Editorial

Future of transcatheter versus surgery for mitral annular calcification

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Mitral annular calcification (MAC) is highlighted in this issue of the *Annals of Cardiothoracic Surgery* due to an increasing experience of patients with MAC being referred to cardiac surgery and valve heart teams. This issue highlights the challenges associated with MAC due to anatomy and patient risk.

MAC should be stratified by severity, pattern, and density that weighs into the surgical risk. The focus of this editorial is on severe MAC cases causing either mitral regurgitation (MR), mitral stenosis (MS) or combined disease. In this population, severe MAC treated with surgery is associated with a higher risk of paravalvular leak (PVL), atrioventricular groove disruption, circumflex injury, low cardiac output, and mortality.

There are likely differences in ventricular mechanics and geometry in the setting of MR versus MS. The left ventricle (LV) of the stenotic mitral may be better preserved and smaller but more likely to have significant diastolic dysfunction, while the LV in the MR patient may have more dilation and potentially systolic dysfunction if late in the disease.

There are two key adjuncts in the surgical setting which has aided surgeons in the surgical performance in this patient population. The first is the use of ultrasonic aspiration tools that help to remove MAC without torquing with conventional surgical debridement tools. With two approved devices, these devices have facilitated safer conventional mitral valve replacement. Of note, ultrasonic aspiration can also be used in the setting of posterior degenerative mitral disease with posterior MAC to create a more mobile potentially providing a more durable repair.

The second adjunctive technique has been the utilization of reversed transcatheter aortic valves in the mitral position [aka, the SITRAL (surgical implantation of transcatheter low-profile valves) approach]. This device can be delivered percutaneously, transapically, or transatrially (at the time of surgery). The techniques have been discussed in this issue. While this still carries high risk due to PVL and left ventricular outflow tract obstruction (LVOTO), if anatomy is favorable, this can obviate the need for extensive MAC removal/debridement. Careful analysis of MAC burden, pattern, annular size can mitigate the risk of PVL. While many patients with MS have dimensions that are favorable for SITRAL, MR patients may be too large for this approach given the maximum TAVR valve size limitations. Careful analysis of the predicted neo LVOT should also be performed to mitigate LVOTO risk. Although surgical approaches allow anterior leaflet excision, additional septal myectomy may be required. Despite these adjuncts, the operative mortality with severe MAC is highly dependent on careful selection and still can range from 3% to 20%.

Given the risks with surgical approaches, transcatheter mitral valve replacement (TMVR) may be the keys of the future yet have substantial limitations. Tendyne (Abbott, Abbott Park, IL, USA) has recently received approval for the treatment of MAC. Data from the SUMMIT-MAC (surgical and mechanical interventions for treating mitral annular calcification) registry in 103 patients showed a technical success of 94% and improvement in the New York Heart Association (NYHA) Class from 30% to 87%

at 1 year (*JACC*, in press). Despite the dramatic quality of life improvement, the transapical approach, 6.8% operative mortality, and roughly 80% screen failure rate will lead to selective adoption.

With the realization that the MAC patient population may be larger than anticipated, other TMVR devices are also being studied in the MAC population. The APOLLO trial investigating the Intrepid valve (Medtronic, Minneapolis, MN, USA) has added nonrandomized pivotal MAC arm and is delivered through a transfemoral approach. Due to the high screen failure rate due to annular dimension and especially LVOTO risk, numerous devices with different profiles are being investigated in early feasibility studies including the Cephea valve (Abbott) and the Alta valve (Edwards Lifesciences, Irvine, CA, USA).

As technology and devices improve there likely will be MAC specific devices with low ventricular profiles, with or without anterior leaflet mobilization/cutting. The very high screen failure rates dampen the enthusiasm and need to be addressed.

Other challenges remain regarding anticoagulation intensity and duration and addressing other lesion which are frequently common in the MAC population.

In short, TMVR approaches are incredibly enticing but remain highly selective and limited in application. The future of MAC treatment will include more sophisticated computed tomography (CT) assessment of MAC pattern and location, enabling rapid assessment of anatomic candidacy between multiple commercial options ranging from conventional surgical MVR to SITRAL to Tendyne that can be determined by treating heart teams. There remains a desperate need for improved transcatheter devices including larger TAVR devices, and/or mitral specific valves that mitigate LVOT risk. In addition, a better understanding of why and how MAC forms at a basic level may also aid patients with incidental or early findings of MAC.

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