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EDITORIAL COMMENT

Management of Patients With MAC

Percutaneous Therapies for the Rescue of Failing Surgery*

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Mitral annular calcification (MAC) is observed in 18% of patients undergoing mitral surgery.[1] Operative mortality is high in those patients, with a risk of major complications such as annulus rupture, circumflex artery impairment, reoperation for bleeding, and paravalvular leaks.[1] Indeed, MAC poses a unique technical challenge. Several surgical techniques have been proposed to surmount the technical constraints associated with MAC.[2] The 2 most used techniques are the intra-atrial insertion of a mitral prosthesis which is associated with a risk of paravalvular leaks and circumflex artery impairment covering, and the en-bloc decalcification of the annulus (with a risk of annulus rupture or atrioventricular groove disruption).[2] The left atrium to left ventricle bypass was proposed in 2014 as a surgical option to treat calcified mitral valve stenosis with no mitral regurgitation.[3]

Recently, transcatheter mitral valve replacement (TMVR) using aortic valves (mostly of the Sapien family; Edwards Lifesciences) has emerged as a therapeutic alternative to treat patients with MAC.[4] Calcifications, while precluding the placement of sutures, serve as anchors for aortic valves. Several approaches may be used: the transseptal, transapical, and the open-hearted transatrial. Initial results have shown that TMVR may be associated with risks such as valve embolization, paravalvular leaks, and left ventricular outflow tract (LVOT) obstruction. A multimodal evaluation with echography and computed tomography before the intervention is crucial to confirm eligibility to this therapy and prevent these complications.[5] LVOT obstruction (which incidence varies between 7% and 39%[6]) is caused by the displacement of the anterior leaflet covering the stent of the Sapien 3 transcatheter heart valve (THV), which protrudes in the LVOT. As it is associated with a 50% rate of mortality,[7] this risk is one of the main causes to deny this therapy.[8] Several factors contribute to the risk of LVOT obstruction, mainly: septal hypertrophy, a small hypercontractile left ventricle,[8] and an acute aorto-mitral angulation.[9]

Preemptive alcohol septal ablation,[10] LAMPOON (laceration of the anterior mitral leaflet to prevent outflow obstruction),[11] SESAME (septal scoring along the midline endocardium)[12], or preemptive radiofrequency septal ablation[13] have been proposed to minimize the risk of LVOT obstruction. The LAMPOON technique is a transcatheter electrosurgery technique to lacerate the anterior leaflet preventing the complete covering of the anterior part of THVs. The initial technique had a success rate of 73%[14] and a considerable risk of complications (conversion to open heart surgery in 3% patients, need for repeated intervention or surgery in 25%, severe hypotension in 12%). The technique has been modified to an anterograde simplified approach,[15] in which both catheters are inserted through the interatrial septum. This technique was as effective as the retrograde technique in preventing LVOT obstruction, with a shorter procedure time.

In this issue of *JACC: Case Reports*, Tawney et al[16] perfectly illustrate the use of LAMPOON to prevent the risk of LVOT obstruction in a patient with a MAC and a thrombosis of an extracardiac conduit.

This patient had several risk factors for LVOT obstruction: a subaortic membrane and a hypertrophic septum, both precluding a "classic" transseptal TMVR as first-choice therapy. During the first surgery,

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they constructed an extracardiac valved conduit, resected the subaortic membrane and performed a myomectomy. In a second time, following a conduit thrombosis, they proceeded with a TMVR. The authors[16] decided to use the LAMPOON technique to prevent LVOT obstruction with a perfect result. We congratulate Tawney et al[16] for this brilliant early result.

This case raises important issues. First, although cardiac conduits are not frequently used in an adult noncongenital population, expert consensus of the management of thrombosis in congenital heart disease[17] states that a perfect anticoagulation regimen is paramount to prevent a conduit thrombosis. This case confirms that this therapy should not be proposed to patients who are not compliant with anticoagulation therapy. Second, one can wonder about the risk of LVOT obstruction in this particular patient, after the resection of the subaortic membrane. Indeed, the dimensions of neo-LVOT predicting a risk of LVOT obstruction remain controversial. The 2 main studies on this subject seem to confirm a sensible prediction of LVOT obstruction with a predicted neo-LVOT area of ≤190 mm^2 [18] or ≤170 mm^2.[19] Thus, the risk of this patient with a predicted neo-LVOT of 174 mm^2 seems to be real but not critical. Third, considering that this patient needed surgery for the resection of the subaortic membrane, why was a transatrial TMVR not initially performed? This would have been an elegant option to treat this patient. The resection of the anterior leaflet might have directly solved the problem of LVOT obstruction.[20] Last, the authors[16] have reported only 30-day outcomes. Growing evidence on valve-in-MAC TMVR shows discouraging results at 1 year in terms of survival, even when the outcomes at 30 days were acceptable or good.[21]

In conclusion, this case provides insights on the management of patients with MAC and at risk of TMVR-induced LVOT obstruction, supporting a growing role of percutaneous therapies. The evaluation before the procedure and the techniques of LAMPOON and TMVR are perfectly illustrated. This also raises several points of discussion and unanswered questions, which will be probably answered in the near future.

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