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Case Report

Redo mitral valve surgery 15 years after bioprosthetic valve implantation in a patient with hepatic and cardiac comorbidities

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ABSTRACT

Redo mitral valve surgery poses significant technical and clinical challenges, especially in patients having a third reoperation. These cases are associated with increased operative threat due to adhesions, previous sternotomies, and limited surgical exposure. With significant advancements in surgical techniques, perioperative care, and patient selection, successful outcomes can still be achieved. We report the case of a 47-year-old male with a complex cardiac history, including surgical atrial septal defect (ASD) closure and prior bioprosthetic mitral valve replacements, who presented with symptomatic structural valve deterioration and progressive heart failure. A third-time redo mitral valve replacement was performed via median sternotomy, using femoral cannulation. Intraoperative findings included extensive adhesions and prior prosthetic valve degeneration. The postoperative course was notable for transient low cardiac output and arrhythmia management; however, the patient eventually recovered well and was discharged on the 10th postoperative day.

Keywords: Redo mitral valve replacement, Femoro-femoral cardiopulmonary bypass, Structural valve deterioration

INTRODUCTION

Structural valve deterioration (SVD) of bioprosthetic mitral valves refers to the progressive, intrinsic degeneration of the valve tissue, resulting in permanent structural changes such as leaflet thickening, calcification, tearing, or pannus formation.[1,2] These changes compromise valve function, commonly resulting in mitral regurgitation, stenosis, or a combination of both. SVD is distinct from non-structural valve dysfunction, thrombosis, or endocarditis, and represents a major limitation to the long-term durability of bioprosthetic mitral valve replacements (MVR).

The use of bioprosthetic valves in the mitral position has increased, particularly in elderly patients and those for whom lifelong anticoagulation poses significant risks. However, the mitral valve is exposed to higher mechanical stresses than the aortic valve, which may contribute to earlier and more frequent SVD in the mitral position.[3]

Long-term studies have shown that the durability of bioprosthetic mitral valves is generally lower compared to their aortic counterparts, with SVD rates rising significantly after 10–15 years, particularly in younger patients.[5]

Redo MVR presents significant surgical challenges, and when performed for a third time, the complexity and associated threats are basically increased. Third-time redo MVR is generally warranted by SVD, prosthetic valve dysfunction, endocarditis, or pannus formation following prior mitral valve surgeries—whether mechanical or bioprosthetic. As life expectancy improves and the use of bioprosthetic valves becomes more prevalent, especially in younger and intermediate-risk patients, the need for multiple reoperations over a patient's lifetime is increasingly encountered in clinical practice.[5,6]

Each subsequent reoperation is associated with increased technical difficulty due to factors such as dense adhesions,

distorted cardiac anatomy, former sternotomies, and compromised myocardial protection. These contribute to higher operative morbidity and mortality compared to first-time or even second-time interventions.[3] Furthermore, patient comorbidities and limited surgical options complicate decision-making and necessitate careful consideration of surgical approach, valve type, and long-term management program.

Advancements in surgical techniques, myocardial protection, and perioperative care have enhanced outcomes in high-risk re-operative surgery. However, third-time redo MVR remains a high-stakes procedure, emphasizing the need for personalized treatment planning and multidisciplinary assessment.

CASE REPORT

A 47-year-old male presented with a six months' history of exertional dyspnea and palpitation. On admission, his blood pressure was measured at 100/55 mmHg. He had a low volume irregularly irregular pulse and a heart rate of 128 beats per minute. Additionally, his respiratory rate was 16 breaths per minute. Precordial examination revealed visible cardiac impulse in mitral area, apex beat shifted to left 6th intercostal space 10 cm from midline, pansystolic murmur over the mitral area, which radiates to the left axilla.

The patient reported a history of surgical ASD closure performed 15 years ago. As his symptoms reappeared just a few days after the operation, further investigations were conducted, and he was diagnosed with failed ASD closure. In addition, he was found to have mitral valve prolapse with severe mitral regurgitation (MR), pulmonary hypertension, liver cirrhosis, chronic hepatitis B virus (HBV) infection, and grade 1 esophageal varices.

After optimization of the patient's condition and considering his hepatic status, mitral valve replacement was performed using a 29 mm St. Jude Medical bioprosthetic valve, along with ASD closure through a right atrial approach. Following surgery, the patient enjoyed a good quality of life without any symptoms and was under regular follow-up. However, during the last six months, his symptoms have reappeared.

Color Doppler echocardiography revealed malfunctioning bioprosthetic mitral valve with moderate MR and severe MS (with PPG=20.4 mmHg, MPG=14.2 mmHg), ASD closure patch in situ with tiny residual ASD flow, PASP=48 mmHg. Abdominal ultrasound showed features suggestive of chronic hepatitis. Following the diagnosis, a multidisciplinary board was formed and preparations were made for surgery. A contrast CT scan of chest was done for assessment of cardiovascular structures and their relations to the sternum.

During the surgical intervention, femoro-femoral cardiopulmonary bypass was initially established (Figure 1) under general anesthesia after achieving an activated clotting time (ACT) greater than 480 seconds.

Hypothermia was maintained at 32°C throughout the procedure to provide myocardial protection. This approach was employed to decompress the heart and minimize the risk of injury to the right heart during sternotomy. A median sternotomy was then performed using an oscillating saw, followed by meticulous adhesiolysis. The superior vena cava (SVC) and aortic root were cannulated subsequently. The heart was induced into fibrillation using local ice cooling, and the aorta was cross-clamped near the origin of the innominate artery. Cardioprotection was provided by antegrade administration of Del Nido cardioplegic solution through the aortic root cannula.

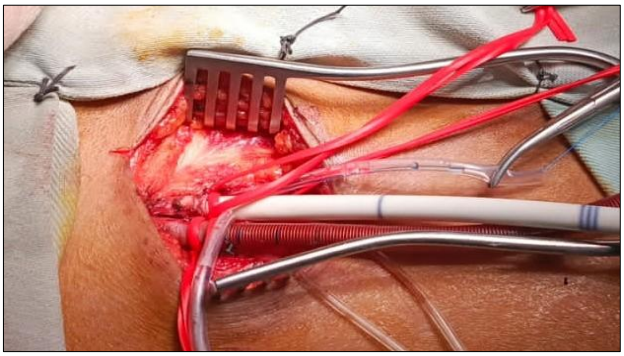

Figure 1: Left sided femoral venous and femoral arterial catheter.

A hugely dilated left atrium (LA) was observed, and a left atriotomy was subsequently performed. No intracardiac thrombus was found. The mitral valve was severely calcified, degenerated and malfunctioning, which was then excised (Figure 2). After sizing the mitral annulus, a 25 mm On-X bileaflet mechanical valve was implanted (Figure 3). The left atriotomy was then closed, deairing was performed, and the patient was gradually weaned off cardiopulmonary bypass once adequate hemostasis was confirmed.

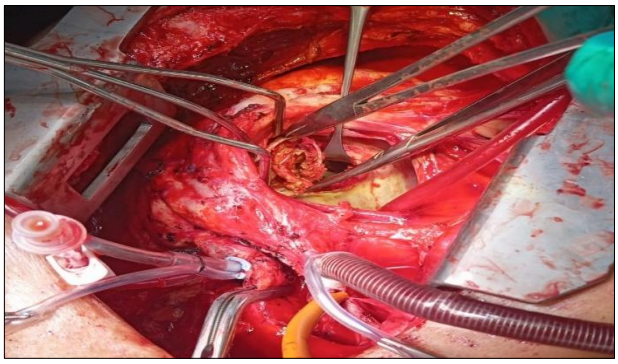

Figure 2: Excised degenerated bioprosthetic valve.

Postoperatively, the patient experienced transient low cardiac output syndrome and arrhythmia, which were managed according to standard ICU protocols. He

subsequently recovered well. Follow-up echocardiography demonstrated satisfactory valve function with mild left and right ventricular systolic dysfunction. Serum creatinine levels remained stable at 1.3 mg/dl.

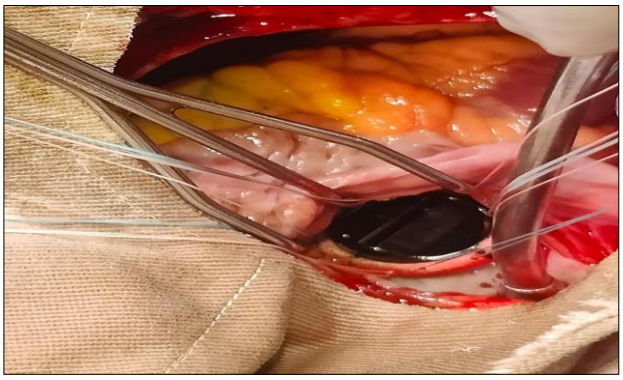

Figure 3: Implanted On-X bileaflet mechanical mitral valve.

DISCUSSION

This case highlights the complex and multidisciplinary management of a patient with prior congenital heart disease correction, SVD, and multiple systemic comorbidities. The patient presented with classic symptoms of bioprosthetic valve dysfunction—exertional dyspnea and palpitations—which reemerged 15 years after bioprosthetic MVR and ASD closure.

Bioprosthetic valves are frequently chose in younger patients with contraindications to long-term anticoagulation, such as chronic liver disease and esophageal varices, as seen in this patient. However, bioprosthetic valves are known to degenerate over time, over 10 years, failure rate of around 20-30%, with this rate increasing to over 50% at 15 years.[5,8] The echocardiographic findings of moderate mitral regurgitation (MR), severe mitral stenosis (MS), and extensive valve calcification confirmed the diagnosis of SVD.

A second challenge was the presence of a residual ASD with pulmonary hypertension, compounding the hemodynamic burden on the left atrium and ventricles. Pulmonary hypertension is a known sequela of longstanding volume overload and can increase perioperative risk.[9]

The patient's prior cardiac surgery, chronic hepatitis B infection and liver cirrhosis, careful preoperative planning was critical. The use of preoperative contrast computed tomography (CT) scan of chest to assess cardiac anatomy and its relation to the sternum, along with initiation of femoro-femoral cardiopulmonary bypass prior to re-sternotomy, reflects modern strategies to minimize intraoperative complications such as right heart injury or major bleeding during re-entry.[10]

The choice to implant a 25 mm On-X mechanical bi leaflet valve was well-suited to this clinical scenario. On-X valves are known for their superior hemodynamic performance and lower thrombogenicity compared to older mechanical prostheses, potentially permitting for lower-intensity anticoagulation in selected patients.[11] This is particularly applicable given the patient's history of liver disease and variceal risk.

Postoperative complications included transient low cardiac output syndrome and arrhythmias, both managed effectively with standard ICU protocols. These complications are common following re-operative cardiac surgery but can be relieved with vigilant monitoring and timely intervention.[12] The patient's rapid clinical recovery and satisfactory prosthetic valve function on follow-up echocardiography demonstrate the success of the surgical and perioperative strategy.

CONCLUSION

This case highlights the critical importance of long-term surveillance in patients with bioprosthetic valves and congenital heart disease, as well as the need for individualized surgical planning in patients with significant comorbidities. Despite the high risk associated with third-time redo mitral valve surgery, careful preoperative preparation, a multidisciplinary approach, and advanced surgical techniques can enable safe procedures with favorable outcomes.

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