Transcatheter mitral valve replacement in patients with severe mitral annular calcification: Pushing the limits to the sky

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Central Message

A potentially fatal complication after simultaneous valve-in-valve TAVR and TMVR is reported in a patient with severe mitral annular calcification. This was resolved by a redo valve-in-valve TMVR.

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In this issue of the *Journal*, Poulin and colleagues¹ report a very interesting and potentially fatal complication of subacute mitral valve dysfunction after transcatheter aortic valve replacement and transcatheter mitral valve replacement (TMVR) in a high-risk patient with previous surgical aortic valve replacement. Preprocedural imaging showed a failing aortic valve bioprosthesis (21-mm Mitroflow; LivaNova PLC, London, United Kingdom) with relevant stenosis and regurgitation, combined with a degenerative mitral valve disease and severe mitral annular calcification (MAC; mean pressure gradient of 8 mm Hg, valve area of 0.96 cm²). The internal diameters of the aortic and mitral valves were 17 and 29 mm, respectively, as assessed by cardiac computed tomographic scan. Through a transapical approach, the heart valve team from Quebec proceeded to a transcatheter aortic valve-in-valve (ViV) replacement (23-mm Sapien XT; Edwards Lifesciences, Irvine, Calif) and a simultaneous TMVR with a 29-mm Sapien XT. Immediate postprocedural imaging confirmed the satisfactory function of both implanted valves; however, the hemodynamic status of the patient deteriorated acutely in the intensive care unit as a result of a newly diagnosed severe central regurgitation of the implanted mitral prosthesis. Emergency redo ViV TMVR was performed with another Sapien XT (29 mm). This replacement valve successfully resolved the preexisting regurgitation and acute hemodynamic instability of the patient. Ultimately, the patient had an uneventful course.

Pushed by the growing expertise of the heart valve team and constant evolution of transcatheter valve replacement therapies in the aortic position,^{2,3} TMVR has become a viable therapeutic option for patients previously not considered operative candidates, and it will reshape the future of mitral valve therapy.⁴ In patients with failing mitral valve bioprosthesis (ViV TMVR) or after surgical mitral repair with an annuloplasty ring (valve-in-ring TMVR), success rates of 96% and 83%, respectively,

have recently been reported.⁵ Although ViV TMVR in a failing surgical bioprosthesis seems to be technically feasible, the precise deployment, positioning, and anchoring of a transcatheter delivered device during valve-in-ring TMVR or in patient with severe native MAC seems to be more challenging. In a recent report,⁵ a second valve implantation was necessary in 11% of cases of valve-in-ring TMVR, and moderate to severe postprocedural mitral regurgitation was documented in 19%. Current data are even worse for patients with MAC undergoing TMVR. Guerrero and colleagues⁶ reported a technical success rate of 72%, with the need for a second valve implantation in 17%, mostly due to severe regurgitation.

The case report of Poulin and colleagues¹ and the existing data from small series of TMVR procedures in patients with MAC underscores the fact that several important challenges for transcatheter mitral valve therapies still need to be addressed. First, periprocedural imaging and meticulous analysis of mitral annular calcification and the anterior mitral leaflet needs to be performed for appropriate mitral valve sizing. Second, known predictors for left ventricular outflow tract obstruction after TMVR, such as outflow tract diameter, septal hypertrophy, left ventricular size, aortomitroannular plane, and the length of the anterior mitral leaflet have to be considered.⁷ Finally, exact intraprocedural

deployment into the native mitral annulus is crucial to avoid valve malfunction of left ventricular outflow tract obstruction. As nicely depicted in the videos in the case report of Poulin and colleagues,¹ a rather high position with “atrialization” of the primarily deployed valve with protrusion of the anterior mitral leaflet may have played a pivotal role in the observed malfunction, which was resolved by a deeper implantation of the secondary prosthesis during the ViV procedure.

Given that the currently used devices for TMVR were primarily developed and designed for aortic valve replacement, some of the previously mentioned restrictions of TMVR may be overcome by newly introduced devices specifically made for the mitral valve position. Until then, all heart valve teams, including the team from Quebec, are to be congratulated for providing these complex treatment options with satisfactory outcomes to patients who are not operative candidates.

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