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Case Report

Transcatheter mitral valve replacement (TMVR) for degenerated mitral valve bioprosthesis - A case series

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ABSTRACT

Mitral regurgitation (MR) is the leading cause of heart valve disease worldwide. In aging population, the incidence of mitral regurgitation (MR) has gradually surpassed that of aortic valve stenosis. We present a report of 5 cases,with history of rheumatic heart disease and old malfunction bioprosthetic valve, presenting with dyspnea, poor ejection fraction.Investigations revealed severe mitral stenosis and regurgitation. TMVR (trans catheter mitral valve replacement) was done with successful outcome.

1. Introduction

Valvular heart disease affects more than 100 million patients worldwide, which is estimated to increase further with the aging population and a subsequent increase in degenerative valve disease.[1] Mitral regurgitation (MR) is the most prevalent form of valvular heart disease in the developed world, affecting about 10% of people aged over 75 years.[2] Mitral valve replacement and repair have formed the backbone of the surgery. Mitral pathology varies from degenerative and ischemic, which are commonly seen in the western world, to rheumatic

heart disease, which is predominantly seen in developing countries.[3] Mechanical valves are preferred in younger patients as they can last lifelong but require anticoagulation. In comparison in older patients, a bioprosthesis (pericardial or porcine) valve is preferred to eliminate the need for anticoagulation. Bioprosthetic valves degenerate with time with an average functional durability time being 10–15 years. Surgical intervention is at risk secondary to the presence of concomitant cardiac and non-cardiac comorbidities.[4] Owing to the high risk of morbidity and mortality,transcatheter mitral valve replacement (TMVR) remains a potential therapeutic option in degenerative bioprosthetic mitral valve diseases.[5] We present case series of five patients with old bio prosthetic mitral valve replacement with current restenosis and regurgitation. Redo surgical mitral valve replacement would have been a high risk treatment option hence transcutaneous mitral – ViV (Valve in valve implantation) was performed with balloon expandable valve.: *Edward life sciences 2, Irvine, CA, USA* and *Meril Life sciences 3, Gujrat, India.* with successful outcome.

2. Case report

The average age group of the patients was 71.66 years (58–82 years) and presented with a history of rheumatic heart disease associated with severe mitral stenosis and regurgitation. All patients had degenerative prosthetic valves implanted few years ago. Patients presented with dyspnoea and most patients (80%) were in New York Heart Classification (NHYA) Class 3 or 4. Initial diagnostic investigations on echocardiogram and CT scan revealed prosthetic mitral valve stenosis.The left ventricular ejection fraction (LVEF) was 30–55% (range) (Table 1) The Society for thoracic surgery score (STS) ranged between 4.2 and 6.2 and preoperative mean mitral valve pressure gradient was 12–18 mmHg (Table 1) Considering redo MVR would have been a high risk surgery, TMVR was the ideal treatment option.

3. Surgical procedure

Transesophageal echocardiography (TEE) showed severe stenosis in the previously placed malfunctioned biprosthetic mitral valve in all the patients with a mean pressure mitral valve gradient of 15 mmHg(Figs. 2 and 3 4). Low ejection fraction rate was detected in 4 cases (30%–45%). All patients had a significant history of rheumatic heart disease. Initial assessment of the dysfunctional prosthetic valve was calculated with ViV mitral app[6] (UBQO) (Figs. 3–5) and CT scan (Fig. 1) for planning the new

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Table 1
Baseline characteristics and procedural outcomes of TMVR patients.

Characteristics (n = 5)	1	2	3	4	5
Age (years)	82	64	58	64	72
Gender (male/female	Female	Female	Female	Female	Male
STS score	6.2	4.8	4.4	4.2	5.0
Etiology MR/MS	Degenerative prosthetic valve causing MS	Degenerative prosthetic valve causing MS	Degenerative prosthetic valve causing MS	Degenerative prosthetic valve causing MS	Degenerative prosthetic valve causing MS
NYHA class 3/4	C4	C3	C3	C3	C3
LVEF (%)	30%	45%	55%	35%	40%
Approach					
➢ Transfemoral	Transfemoral	Transfemoral	Transfemoral	Transfemoral	Transfemoral
➢ Transapical	–	–	–	–	–
MEDICAL CONDITION Rheumatic heart disease > CAD/DM/AF/Prior CABG/prior MI/PRIO VALVE INTERVENIOTL SURGRY/PH/	Rheumatic heart disease, post MVR DM	Rheumatic heart disease, post MVR CAD	Rheumatic heart disease, post MVR	Rheumatic heart disease, post MVR	Rheumatic heart disease, post MVR DM
preoperative mean MV pressure gradient (mmHg)	20	18	16	14	16
TEE baseline features	degenerated mitral valve stenosis with calcification	degenerated mitral valve stenosis with calcification	degenerated mitral valve stenosis with calcification	degenerated mitral valve stenosis with calcification	degenerated mitral valve stenosis with calcification
New Valve (company)	Myval	Myval	Edward Lifesciences Sapien 3	Myval	Edward Lifesciences Sapien 3
New Valve size (mm)	23	27.5	26	26	26
Old prosthetic valve size (mm) and company	25 (SJM) Epic	27 (Perimount Valve)	25 (Perimount valve)	27 (SJM)	27 (SJM)
Post-operative mean MV pressure gradient (mmHg) at discharge	2	3	4	2	3
Hospital stay (days)	4	3	3	1week	5
mean MV pressure gradient (mmHg) at 1 month follow up	2	3	4	2	3

MR = Mitral regurgitation, MS = Mitral stenosis, LVEF = Left ventricular ejection fraction.
MV = Mitral Valve, STS Score = Society of Thoracic Surgeons (STS) scores, SJM= St Jude's Medical.

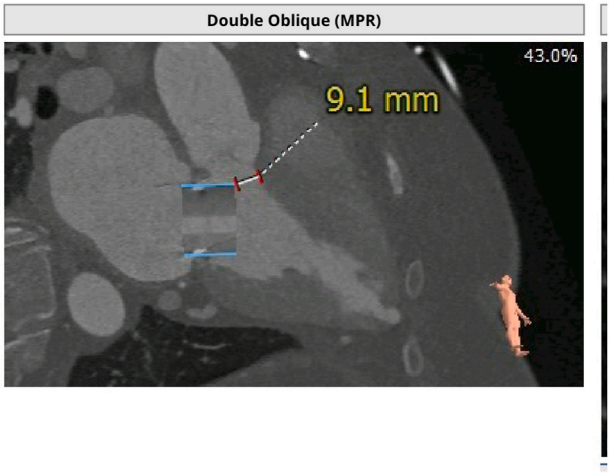

Fig. 1. Mitral aortic valve angulation on CT.

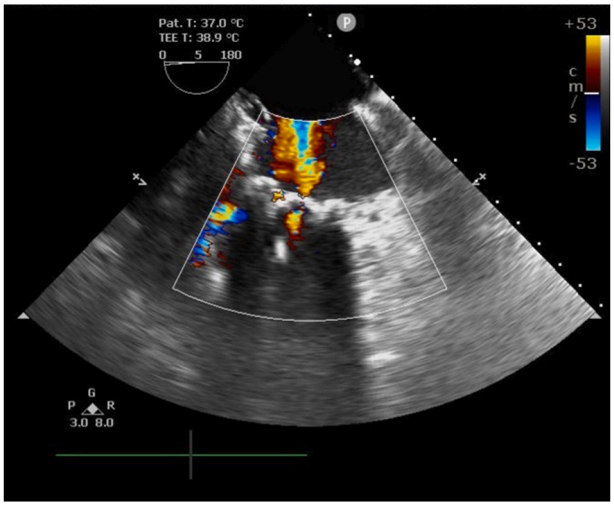

Fig. 2. ECHO Pre Procedure diseased Stenotic Prosthetic Mitral valve.

valve size (Table 1). The patients were intubated under general anesthesia. The procedure was performed in all 5 cases through transfemoral/transseptal approach. Under transesophageal echocardiogram guidance, transseptal postero inferior puncture was done through right femoral vein. The left femoral vein access was kept patent to utilize for temporary rapid pacing during valve implantation. Radial artery access was kept for pressor monitoring. Intra -atrial septum was dilated with 24 mm balloon (Boston Scientific) (Fig. 5). New valve was mounted for mitral position and taken across the septum and into the previous dysfunctional valve. In one of the cases however the 24 size balloon could not cross the dysfunctional valve therefore another Landerquist wire (Cook medical) was taken across the interatrial septum and parked in left ventricle (LV) along with the first Amplatzer wire (Boston scientific). Then with a double wire technique the new valve was crossed into the old dysfunctional valve. Right ventricle (RV) was paced at 180 beats per minute. Once the blood pressure dropped to less than 50 mm Hg the new valve was deployed (Fig. 6). The device implanted in four cases was Myval THV (Meril Lifesciences Gujrat, India) and the fifth case was implanted with Sapien M3 valve (Edward Lifesciences, Irvine,CA, USA) In one of the cases there was mild para valvular leakage (PVL) therefore post dilatation was done with 1 cc extra contrast(Visipaque (GE Healthcare, Ireland). Post procedure there was no mitral regurgitation and stable hemodynamics was achieved. Patients were extubated within 12 hours. The femoral venous access site was closed with figure of 8 silk sutures. All the patients were discharged within 3–4 days except

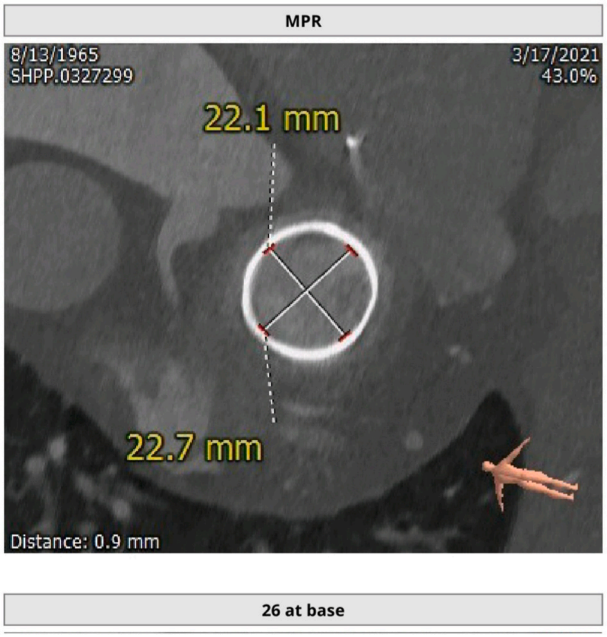

Fig. 3. Pre procedural mitral perimount valve annular size.

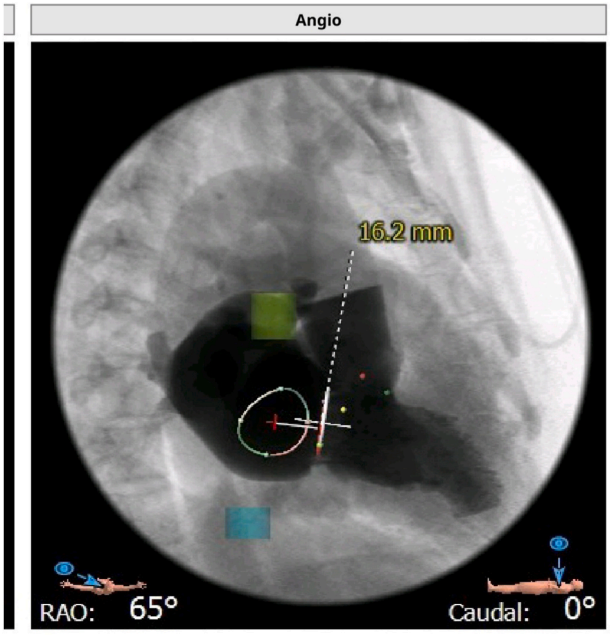

Fig. 4. CT Pre procedural mitral and aortic annular distance.

one patient, who was discharged after 7 days. Paravalvular leakage was observed in one of the cases. Post-operative ECHO on discharge showed a mean pressure gradient of 2–4 mmHg with no mitral regurgitation. Patients were followed up to one month with a stable mitral valve pressure (Table 1)

4. Discussion

Mitral valve (MV) disease is the second most common valvular heart disease (VHD) in Europe. 5 Mitral regurgitation (MR) remains the most common disease of the MV with primary degenerative MR (due to dysfunction of any of the components of the MV) being more common than secondary or functional MR (caused by changes in the geometry of

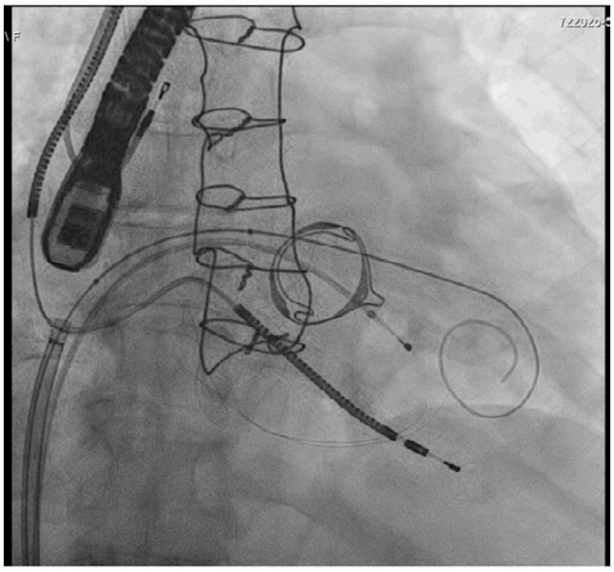

Fig. 5. Balloon dilatation of the interatrial septum and disease mitral prosthesis.

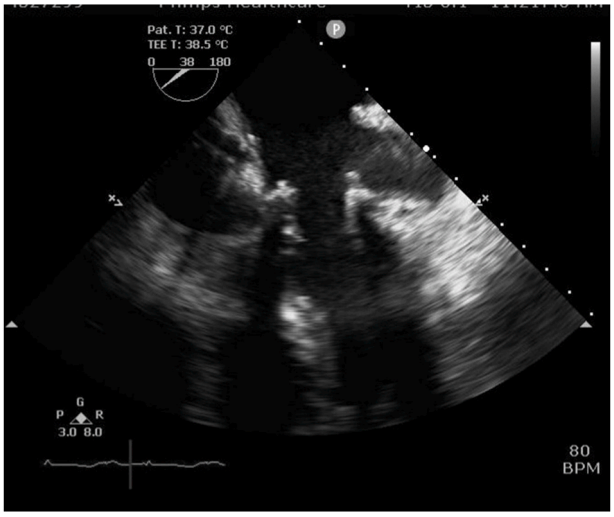

Fig. 6. Post TMVR opened mitral valve.

the left ventricle or left atrium). Primary MR when occurring as a redo mitral valve surgery is associated with higher mortality rates as compared to native surgery (6%–17.8%)[7] Bioprosthetic mitral valve dysfunction requiring re-intervention occurs in approximately 20% of patients during 10 years following surgical mitral valve replacement (MVR).[8]

In our report of 5 cases, all the patients except one were discharged on the 3–4th day post-surgery. One patient developed infection with a high total leucocyte count (TLC) for which she was under antibiotic course. She also developed atrial fibrillation and a fast ventricular rate. This patient was discharged after 7 days.

Recent systematic review on analyzed TMVR results in 308 patients and reported successful valve implantation and hemodynamic results in a mean follow up of 10–24 months Low transvalvular gradients (mean:<4 mm Hg) were observed following the procedure.[9] In our case report we achieved similar results with 30 day follow up (mean valvular pressure gradient = 2–4 mmHg) In our report one of the patients had a paravalvular leakage post device implantation. Similar finding was reported in a recent case report.[10] With an aging population and longer life

expectancy the common use of bioprosthetic valves is common and there has also been an increase in the degenerative structural heart disease (SHV).[11,12] Transcatheter repair devices have been most commonly used, and with appropriate patient selection, have good outcomes. However, not all patients are suitable for repair procedures. Hence transcatheter mitral valve replacements (TMVR) have increased over the last number of years and is increasingly becoming a viable option for patients with high surgical risk and prohibitive anatomy for transcatheter repair.

5. Conclusion

1) The series of five patients with old malfunctional bioprosthetic valves with restenosis showed that redo MVr in these situation was a high risk and TMVR is relatively low risk with good acute outcomes.
2) Although data remains scarce, we recommend a large number of prospective studies on TMVR implantation and its long term results.

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