solution for our patients experiencing the ravages of isolated, severe TR.

References

1. Singh JP, Evans JC, Levy D, Larson MG, Freed LA, Fuller DL, et al. Prevalence and clinical determinants of mitral, tricuspid, and aortic regurgitation (the Framingham heart study). *Am J Cardiol*. 1999;83:897-902.
2. Topilsky Y, Maltais S, Medina Inojosa J, Oguz D, Michelena H, Maalouf J, et al. Burden of tricuspid regurgitation in patients diagnosed in the community setting. *JACC Cardiovasc Imaging*. 2019;12:433-42.
3. Mangieri A, Montalto C, Pagnesi M, Jabbour RJ, Rodés-Cabau J, Moat N, et al. Mechanism and implications of the tricuspid regurgitation: from the pathophysiology to the current and future therapeutic options. *Circ Cardiovasc Interv*. 2017;10:e005043.
4. Nath J, Foster E, Heidenreich PA. Impact of tricuspid regurgitation on long-term survival. *J Am Coll Cardiol*. 2004;43:405-9.
5. LaPar DJ, Likosky DS, Zhang M, Theurer P, Fonner CE, Kern JA, et al. Development of a risk prediction model and clinical risk score for isolated tricuspid valve surgery. *Ann Thorac Surg*. 2018;106:129-36.
6. Fukuda S, Saracino G, Matsumura Y, Daimon M, Tran H, Greenberg NL, et al. Three dimensional geometry of the tricuspid annulus in healthy subjects and in patients with functional tricuspid regurgitation: a real time, 3-dimensional echocardiographic study. *Circulation*. 2006;114(1 Suppl):I492-8.
7. Donatelle M, Ailawadi G. Transcatheter tricuspid valve repair: bringing the forgotten valve into the spotlight. *J Thorac Cardiovasc Surg*. 2020;160:1467-73.
8. Curio J, Demin OM, Pagnesi M, Mangieri A, Gianini F, Weisz G, et al. Update in the current landscape of transcatheter options for tricuspid regurgitation treatment. *Interv Cardiol*. 2019;14:54-61.
9. Antunes MJ, Rodríguez-Palomares J, Prendergast B, De Bonis M, Rosenhek R, Al-Attar N, et al. Management of tricuspid valve regurgitation: position statement of the European Society of Cardiology working groups of cardiovascular surgery and valvular heart disease. *Eur J Cardiothorac Surg*. 2017;52:1022-30.

See Article page 1467.

Commentary: The forgotten valve no longer: But what about the intervention?

Vivek Rao, MD, PhD

Vivek Rao, MD, PhD

CENTRAL MESSAGE

Percutaneous tricuspid valve therapies will result in greater referrals of patients for heart team assessment. Surgeons should maintain an active role in decision making for this patient population.

The tricuspid valve is often referred to as the "forgotten" valve, as historically, surgeons have been loath to intervene for a variety of reasons. Beginning with the indications for surgery, the available options, and the long-term results, surgical management of primary or secondary tricuspid valve pathology has been fraught with challenges.[1,2]

The most common pathology for isolated tricuspid disease is infective endocarditis, usually due to intravenous drug abuse. The high rate of recidivism in this population, which portends the risk of converting native valve to prosthetic valve endocarditis, has led to a more conservative approach to this population. Furthermore, the need for formal valve replacement has reduced the enthusiasm for surgical intervention. There is a general, unfounded acceptance that tricuspid valve replacement is associated with poor outcomes. An earlier report from our institution demonstrated an overall survival of 37% and a conditional survival of 50% at 15 years in patients receiving either mechanical or biologic valves.[1] Conditional survival was measured in patients who were discharged from hospital following their index operation. However, few studies

From Cardiovascular Surgery, Room Number 4PMB-457, Peter Munk Cardiac Centre, Toronto General Hospital, Toronto, Ontario, Canada.

Disclosures: Dr Rao is a consultant for Abbott and Medtronic and serves on the North American Surgical Advisory Board for Medtronic.

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 May 11, 2020; revisions received May 11, 2020; accepted for publication May 12, 2020; available ahead of print May 25, 2020.

Address for reprints: Vivek Rao, MD, PhD, Cardiovascular Surgery, Peter Munk Cardiac Centre, Toronto General Hospital, 200 Elizabeth St, Toronto, Ontario, Canada M5G2C4 (E-mail: vivek.rao@uhn.ca).

J Thorac Cardiovasc Surg 2020;160:1477-8
0022-5223/$36.00

https://doi.org/10.1016/j.jtcvs.2020.05.038

have compared surgical intervention with conservative medical therapy. Hopefully, these data will emerge during the clinical evaluation of novel percutaneous therapies.

The most common overall indication for tricuspid valve intervention is in the setting of associated mitral valve disease. Even in this population, the ideal management strategy is controversial, with some surgeons advocating near-universal repair while others recommending a more selective approach.[3] It will be interesting to see whether the emergence of efficacious percutaneous tricuspid therapies will lower the rates of concomitant tricuspid repair at the time of mitral surgery. In contrast, the lack of efficacious therapies may lead to an increased rate of concomitant tricuspid repair as the rates of progressive tricuspid regurgitation after isolated mitral repair are better understood.

As with other cardiac pathologies, percutaneous therapies are rapidly evolving to address the tricuspid valve. In this issue of the *Journal*, Donatelle and Ailawadi[4] have reviewed the currently available technologies commonly applied to the tricuspid position. Surprisingly, the most common device is a percutaneous therapy initially designed for the mitral valve. The manufacturer has subsequently introduced a larger device that may be appropriate for the tricuspid anatomy, and the device is currently being evaluated in the TRILUMINATE trial.

The experience with other percutaneous technologies, particularly for transcatheter aortic valve implant, is a large increase in referrals for therapy. An appropriate heart-team approach has led to increased volumes for both conventional surgical and percutaneous procedures. Time will tell whether the introduction of percutaneous tricuspid valve technologies will lead to increased referral for intervention. As with transcatheter aortic valve implant, it will be important for a fulsome heart team discussion to determine whether standard surgical approaches are best suited for any individual patient. Unfortunately, unlike the aortic position, surgeons are less likely to embrace patients requiring tricuspid valve intervention, and this is a disservice to this population.

It is important to realize that acute infective endocarditis is not currently an acceptable indication for percutaneous therapy, as the primary goal of intervention is to eradicate the infection and then to repair the residual defects. However, for the more common scenario of functional tricuspid insufficiency (particularly after previous mitral intervention), percutaneous therapies have the potential to address an important clinical problem. However, similar standards for efficacy need to be applied for standard surgical and percutaneous therapies. In surgical cases, a reduction of 1-2 grades of regurgitation implies an improvement from severe to moderate or less tricuspid insufficiency. In contrast, several reports of percutaneous therapies introduce new grading schemes to demonstrate procedural success (defined as a reduction in 1-2 grades of regurgitation). However, reducing torrential tricuspid insufficiency to severe regurgitation, while indicating a "successful" percutaneous outcome, may not actually have a clinical impact. Furthermore, one single percutaneous device may not be sufficient (for either the mitral or tricuspid position). Surgical experience suggests that in both positions, the addition of a prosthetic annuloplasty device improves long-term durability of the repair.[5]

As the authors indicate in their review, the introduction of transcatheter tricuspid valve therapies should lead to an exponential rise in the number of patients referred for intervention and who ultimately receive either surgical or percutaneous therapy. Surgical involvement in the decision-making process is of paramount importance. Ongoing clinical research will hopefully define the optimal timing of intervention. As with the mitral valve, we will likely find that earlier intervention before the development of right ventricular failure, cardiac cirrhosis, or other comorbidities that preclude surgical therapy will lead to better long-term outcomes. It is clear that industry is not ignoring the tricuspid valve; it is time for surgeons to likewise embrace this disease. Our patients deserve our involvement.

References

1. Scully HE, Armstrong CS. Tricuspid valve replacement: fifteen years of experience with mechanical prostheses and bioprostheses. *J Thorac Cardiovasc Surg*. 1995;109:1035-41.
2. Singh SK, Tang GH, Maganti MD, Armstrong S, Williams WG, David TE, et al. Midterm outcomes after tricuspid valve repair versus replacement for organic tricuspid disease. *Ann Thorac Surg*. 2006;82:1735-41.
3. David TE, David CM, Fang CS, Manlhiot C. Tricuspid regurgitation is uncommon after mitral valve repair for degenerative diseases. *J Thorac Cardiovasc Surg*. 2017;154:110-22.
4. Donatelle M, Ailawadi G. Transcatheter tricuspid valve repair: bringing the forgotten valve into the spotlight. *J Thorac Cardiovasc Surg*. 2020;160:1467-73.
5. Tang GH, David TE, Singh SK, Maganti MD, Armstrong S, Borger MA. Tricuspid valve repair with an annuloplasty ring results in improved long-term outcomes. *Circulation*. 2006;114:s577-81.