

Redo Aortic and Mitral Valve Replacement using St. Jude Medical Mechanical Prosthesis in a Patient with Degenerated Mitral Bioprosthesis and Severe Aortic Regurgitation: A Video Presentation

Ujjwal K. Chowdhury¹ Lakshmi Kumari Sankhyan¹ Sukhjeet Singh¹ Niwin George¹ Sandeep Sharan¹ Poonam Malhotra Kapoor¹ Parag Gharde¹ Sanjoy Sengupta¹ Sushamagayatri B¹

¹Cardio-Thoracic Sciences Centre, All India Institute of Medical Sciences, New Delhi, India

Address for correspondence Dr. Ujjwal Kumar Chowdhury, M.Ch, Diplomate NB, Professor, Department of Cardiothoracic and Vascular Surgery, All India Institute of Medical Sciences, New Delhi-110029, India (e-mail: ujjwalchow@rediffmail.com, ujjwalchowdhury@gmail.com).

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Abstract

Keywords

- ▶ mechanical prostheses
- ▶ patient with degenerated mitral bioprosthesis
- ▶ redo aortic and mitral valve replacement
- ▶ severe aortic regurgitation

The American College of Cardiology/American Heart Association practice guidelines suggest bioprosthetic aortic and mitral valve replacement is a reasonable option for patients older than 65 years and for selected patients younger than 65 years according to patients' preference. However, routine use of bioprosthetic valves in younger patients remains controversial. Patients prevalence to avoid anticoagulation, decreasing operative risks for valve reoperations, and the availability of catheter valve-in-valve techniques have created a need to reexamine bioprosthetic valve durability, particularly in young patients undergoing valve replacements

Introduction

The American College of Cardiology/American Heart Association practice guidelines suggest bioprosthetic aortic and mitral valve replacement as a reasonable option for patients older than 65 years and for selected patients younger than 65 years according to patients' preference.^{1,2} However, routine use of bioprosthetic valves in younger patients remains controversial. Patients prevalence to avoid anticoagulation, decreasing operative risks for valve reoperations, and the availability of catheter valve-in-valve techniques have created a need to reexamine bioprosthetic valve durability, particularly in young patients undergoing valve replacements.^{3–5}

In developing countries, the severity and rapid progression of valvular disease to rheumatic heart disease in pediatric age group and in young adults poses a challenging problem.⁶

The severity of anatomic changes in young patients with rheumatic heart disease precludes reparative procedures.^{4–12}

Younger patients with rheumatic heart disease undergoing mechanical mitral valve replacement require life-long anticoagulation and are at risk of bleeding and thromboembolic complications.^{4–12}

The reported incidence of survival following mechanical mitral valve replacement in the published literature at 10, 20, and 30 years is 61 to 75%, 36.5 to 39% and 22.6%, respectively.^{4–9,12} Although tissue heart valves are an established choice in older age groups, there is a reluctance in using tissue valves in younger age groups because of higher reoperation rates which are inversely proportional to the age of the patients.^{2,4–12}

The Carpentier–Edwards Perimount pericardial bioprosthetic (Edwards Lifesciences, Irvine, CA) is a second

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generation trileaflet bioprosthetic valve consisting of bovine pericardial leaflets mounted on a flexible frame. The design of the valve was aimed at improving on the limited durability of porcine bioprostheses and poor performance of the first-generation pericardial valves.^{4,5,13-16}

Studies on long-term new-generation Carpentier–Edwards pericardial bioprostheses (Perimount) have documented excellent hemodynamic profile and a low incidence of structural deterioration with freedom from reoperation being $89.5\% \pm 5\%$ at 15 years.^{3-5,13-16}

With this background, a group of 132 patients less than 40 years of age underwent mitral valve replacement using Perimount pericardial bioprosthesis model 6900–mitral (Edwards life sciences, Irvine, CA, US) at the All India Institute of Medical Sciences, New Delhi, India. The actuarial survival and actuarial event-free survival at 204 months was 96.9% ($\pm 0.01\%$) and 93.4% ($\pm 0.03\%$), respectively. At the time of reporting in 2017, 6 (4.7%) patients underwent redo mitral valve replacement for severe bioprosthetic degeneration with stiffening and calcification.³

We report herein our seventh patient from this series who underwent mitral valve replacement 13 years back using a 31 mm Carpentier–Edwards pericardial perimount prosthesis. He underwent redo aortic and mitral valve replacement using St. Jude Medical mechanical prosthesis. The indication for reoperation was severe bioprosthetic degeneration with severe aortic regurgitation. He was weaned off cardiopulmonary bypass on dopamine $5\mu\text{g}/\text{kg}/\text{min}$, dobutamine $10\mu\text{g}/\text{kg}/\text{min}$, and adrenaline $0.01\mu\text{g}/\text{kg}/\text{min}$ with stable hemodynamics.

Surgical Techniques

Following systemic heparinization, elective right femoral arteriovenous cannulation is done using long femoral arterial and venous cannulae (Edwards Lifesciences LLC, One Edwards Way, Irvine, CA, USA).

Under cardiopulmonary bypass, secondary median sternotomy was performed with the heart decompressed on bypass. The pericardium overlying the aorta, right ventricular outflow tract, and superior vena cava was dissected.

An 18-Fr sump suction vent was placed over the main pulmonary artery for further decompression of the heart to

facilitate dissection. The superior caval vein was dissected and cannulated directly using an angled metal tipped venous cannula and drained directly into the oxygenator. The intrapericardial inferior caval vein was dissected and looped for later occlusion.

The right pleural cavity was widely opened. Due to dense adhesions overlying the right and left atrium, the pericardium overlying body of the right atrium was not dissected. The patient was planned for transeptal approach of mitral re-replacement.

The aorta was cross-clamped using an atraumatic aortic vascular clamp. An oblique horseshoe-shaped aortotomy was done starting 2 cm above the right coronary sinus and ending 1 cm above the mid-point of noncoronary sinus. Myocardial protection was achieved by integrated myocardial protection using direct osteal St. Thomas (II) based cold blood cardioplegia (4:1) and topical cardiac cooling using ice cold saline. Successive doses of cardioplegia were repeated every 30 minutes.

After snugging the inferior caval vein, the pericardium overlying the right atrium was directly incised in between stay sutures. The interatrial septum was incised and opened in between stay sutures.

Two stay sutures of 2-0 Ethibond (Johnson and Johnson Ltd., Ethicon, LLC, San Lorenzo, USA) were placed over the prosthetic mitral annulus to facilitate later explantation of the mitral prosthesis.

An incision was made on the mitral prosthetic ring using a No.11 scalpel blade. The prosthetic valve was detached from the anterior atrioventricular groove by a combined sharp and blunt dissection (**→Figs. 1 a-c**).

A small right angle forceps was insinuated within the opening to facilitate explantation of the mitral prosthesis. The prosthetic valve was explanted by incising the prosthetic fibrous capsule on both atrial and ventricular surfaces. Extreme precautions were taken not to cause type I atrioventricular groove rupture. Precautions were also taken not to dislodge the thrombus contained within the prosthetic mitral valve. The posterior chordal apparatus was retained. The ventricular cavity is irrigated using cold normal saline.

Re-replacement of the mitral valve was done using a 29 mm St. Jude Medical mechanical prosthesis (St. Jude Medical; St

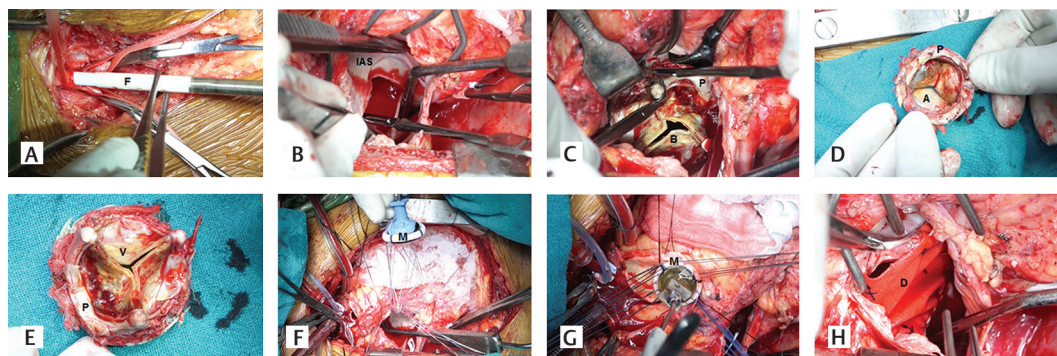


Fig. 1 (A-H) Step-by-step demonstration of explantation of the mitral bioprosthesis and implantation of a 29 mm St. Jude Mechanical mitral prosthesis via transeptal approach (A–atrial surface of degenerated bioprosthesis, B–degenerated bioprosthesis, D–Dacron polyester patch, F– femoral arterial cannula, I–interatrial septum, M–St. Jude Medical mechanical mitral prosthesis, P–prosthetic sewing, V–ventricular surface of degenerative bioprosthesis).

Jude Medical; St. Paul, MN, USA) and interrupted 2-0 Ticon mattress suture (►Figs. 1 d–h).

Three stay sutures of 2-0 atraumatic silk were placed on third aortic commissures. The incompetent, diseased aortic valve was excised and replaced using a No.21 St. Jude Medical mechanical aortic prosthesis and interrupted using a nonpledgeted 2-0 Ticon suture (M/s Covidien Domingo, Dominican Republic, USA).

The aortotomy was closed in two layers using 4-0 polypropylene suture: horizontal mattress and over and over continuous. The surgically created atrial septal defect was reconstructed using a Dacron polyester patch (Bard Savage filamentous knitted polyester fabric, Bard Peripheral Vascular Inc., Tempe, AZ, USA) (►Fig. 1 h). The right atrium was closed in two layers using 2-0 polypropylene suture. The cardiac chambers were covered using a patch of bovine pericardium (Video 1).

Video 1

Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0041-1723625>.

Results

The patient had an uneventful postoperative recovery. At 14 months follow-up, he is in New York Heart Association functional class I with left ventricular ejection fraction 0.60, normal aortic and mitral prosthetic valve function, and/or oral anticoagulation with warfarin.

Conclusions

Elective institution of cardiopulmonary bypass through femoro-femoral arteriovenous cannulation prior to sternotomy prevents accidental injury to the cardiac chambers and great vessels during sternal entry. Pulmonary artery venting and cannulation of the superior vena cava further facilitates dissection of the cardiac chambers without causing injury. Placement of two stay sutures on the prosthetic annulus and intracapsular dissection greatly facilitates explantation without causing rupture of the atrioventricular groove.

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Conflicts of Interest

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