diameter ≥ 45 mm rather than 40 mm.

Perhaps the most important finding from the article by Dreyfus and colleagues² is the reaffirmation of the inadequacy of our understanding of the complex topic of FTR. Dreyfus acknowledged that there is uncertainty about the factors that contribute to annular dilatation in patients with FTR, and clearly factors other than the severity of TR and the annular size influence TR progression and clinical outcomes. In the authors' study population, 39% of the TA group had preoperative atrial fibrillation (AF) compared with 23% in the no-TA group.² Preoperative AF was associated with TR progression in the group with no TA, although 10% of the patients in the no-TA group underwent surgical ablation versus 23% in the TA group. Kim and colleagues⁷ found that the omission of AF ablation was associated with deterioration of TR in patients with preoperative mild TR following tricuspid repair during rheumatic mitral surgery. McCarthy and colleagues⁵ confirmed that the presence of preoperative AF predicted a higher likelihood of TR progression even with a successful surgical ablation rate of 87% during follow-up. The real influence of comorbid AF on TR progression remains to be determined. The lack of data on right heart function and physiology in most studies also adds to the incompleteness of our understanding of FTR.

Finally, the selection of a tricuspid annuloplasty ring and its appropriate size may also be a critical factor affecting long-term clinical outcomes.⁸ In the study presented by Dreyfus and colleagues,² a Carpentier-Edwards classic tricuspid ring with a mean size of 32 mm was used. However, a recent US trial recommended using an undersized (ie, 26 mm or 28 mm) rigid nonplanar annuloplasty ring.⁹ Whether such an approach can safely improve repair durability, particularly in the setting of tricuspid annular dilatation without significant regurgitation, or whether it would potentially lead to a relatively high pacemaker implantation rate (eg, 10%⁹-14.7%¹⁰), certainly deserves further investigation.

Obviously, it will take more than a retrospective analysis to change contemporary practice. It is worth emphasizing that the addition of tricuspid repair is not as benign as is advocated, and is associated with longer durations of cardiac ischemia and pump run, as well as higher rates of pacemaker implantation.^{9,10} We eagerly await the results of the ongoing randomized Cardiothoracic Surgical Trials Network trial, which should provide further important guidance. At this point, the management of TR in patients with less-than-moderate FTR during mitral surgery should be individualized, and treatment decisions should consider the multiple risk factors of TR progression, including, but not limited to, tricuspid annular diameter.

References

1. Dreyfus GD, Corbi PJ, Chan KM, Bahrami T. Secondary tricuspid regurgitation or dilatation: which should be the criteria for surgical repair? *Ann Thorac Surg.* 2005;79:127-32.
2. Dreyfus GD, Essayagh B, Benfari G, Dulguerov F, Haley SR, Dommer C, et al. Outcome of consistent guideline-based tricuspid management in patients undergoing degenerative mitral regurgitation correction. *J Thorac Cardiovasc Surg Open.* 2021;7:125-38.
3. Chikwe J, Itagaki S, Anyanwu A, Adams DH. Impact of concomitant tricuspid annuloplasty on tricuspid regurgitation, right ventricular function, and pulmonary artery hypertension after repair of mitral valve prolapse. *J Am Coll Cardiol.* 2015;65:1931-8.
4. David TE, David CM, Fan CS, Manlihot C. Tricuspid regurgitation is uncommon after mitral valve repair for degenerative diseases. *J Thorac Cardiovasc Surg.* 2017;154:110-22.
5. McCarthy PM, Szlapka M, Kruse J, Kislitsina ON, Thomas JD, Liu M, et al. The relationship of atrial fibrillation and tricuspid annular dilation to late tricuspid regurgitation in patients with degenerative mitral repair. *J Thorac Cardiovasc Surg.* 2021;161:2030-40.
6. Lee H, Jeong DS, Kim WS, Sung K, Carriere KC, Park SJ, et al. Is prophylactic tricuspid annuloplasty beneficial for degenerative mitral valve repair? *Ann Thorac Surg.* 2021;111:1502-11.
7. Kim WK, Kim SE, Yoo JS, Jung JH, Kim D-H, Kim JB, et al. Impact of valve repair on mild tricuspid insufficiency in rheumatic mitral surgery. *J Thorac Cardiovasc Surg.* June 2, 2021 [Epub ahead of print].
8. Wan S. Commentary: There is never "best," only "better". *J Thorac Cardiovasc Surg.* 2021;161:e211-2.
9. Maghami S, Ghoreishi M, Foster N, Dawood MY, Hobbs GR, Stafford P, et al. Undersized rigid nonplanar annuloplasty: the key to effective and durable repair of functional tricuspid regurgitation. *Ann Thorac Surg.* 2016;102:735-42.
10. Badhwar V, Rankin JS, He M, Jacobs JP, Furnary AP, Fazzalari FL, 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;103:587-93.