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Mitral valve-in-ring: Simply complicated

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Key Points
- Long anterior mitral valve leaflets are an additional risk factor for left ventricular outflow tract (LVOT) obstruction independent of small predicted neo-LVOT.
- Mitral valve-in-ring is prone to lower rates of technical success due to paravalvular leak and frequent need for second valve implantation.
- Three-dimensional shaped rings are more challenging to treat and have higher rates of paravalvular leak.

Mitral valve-in-ring (MVIR) has been demonstrated to have attenuated outcomes relative to mitral valve-in-valve (MVIV) in a large multicenter registry. The complexity of MVIR is rooted in the understanding the subtleties in ring architecture, ring integrity, valve anchoring, LVOT obstruction (LVOTO), and paravalvular leak. This manuscript illustrates an even more nuanced part of TMVR, the importance of anterior mitral leaflet (AML) length as a component of the neo-LVOT. Implanting a THV in the mitral position displaces the AML toward the basal anterior septum narrowing the LVOT, hence the need for CT modeling. However, it has been previously observed that long anterior leaflets (>25 mm) can interfere in unexpected ways, such as compromising THV function. If there is significant laxity and redundancy in the anterior leaflet, dynamic LVOTO may result despite a large neo-LVOT (>170 mm²) as observed in this series. This should not surprise clinicians as surgical literature has warned of post-surgical systolic anterior motion (SAM) of the anterior leaflet with long anterior mitral leaflets after mitral repair.3

Comprehensive transcatheter mitral valve replacement (TMVR) requires expertise in LVOT modification to address LVOTO risks such as long AML. LVOT modification can be performed from either the myocardial or leaflet side of the LVOT. From the myocardial side, one can perform septal reduction using either alcohol septal ablation or radiofrequency ablation. Alternatively, preemptive or post-implantation intentional laceration of the anterior mitral leaflet (LAMPOON) can be a means of LVOT modification.4 In the former case, preemptive laceration is done base-to-tip while the latter performs leaflet laceration tip to base. With the added clinical knowledge from Sekaran et al.’s findings, long AML is another high-risk entity to screen and select for pre-emptive LVOT modification in TMVR.

Another important facet in MVIR is the high rate of paravalvular leak (PVL) requiring second valve implantation and the resulting lower rate of procedural success. PVL becomes an increasing challenge for three-dimensional (3D) rings and rigid rings. MVIR has a short landing zone and relies heavily on coaxial trajectory to prevent paravalvular leak. Should the valve be implanted in a canted fashion, PVL or valve embolization may result, and it is not surprising to see a 38.1% rate of second valve deployment. Additionally, use of a smaller Sapien valve makes implantation even more challenging since the THV is shorter (e.g., 23 mm Sapien 3 height 18 mm) and the valve will foreshorten from the atrial side. In light of these challenges, some groups have resorted to use CT prediction models to anticipate poor coaxial alignment.5 In the case of predicted poor alignment, use of periapical access for treating a transapical rail can improve coaxial positioning for THV implantation.

Mitral valve-in-ring will remain an interventional challenge given the push for surgical mitral valve repair in all eligible patients. Operators embarking on MVIR need skills sets to encompass not only THV implantation, but also paravalvular leak repair and LVOT modification as well. Until a dedicated THV can provide more consistent anchoring and prevention of PVL, MVIR will continue to test the mettle of even the most experienced operators.

CONFLICTS OF INTEREST
Marvin H. Eng is a clinical proctor for Edwards Lifesciences and Medtronic. Divya Ratan Verma has no conflicts to disclose.

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