CASE REPORT

Long-term outcome in a case of translocated mitral valve replacement for massive mitral annular calcification

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Key Clinical Message
Few reports have described long-term outcomes after translocated mitral valve replacement. We describe tips, potential pitfalls, and long-term outcome associated with the construction of a new mitral annulus and reinforcement of prosthesis attachment using a mitral prosthetic valve with an equine pericardial collar in a woman with extensive mitral valve calcification.

Keywords
Calcification, dialysis, mitral stenosis.

Case Report
A 55-year-old woman on hemodialysis for chronic glomerular nephritis for 18 years had undergone dual-chamber pacemaker implantation because of a complete atrioventricular block 4 years before presentation. The preoperative transthoracic echocardiogram indicated severe mitral stenosis with an estimated pressure gradient of 15 mmHg and a MV area of 0.8 cm². In particular, the posterior leaflet of the mitral annulus, a part of the left ventricle, and papillary muscles were severely calcified (Fig. 1). The preoperative computed tomography scan demonstrated severe calcification around the mitral annulus and calcification invading the left ventricle. Cardiac catheterization showed normal coronary arteries with normal left ventricular function (ejection fraction, 70%).

The operation was performed through median sternotomy. Cardiopulmonary bypass was established through ascending aortic cannulation and bicaval drainage. A left venting tube was inserted through the right superior pulmonary vein. After cardiac arrest, the right side of the left atrium was incised. The tissue surrounding the mitral annulus, especially the posterior mitral annulus, posterior...
leaflet, and part of the anterior leaflet, including the chordae, were severely calcified. The posterior leaflet and part of the anterior leaflet could not be excised because of extensive calcification. For MVR, four sutures were placed at the supraannular position on the anterior mitral annulus. Eleven additional sutures were placed through all the layers of the left atrial walls so that they wrapped around the posterior mitral annulus (Fig. 2A and B). A 29-mm expanded cuff of a mitral prosthetic valve (St. Jude Medical [SJM], Inc., St. Paul, MN) was enlarged at the circumference of the suture ring by attaching a 1.5-cm wide equine pericardial collar (Equine Pericardial Patch; Edwards Lifesciences, LLC, Irvine, CA; Fig. 2C); this cuff was secured with 2-0 polyester pledgeted mattress sutures. The free edge of the equine pericardial collar was sutured to the atrial wall with a running 4-0 polypropylene suture for additional reinforcement. The mechanical valve was placed in anti-anatomical position. The patient was weaned off cardiopulmonary support uneventfully. The aortic cross clamp time, cardiopulmonary bypass time, and operative time were 146, 176 and 311 min, respectively. The postprocedural transesophageal echocardiogram showed no periprosthetic leakage.

The postoperative multidetector computed tomography scan demonstrated good opening and closing of the

Figure 1. Preoperative transthoracic echocardiogram. Extended calcification of the posterior leaflet of the mitral annulus, part of the left ventricle, and papillary muscles (white arrows) is shown. Ao, aorta; LA, left atrium; LV, left ventricle; RV, right ventricle.

Figure 2. (A) A 29-mm SJM valve is secured in the supraannular position of the same plane. (B) Mitral valve replacement. Four sutures are placed in a supraannular manner on the anterior mitral annulus, and an additional 11 sutures are placed through all the layers of the left atrial wall. (C) A 1.5-cm wide equine pericardial collar sutured to the ring of a 29-mm SJM valve. Calc, calcification; LA, left atrium; LV, left ventricle; SJM, St. Jude Medical.
prosthetic valve during the systolic and diastolic phases (Fig. 3A and B). The patient’s postoperative course was uneventful, and she was discharged on the fourteenth postoperative day. She had satisfactory improvement, and the transthoracic echocardiogram showed normal prosthetic valve function without periprosthetic leakage and a mean transvalvular pressure gradient of 6 mmHg at 45 months postoperatively.

**Discussion**

In patients undergoing dialysis, mechanical stress caused by hypertension and a high cardiac output due to an arterial-venous shunt can lead to the development of mitral annular calcification, which in some cases may extend to the valve leaflets and myocardium [3]. Several surgical techniques have been used to manage extensive calcification at the mitral annulus, such as the active removal of calcification and posterior mitral annular reconstruction using an anterior MV patch [4, 5] to create a new annulus [6, 7], or a combination of these techniques [2]. Complete calcium debridement may cause atrioventricular rupture, left circumflex coronary artery damage, and/or thromboembolic events [1]. Intra-atrial insertion of the prosthesis after constructing a new annulus may lead to severe hemorrhage or valve dehiscence due to the transfer of high left ventricular pressure into the left atrium [8].

To prevent fatal complications in the present patient, we did not remove the posterior mitral leaflet and part of the anterior mitral leaflet because of extensive calcification. The technique of avoiding active removal of severe calcification was considered reliable and reproducible. We propose the following three approaches during modified translocated MVR to reduce complications. First, all needles should exit in the same arterial plane, as this enables the prosthesis to be placed in the supraannular position, thus reducing periprosthetic leakage. MVR performed in the supraannular position enables surgeons to insert a larger prosthesis. Second, the sutures should be placed through all the layers of each of the two atrial walls so that they wrap around the posterior mitral annulus. In addition, the mitral prosthetic valve with an equine pericardial collar should be sutured using a running 4-0 polypropylene suture to reinforce the attachment of the prosthetic valve. Finally, the SJM expanded cuff of the mitral prosthetic valve should be used, as it increases the contact area between the sutured cuff and atrium and prevents disturbance of the opening of the prosthetic leaflets caused by the remaining extensively calcified native posterior leaflet. SJM valves have the advantage of causing minimal interference between the leaflets and subvalvular tissue because the height of this valve leaflet from the support frame is the lowest (3.4 mm) among other mitral mechanical prostheses [9]. Kato et al. reported that a paravalvular leak occurred in one of five patients who had undergone MVR by simple supraannular prosthesis insertion [10]. From their viewpoint, sutures of the sewing cuff, both layers of the left atrial wall, and collar patch are very important to reduce the chance of a paravalvular leak. However, surgeons need to pay attention to avoid involving the left circumflex artery when placing sutures on the posterior side of the left atrial wall.

We consider that using these techniques, translocated MVR can reduce the perioperative risk and limit re-intervention after MVR in a patient with extensive calcification of the mitral annulus, especially when the calcified posterior mitral leaflet cannot be excised. We believe that

**Figure 3.** (A) Postoperative multidetector computed tomography scan of the left ventricle during the systolic phase. Adequate closure of the SJM valve is shown. The white arrow indicates that the SJM valve was displaced from the posterior mitral annulus with extensive calcification to the left atrium. (B) Postoperative multidetector computed tomography scan of the left ventricle during the diastolic phase. Adequate opening of the SJM valve is shown. The SJM valve is not interrupted by the subannular apparatus. SJM, St. Jude Medical.
our techniques may be suitable for performing MVR in patients with extensive calcification of the mitral annulus, and good long-term outcomes may be obtained.

Consent
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the editor in chief of this journal.

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Authorship
GK: made substantial contributions to the conception and design, acquisition of data, and analysis and interpretation of data. KN: was involved in drafting the manuscript or revising it critically for important intellectual content. RA, AS, and WT: approved the final version to be published. All authors read and approved the final manuscript.

Conflict of Interest
The authors declare no conflict of interest.

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