Successful Valve in Ring Abolishing the Stenosis and Regurgitation with Robust Clinical Impact

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Transcatheter mitral valve-in-ring implantation (TMVIRI), is a novel alternative treatment strategy and promising technique for patients at high risk of repeat open-heart surgery. In this report we demonstrate a case of 61 years old male with multiple co morbidities who underwent mitral valve repair long time ago who successfully treated and dramatically improved through trans-septal approach, under trans-oesphageal echocardiography and fluoroscopic guidance in Hybrid catheterization laboratory.

Key Words: Transcatheter, Mitral Valve, valve in-Ring Implantation.

INTRODUCTION

Mitral valve surgery is the gold standard for severe symptomatic native mitral valve disease (O’Gara et al., 2017). Unfortunately, the durability of surgical mitral valve repairs is limited. Late failure of MV repair using annuloplasty ring is usually due to new valve pathology & MV replacement is the treatment of choice(Dumont E et al.,2007) For patients at high risk of repeat open-heart surgery, placement of a transcatheter mitral valve in the ring has emerged as a novel alternative treatment strategy(Eleid MF et al.,2016; Attizzani GF et al.,2016; Descoutures F et al.,2013; Latib A et al.,2016). We describe a case of a failed mitral valve repair that was successfully treated with Edwards SAPIEN 3 transcatheter heart valve delivered via the trans-septal approach. Several series have shown the feasibility of transcatheter mitral valve-in-valve and transcatheter mitral valve-in-ring implantation (TMVIRI), which have emerged as potential therapeutic alternatives for high risk patients with failed mitral bioprosthesis or mitral valve repair (Cheung A et al., 2013; Descoutures F et al., 2013; Wilbring M et al., 2014).

CASE PRESENTATION

A 61 years old male who underwent MV repair in 1986 for severe MR secondary to rheumatic heart disease. A Duran flexible ring size 29 mm was used. Comorbidities include diabetes mellitus, hypertension, chronic obstructive airway disease, atrial fibrillation & chronic kidney disease.

He presented with 2 months history of progressive shortness of breath, orthopnea, paroxysmal nocturnal dyspnea, massive abdominal and lower limb swelling. He had deterioration in his functional class and became bedridden 2 weeks prior to admission.

He had severe heart failure with raised JVP, severe anasarca, pulmonary edema, and hepatomegaly.

TTE: EF = 55%. The right ventricle is moderately dilated. The right ventricular (RV) systolic function is moderately reduced, Degenerated, repaired mitral valve (MV) with severe mitral stenosis, and moderate mitral regurgitation. There is Moderately severe tricuspid regurgitation & The PASP measures 100 mmHg

Trans-esophageal echocardiography (TEE): documented normal left ventricular (LV) size and systolic function, EF 55%, flattened interventricular septum (IVS) consistent with RV pressure overload, severely dilated left atrium and right atrium, dilated RV with moderately reduced RVF, repaired MV with severe mitral stenosis and MR, mean mitral valve gradient of 10 mmHg, severe TR and PASP of 100 mmHg.

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**Right heart catheterization** documented severe pulmonary hypertension (PASP 98 mmHg, mean PAP 65 mmHg).

He was initially treated with IV diuretics and metolazone with no significant improvement. Ascitic tapping was done and he was started on Ultrafiltration, after nephrology consultation, with significant improvement and resolution of his pulmonary edema and anasarca.

Following discussion with the heart team and encompassing the patient’s best interests we decided to perform a mitral valve in ring procedure in view of the high SOCIETY OF THORACIC SURGEON (STS) score of 18%.

**Preprocedural:** TEE was reviewed by the heart team for the suitability of MVIR procedure, risk of LV outflow obstruction, aorto-mitral angle, anterior mitral valve leaflet length, interventricular septal thickness, LVOT size, ring size and dimensions were assessed. He was assessed as suitable for MVIR procedure with low risk for LVOT obstruction.

The ring size and proposed valve size was assessed by the MVIV/MVIR APPLICATION. The suitable size was Edward Valve size 29 mm.

**Procedure:** under general anesthesia, the right common femoral vein (CFV) was accessed and an 8Fr sheath was placed, two Proglides deployed for closure. A temporary pacemaker was introduced through the left femoral vein (LFV) into the RV for rapid pacing. Under TEE guidance, a high posterior transseptal puncture was performed & exchange wire was placed into the left upper pulmonary vein over which a dilator was advanced to further dilate the IAS. Heparin & Cefuroxime IV were given.

The intra-atrial septum (IAS) was dilated with a 14 X 20 mm balloon under TEE guidance to facilitate the THV crossing. MV was then crossed with a Terumo Exchange wire using a JR4 guiding catheter to facilitate wire direction through the MV. The JR4 was advanced into the LV & a Confida stiff wire was placed at the LV apex. The transmirtal gradient was assessed using a pigtail catheter. Edward sheath size 16F was inserted into the right femoral vein. The Edward transcatheter heart valve system was prepared in the same manner as a transapical TAVR. valve orientation was confirmed by the two operators. Deployment balloons were prepared with 3 mL of additional contrast to facilitate approximately 10% oversizing in order to produce some degree of LV flaring to minimize the chance of atrial embolization.

The valve was advanced through the IAS & positioned within annuloplasty ring so that 70% to 80% valve is below the mitral annulus or ventricular. Positioning was confirmed during a period of rapid ventricular pacing and apnea.

Under rapid pacing, the THV was deployed under fluoroscopic & TEE guidance using gradual inflation & adjustment to ensure accurate position into the MV ring. Flaring was confirmed by fluoroscopy.

Post procedural TEE: the valve was well-positioned with mean MVG of 3 mmHg, no pericardial effusion, LVOT obstruction, LVOT gradient, or significant right to left atrial shunt.

Access site was successfully closed with Proglide. Procedure was uncomplicated.

The Patient was extubated in the Hybrid catheterization laboratory. He was admitted to coronary care unit for observation.

Vitamin k antagonist (warfarin) was started with a target INR of 2.5.

**Follow up at 6 months:** The patient was compensated with no heart failure symptoms or signs. TTE showed normal LV size & function, mildly dilated RV with good RVF, dilated LA & RA, well seated MV prosthesis with mean MVG of 5 mmHg, no MR or paravalvular leak, trace TR & PAP 25 mmHg.

**Follow up 2 yr:** patient was compensated, no symptoms or signs of HF, TTE: EF 50% MVIR in place no PVL, mild TR, PASP 85MMHG.

**DISCUSSION**

This case highlights the effectiveness of transseptal THV-MVIR procedure for the treatment of failed mitral valve repair using annuloplasty ring. The procedure was uncomplicated & at 6 months and 2 years follow up the patient was asymptomatic with no MR or PVL, his TR became mild, RV function returned to normal & pulmonary hypertension has decreased only modestly probably due to persistent and concomitant chronic obstructive pulmonary disease.

Favorable outcomes following MVIV led the US FDA to approve this technique in 2017 for high-risk surgical patients with Society of Thoracic Surgeons–predicted mortality scores >8%. Despite these advances, transcatheter mitral valve therapies may impose important challenges. Significant bleeding (5.6% to 8.0%), LV perforation (0.4% to 6%), valve embolization (1.6% to 6%), LVOT obstruction (3.2% to 4%), emergent open cardiac surgery (2.0% to 8.0%), PVL, prosthetic valve thrombosis (2.0% to 3.6%), and death(1.2% to 6.0%) have all been described (Yoon et al., 2017; Eleid et al., 2016; Urena et al., 2017) Additionally, a significant learning curve exists in order to minimize complications (Eleid et al., 2016) In light of the significant potential for complications, a multidisciplinary heart valve team approach is crucial for patient selection, periprocedural imaging, risk mitigation, procedural planning, and optimizing outcomes (Holmes DR et al., 2013)
CONCLUSION

Transseptal transcatheter mitral valve in ring implantation for post-surgical failures is a feasible and effective alternative to repeat surgery. Key elements to success include rigorous anatomic evaluation for prosthesis size and possibility of LVOT obstruction.

ABBREVIATION LIST

MV: mitral valve
LV: left ventricle
RV: right ventricle
LA: left atrium
RA: right atrium
PASP: pulmonary artery systolic pressure
RVF: right ventricular function
PVL: pravalvular leak
EF: Ejection fraction
TMVIRI: transcatheter mitral valve in ring implantation
JVP: jugular venous pressure
TTE: transthoracic echocardiography
TEE: transesophageal echocardiography
MS: Mitral stenosis
IVS: interventricular septum
IAS: interatrial septum
MVS: mitral valve gradient
STS: Society of thoracic surgery
MVIR: mitral valve in ring
MVIV: mitral valve in valve
CFV: common femoral vein
THV: transcatheter heart valve
TAVR: Transcatheter aortic valve replacement
FDA: Food & drug administration
HF: heart failure

REFERENCES


Transcatheter Mitral Valve-in-Ring Implantation

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Figure 1: Echo Doppler for Mitral valve before procedure

Figure 2: Fluoroscopy during implantation of the valve
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Figure 3: Fluoroscopy after implantation of the valve

Figure 4: Echo Doppler for Mitral valve after procedure

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