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Early Clinical Outcome of Mitral Valve Replacement Using a Newly Designed Stentless Mitral Valve for Failure of Initial Mitral Valve Repair

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ABSTRACT

Here we report the early outcome of mitral valve replacement using a newly designed stentless mitral valve for failure of initial mitral valve repair. Mitral valve plasty (MVP) for mitral regurgitation is currently a standard technique performed worldwide. However, whether mitral valve repair should be performed for patients with advanced leaflet damage or complicated pathology remains controversial. Mitral valve replacement might be feasible for patients who have undergone failed initial MVP; however, it is not an optimal treatment because of poor valve durability and the need for anticoagulative therapy. We report two cases of successful mitral valve replacement using a newly designed stentless mitral valve made of fresh autologous pericardium, which may have a potential benefit over mitral valve repair or mitral valve replacement with a mechanical or bioprosthetic valve.

INTRODUCTION

Mitral valve plasty (MVP) for mitral regurgitation (MR) has become a standard technique performed worldwide. MVP has many advantages over mitral valve replacement (MVR), including preservation of left ventricle function; preservation of the anatomical continuity; and a lower frequency of thromboembolism or hemorrhage associated with anticoagulation therapy [Suri 2006; Gillinov2008]. However, whether MVP should be performed in patients with a damaged mitral valve with severe calcification or advanced degeneration remains controversial. For patients who have undergone a failed initial MVP, a novel stentless mitral valve (SMV) made of fresh autologous pericardium and a flexible ring was developed by Kasegawa [Kasegawa 2012; Kainuma 2015]. (Figures 1A, B). Here we report the early clinical outcome of two cases involving MVR with this newly designed SMV.

CASE REPORTS

Case 1 involved a 63-year-old man who had undergone re-MVP for MR 3 years previously and was referred to our hospital because of MR recurrence. Transthoracic cardiac echocardiography revealed severe MR. (Figure 2A). We considered that a second redo MVP would be difficult owing to the degenerative change of the mitral valve leaflet. The patient rejected MVR with a mechanical valve. Alternatively, we suggested SMV implantation, and the patient agreed.

With the patient under general anesthesia, we performed a median sternotomy, dissected the adhesion of the previous operation, and harvested the autologous pericardium. We trimmed the pericardium according to the specially designed template for the SMV and carefully sutured this trimmed and untreated pericardium to a 33-mm flexible annuloplasty ring (Duran AnCore; Medtronic, Minneapolis, MN, USA). (Figures 1A, B). We make it a point to select a slightly smaller

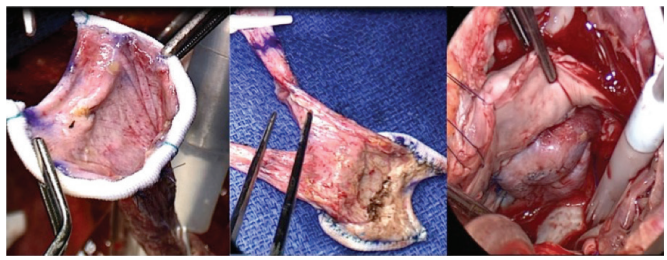

Figure 1. (A) The stentless mitral valve (SMV) made of autologous pericardium. In this case, we used the ring as a band. (B) The legs of the SMV. The length of the legs was determined by preoperative echocardiographic measurement and intraoperative measurement. Delicate adjustment of the length of the legs is necessary to make the SMV function naturally. (C) Implantation of the SMV in the mitral valve position. The coaptation of the anterior and posterior leaflets is adequate.

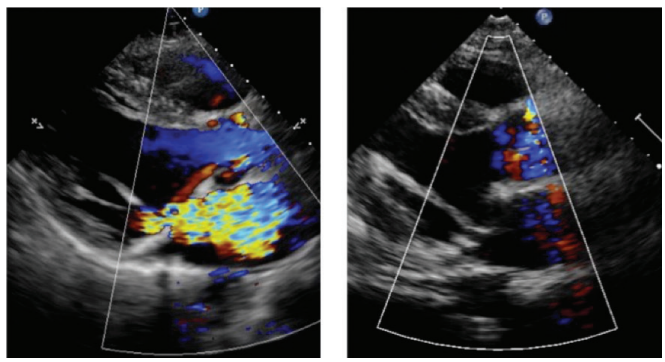

Figure 2. (A) Preoperative transthoracic echocardiography. (B) Postoperative transthoracic echocardiography.

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size SMV to prevent leaflets restriction and systolic anterior motion of mitral valve. The valve competency was confirmed in a saline base before establishing cardiopulmonary bypass. Under routine cardiopulmonary bypass and through a superior trans-septal approach, we resected the severely degenerated mitral valve and measured the distance from the mitral annulus to each papillary muscle. We then fixed the legs of the SMV to each anterior and posterior papillary muscle using mattress sutures and fixed the ring of the SMV to the mitral annulus with a continuous suture. (Figure 1C). Tricuspid valve annuloplasty and a Maze IV operation for persistent atrial fibrillation were performed simultaneously. The patient's postoperative course was uneventful, and he was discharged 25 days postoperatively. Postoperative echocardiography showed only trivial MR. (Figure 2B). He has been well and free from re-intervention and readmission for heart failure during twelve months postoperatively.

Case 2 involved a 47-year-old man who had undergone complicated MVP for MR due to Barlow disease 8 years previously. MR gradually progressed to a severe grade, and transthoracic echocardiography showed dilatation of the left ventricle and a decreasing ejection fraction. He declined to undergo MVR with a mechanical or bioprosthetic valve and instead decided to undergo the SMV operation.

We made the SMV from the untreated autologous pericardium and a 33-mm flexible annuloplasty ring (Duran AnCore; Medtronic) and performed implantation as described above. The patient's postoperative course was uneventful and he was discharged 17 days postoperatively. Postoperative echocardiography revealed no MR. He has been well and free from re-intervention and readmission for heart failure during twelve months postoperatively.

DISCUSSION

The newly designed two-leaflet SMV has a large anterior leaflet and small posterior leaflet sutured to the flexible ring and "legs" that resemble the chordae. These characteristics have the advantages of a flexible annulus, annuloventricular continuity, and sufficient leaflet coaptation. Both in vitro and in vivo studies of this novel SMV have reported excellent valve dynamics and durability [Kasegawa 2012; Kainuma 2015]. We have here described the early clinical outcomes of two cases of SMV replacement for redo cases.

MVP is currently the standard operative technique for MR, and some reports have shown excellent long-term outcomes[Suri 2006; Gillinov2008]. MVP is preferred to MVR because of the preservation of left ventricle function; preservation of the anatomical continuity of the mitral annulus, valve leaflet, chordae, and papillary muscle; and lower frequency of thromboembolism or hemorrhage associated with anticoagulation therapy. However, the quality of MVP is mainly affected by the pathology of the mitral valve leaflet, and whether surgeons should perform MVR for severely damaged valves is unclear. MVR might be feasible for patients in whom the initial MVP has failed; however, it is not an optimal treatment because of poor valve durability, the need for anticoagulative therapy, and other reasons [Kasegawa 2012; Kainuma 2015]. Therefore, SMV may become an optimal treatment method for redo cases.

It is less common for surgeons to perform re-MVP for patients who have undergone failed primary MVP because of tissue damage. Dumont et al. [Dumont 2007] reported that MVP was performed in 68 of 188 (36%) patients who underwent reoperations for recurrent MR after the primary MVP. The other patients did not undergo the re-MVP because of progression of leaflet degenerative change. Considering these results, SMV would be a good option for redo cases.

There are some limitations. In this manuscript, we reported only two cases and early results. We used fresh autologous pericardium to make a stentless mitral valve. It is possible that the fresh autologous pericardium will deteriorate in the future. We need to do a careful and periodical follow up of these patients.

CONCLUSION

At the present time, SMV implantation is a good option mainly for redo cases. However, by accumulating cases and discussing the early- and long-term clinical outcomes, we hope to perform this surgery for patients with irreparable mitral valves, including children and young patients.

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