

See Article page 1467.



## Commentary: Tricuspid: The frustrating and unloved valve

Patrick M. McCarthy, MD

In this issue of the *Journal*, we have an overview of new information about the tricuspid valve (TV) and an observation that it is no longer forgotten.<sup>1</sup> Braunwald and colleagues are credited with our long trend to ignore it at the time of mitral surgery because usually tricuspid regurgitation (TR) stays the same or decreases after mitral surgery.<sup>2</sup> We learned better, though, and recognized that it can start as something annoying, like a leaky septic system smell in your basement that you can't pinpoint, but you know there may be big trouble ahead. Quietly, TR causes fatigue, some edema, but nothing some diuretics can't make look better. Eventually, ascites may become more visible, and the liver and kidney function are getting worse. Finally, cardiac cirrhosis sets in.

The results of surgery aren't very good compared with other valves, so oftentimes patients aren't referred to surgery until late, when the right ventricle is dilated and it doesn't contract well.<sup>3,4</sup> Late referral bias causes a loop that has been hard to break among primary care and general cardiologists. The risk is high because of the failed ventricle, vasoplegia after surgery, and multiorgan failure. The operative mortality of isolated tricuspid surgery, a simple operation to put a ring around the valve or replace it, is 8.8% and isn't improving even now.<sup>5</sup> For comparison, the risk for an ascending and arch aneurysm repair with circulatory arrest and antegrade or retrograde cerebral perfusion has been as low as 6.2% for more than 20 years.<sup>6</sup> At surgery, echocardiography isn't much help; the valve is not well visualized.



Patrick M. McCarthy, MD

### CENTRAL MESSAGE

The tricuspid valve was ignored for years, but this has changed. It is the hardest valve to treat successfully, however, with many anatomic and physiologic challenges for evolving therapies.

Functional TR has all the bad attributes of functional mitral regurgitation, extensive and asymmetric leaflet tethering and a high risk for failed repair, but also frequently a hugely dilated annulus, especially with atrial fibrillation, which is common in these patients.<sup>7,8</sup> In some patients the TR is so bad that there is a new classification with grades worse than severe, including "torrential" and "massive."<sup>9</sup> The annulus doesn't hold stitches well, or transcatheter anchoring mechanisms.<sup>10,11</sup> If a surgeon performs a repair, then you can't test it like you do a mitral repair; there isn't a pulmonary artery crossclamp.

If the surgeon is operating for mitral disease, then we've evolved our approach and always treat severe and even moderate TR. Now some may even treat TR before it occurs, when it is mild or nonexistent, using criteria based on anatomic criteria but based on limited evidence.<sup>7</sup> The conduction system is nearby. We know where it is, but can't see it, so the need for a pacemaker is greater than mitral operations alone. Occasionally the pacemaker wire crosses the valve and causes TR—which we were trying to prevent! The surgeon can throw up his or her hands and replace the valve, but then you might as well put pacer wires on the epicardium, and those don't work well. The dysfunctional right ventricle doesn't like having a big rigid valve replacement in the annulus, and it is suddenly forced to pump against an increased afterload.

Our surgical results have been so bad that there is considerable enthusiasm for a transcatheter approach. Placing a transcatheter TV adds another layer of technical and

From Bluhm Cardiovascular Institute, Northwestern University Feinberg School of Medicine, Chicago, Ill.

Disclosures: Dr McCarthy reports Edwards Lifesciences: speaking fees and royalties; Medtronic and AtriCure: speaking fees; and Abbott: surgical primary investigator REPAIR-MR Trial.

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: Patrick M. McCarthy, MD, Bluhm Cardiovascular Institute, Northwestern University Feinberg School of Medicine, 676 North Saint Clair Street, Arkes Family Pavilion, Suite 730, Chicago, IL 60611 (E-mail: [Patrick.McCarthy@nm.org](mailto:Patrick.McCarthy@nm.org)).

J Thorac Cardiovasc Surg 2020;160:1474-5  
0022-5223/\$36.00

Copyright © 2020 by The American Association for Thoracic Surgery  
<https://doi.org/10.1016/j.jtcvs.2020.05.044>

imaging complexity and causes the same challenging physiologic effects with potential right ventricle failure. There is optimism that clipping the leaflets together, without an annular solution, may reduce torrential TR down to severe, or even moderate, and that may be enough.<sup>1</sup> But we will see how successful that strategy is over time, as edge-to-edge approximation didn't seem to work well with open surgery.<sup>4</sup> Other transcatheter solutions include difficult-to-place annular devices, a balloon that floats in the middle of the leaflets and blocks the TR jet, and years ago we described the ultimate “throw your hands up and surrender” solution and described placing heterotopic valves in the inferior vena cava and superior vena cava.<sup>1,12,13</sup>

It is said that Alain Carpentier had a love affair with the mitral valve. We understand that valve reasonably well, and we get good results with mitral surgery. No one loves the tricuspid valve. It's true, though, the TV is no longer forgotten. We hope that some of the approaches well-described by Donatelli and Ailawadi, alone or in combination, will allow us to address the current shortcomings and that we will grow more fond of it.<sup>1</sup>

## References

1. Donatelle M, Ailawadi G. Transcatheter tricuspid valve repair: bringing the forgotten valve into the spotlight. *J Thorac Cardiovasc Surg.* 2020;160:1467-73.
2. Braunwald NS, Ross J Jr, Morrow AG. Conservative management of tricuspid regurgitation in patients undergoing mitral valve replacement. *Circulation.* 1967;35:163-9.
3. McCarthy PM, Bhudia SK, Rajeswaran J, Hoercher KJ, Lytle BW, Cosgrove DM, et al. Tricuspid valve repair: durability and risk factors for failure. *J Thorac Cardiovasc Surg.* 2004;127:674-85.
4. Navia JL, Nowicki ER, Blackstone EH, Brozzi NA, Nento DE, Atik FA, et al. Surgical management of secondary tricuspid valve regurgitation: annulus, commissure, or leaflet procedure? *J Thorac Cardiovasc Surg.* 2010;139:1473-82.e5.
5. Zack CJ, Fender EA, Chandrashekar P, Reddy YNV, Bennett CE, Stulak JM, et al. National trends and outcomes in isolated tricuspid valve surgery. *J Am Coll Cardiol.* 2017;70:2953-60.
6. Coselli JS, Buket S, Djukanovic B. Aortic arch operation: current treatment and results. *Ann Thorac Surg.* 1995;59:19-26; discussion 26-7.
7. McCarthy PM, Szlapka M, Kruse J, Kisilitsina 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.* December 12, 2019 [Epub ahead of print].
8. McCarthy PM. Too big will fail? The enlarged tricuspid annulus. *J Thorac Cardiovasc Surg.* 2018;155:2427-8.
9. Hahn RT, Zamorano JL. The need for a new tricuspid regurgitation grading scheme. *Eur Heart J Cardiovasc Imaging.* 2017;18:1342-3.
10. Pierce EL, Gentile J, Siefert AW, Gorman RC, Gorman JH III, Yoganathan AP. Real-time recording of annuloplasty suture dehiscence reveals a potential mechanism for dehiscence cascade. *J Thorac Cardiovasc Surg.* 2016;152:e15-7.
11. McCarthy PM. A chain is only as strong as its weakest link. *J Thorac Cardiovasc Surg.* 2016;152:e19-20.
12. McCarthy PM. Device for Reduction of Pressure Effects of Cardiac Tricuspid Valve Regurgitation. U.S Patent #10,418,677; October 21, 2004.
13. Asmarats L, Puri R, Latib A, Navia JL, Rodes-Cabau J. Transcatheter tricuspid valve interventions: landscape, challenges, and future directions. *J Am Coll Cardiol.* 2018;71:2935-56.