JACC: CASE REPORTS VOL. 1, NO. 5, 2019

EDITORIAL COMMENT

Mitral Leaflet Perforation

An Interventional Frontier for Nonsurgical Candidates?*

Konstantinos Charitakis, MD,[a] Scott Schubert, MD,[a] John W. Hirshfeld, Jr, MD[b]

Thirty-six years ago, Professor Alain Carpentier initiated a transformation of our understanding of mitral valve physiology and pathophysiology (1). His work demonstrated multiple pathogenetic mitral regurgitation mechanisms and catalyzed the development of multiple valve repair strategies. These strategies included surgical approaches to direct leaflet repair, augmentation of leaflet coaptation, and reduction of mitral annular circumference.

Development and refinement of direct surgical valve repair techniques has enhanced surgical success rates to the point that valve repair is the standard of care for most causes of mitral valve regurgitation.

The development of the edge-to-edge repair concept by Alfieri et al. (2) created the first mitral valve repair concept that could be adapted to a catheter-delivered device. This led to the development and U.S. Food and Drug Administration approval of the MitraClip (Abbott Laboratories, Abbott Park, Illinois). Early experience with the MitraClip demonstrated the importance of advanced high-quality imaging for case selection and procedure guidance (3).

Subsequent development of catheter-based treatment of mitral regurgitation has focused on catheter delivery of prosthetic valves and devices to reduce annular size. However, none of the valve repair techniques currently in development can effectively treat a major leaflet perforation.

Unusual life-threatening clinical scenarios can stimulate clinicians' creativity to develop new methods to solve particular challenges. In this issue of *JACC: Case Reports*, Panaich et al. (4) report one of the first attempts at percutaneous repair of 2 mitral anterior leaflet perforations due to methicillin-resistant *Staphylococcus aureus* endocarditis in a 66-year-old female. They attempted to adapt devices not engineered for this purpose and used advanced imaging for guidance. Their creative achievements included wiring through the leaflet perforation and successfully retrieving a previously deployed but malfunctioning device.

SEE PAGE 689

Attempting to seal the perforation, the authors had to improvise and implant an Amplatzer cribriform device (designed for implantation in the atrial septum) in the larger perforation. This reduced the severity of the regurgitation, but the hemodynamic success was undermined by severe hemolysis. This was addressed by retrieving the device and deploying a Cardioform septal occluder (W.L. Gore, Newark, Delaware) in the perforation. This was temporarily successful, but the left atrial disc of the Cardioform device subsequently unlocked, resulting in return of severe mitral regurgitation. This likely occurred because either the device was not designed to withstand the pressure differential between the left ventricle and the left atrium or it became fatigued due constant mitral valve motion.

It is challenging to find the best treatment approach for these high-risk patients. There are no guidelines or randomized trials for the off-label use of these devices, and there are no dedicated devices made for every pathology of the mitral valve. Thus, development of an optimal strategy requires synthesis of others' anecdotal experiences. For example, in order to stabilize the valve, other operators have placed a MitraClip prior to placing a septal occluder device, although additional experience is needed to determine whether this strategy is important (5).

*Editorials published in *JACC: Case Reports* reflect the views of the authors and do not necessarily represent the views of *JACC: Case Reports* or the American College of Cardiology.

From the [a]Department of Internal Medicine, Division of Cardiology, University of Texas Health Science Center, Houston, Texas; and the [b]Cardiovascular Division, Department of Medicine Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania. The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2019.10.022

Although the case reported by Panaich et al. (4) did not achieve a durable success, it adds value to the structural interventional community in that it demonstrates the following 3 important relevant, strategic approaches to this problem: 1) accurate placement of catheter-delivered devices within mitral leaflet perforations is feasible using advanced high-quality imaging and excellent catheter control; 2) in appropriate anatomic circumstances, it is possible to place a catheter-delivered device in a mitral leaflet and maintain satisfactory valve function; and 3) there is a need to develop catheter-delivered devices engineered specifically for mitral valve leaflet repair.

Several questions remain regarding the use of vascular plugs and septal occluder devices in plugging regurgitant jets, for example: 1) Which currently available device is optimal for this purpose? 2) What strategies are important to prevent the potential problems of hemolysis, embolization, and left ventricular outflow tract obstruction? and 3) Is there a role for pre-emptively stabilizing the anterior leaflet with a MitraClip?

Panaich et al. (4) should be commended for their creative use of a septal occluder device to attempt to treat a life-threatening mitral leaflet perforation and for reporting their experience. Because randomized clinical trials in this patient cohort are not feasible, reporting such "tips and tricks" and complications is important to inform and motivate other physicians who treat structural cardiac valve defects.

Currently, such techniques are at a premature stage and more evidence is needed for those to be applied in patients who cannot be operated. However, as experience is gained and devices are refined, transcatheter therapies have the potential to play an important role in the management of these complex patients.

ADDRESS FOR CORRESPONDENCE: Dr. Konstantinos Charitakis, University of Texas Health Science Center at Houston, Medicine/Cardiology, 6431 Fannin, Houston, Texas 77030. E-mail: Konstantinos.Charitakis@uth.tmc.edu.

REFERENCES

1. Carpentier A. Cardiac valve surgery-the "French correction." J Thorac Cardiovasc Surg 1983;86:323–37.

2. Maisano F, Torracca L, Oppizzi M, et al. The edge-to-edge technique: a simplified method to correct mitral insufficiency. Eur J Cardiothorac Surg 1998;13:240–5; discussion 245–6.

3. Silvestry FE, Rodriguez LL, Herrmann HC, et al. Echocardiographic guidance and assessment of percutaneous repair for mitral regurgitation with the Evalve MitraClip: lessons learned from EVEREST I. J Am Soc Echocardiogr 2007;20:1131–40.

4. Panaich SS, Qazi AH, Horwitz PA, Staffey K, Rossen JD. Transcatheter repair of anterior mitral leaflet perforation: deploy, retrieve, redeploy. J Am Coll Cardiol Case Rep 2019;1:689–93.

5. Alkhouli M, Rihal CS, Zack CJ, et al. Transcatheter and surgical management of mitral paravalvular leak: long-term outcomes. J Am Coll Cardiol Intv 2017;10:1946–56.

KEY WORDS endocarditis, MitraClip, MRSA