Introduction

Ischemic mitral regurgitation (IMR) is a severe complication after myocardial infarction and is an important cause of cardiac morbidity and mortality.\(^1\)\(^-\)\(^4\) Despite recently improved surgical techniques and perioperative care, surgical treatment for IMR remains a challenge for cardiac surgeons.

The most common operation performed for chronic IMR is undersized ring annuloplasty, which was popularized by Bolling and colleagues.\(^5\) However, it is frequently associated with residual/recurrent mitral regurgitation (MR).\(^6\)\(^,\)\(^7\) McGee and colleagues reported that recurrence of moderate or severe MR developed in 30% of patients 1 year after undersized annuloplasty.\(^8\) In addition, Wu and colleagues showed that undersized annuloplasty did not improve long-term survival in patients with IMR.\(^9\)

Such findings have led surgeons to examine alternative methods of surgical treatment for IMR.\(^10\)\(^,\)\(^11\)

Midterm Outcomes of Chordal Cutting in Combination with Downsized Ring Annuloplasty for Ischemic Mitral Regurgitation

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Purpose: We describe midterm outcomes after division of secondary chords (chordal cutting) combined with downsized ring annuloplasty for ischemic mitral regurgitation (IMR).

Methods: We compared the clinical outcomes in patients who underwent chordal cutting with downsized ring annuloplasty (CC-group, n = 15) and those who underwent conventional ring annuloplasty only (Conventional-group, n = 35) for IMR. Follow-up was complete in all patients. The median follow-up time was 4.1 years.

Results: Thirty-day mortality was 0% in CC-group and 20% in Conventional-group. The overall survival rate at 5-year was 80.8% ± 12.6% in CC-group and 61.7% ± 8.4% in Conventional-group (Log-rank, p = 0.145). The freedom rate from valve-related events at 5 year was 84.6% ± 10.0% in CC-group and 65.3% ± 10.1% in Conventional-group (Log-rank, p = 0.213). Recurrence of severe mitral regurgitation was revealed in 3 patients of CC-group. Preoperative tenting height was the significant predictor of mitral regurgitation recurrence. In CC-group, the mean left ventricular ejection fraction was 38.0% ± 14.0%, which was similar to the preoperative value of 40.0% ± 13.2% (p = 0.349).

Conclusions: Chordal cutting with downsized ring annuloplasty for IMR is a simple method and provides satisfactory early outcomes. However, it carries with high recurrence of MR especially for patients with high tenting height.

Keywords: chordal cutting, ischemic mitral regurgitation, ring annuloplasty, left ventricular function
The chordal cutting procedure, which involves disruption of the secondary chordae, is a simple method performed to repair severe tethering. Messas and colleagues reported that the chordal cutting procedure resulted in decreased leaflet tethering and decreased mitral insufficiency in an animal model. Secondary chords attach to the belly of the mitral valve leaflets and cause kinking of the anterior leaflet in patients with IMR, resulting in the “seagull sign” on echocardiography. The chordal cutting procedure may relieve leaflet tethering, a main cause of recurrent MR after mitral valve repair. Borger and colleagues demonstrated good initial results of the chordal cutting procedure; however, midterm outcomes, especially the impact on left ventricular function, are unknown.

We used to perform undersized ring annuloplasty with or without coronary artery bypass grafting (CABG) for IMR. In 2003, we began performing the chordal cutting procedure for IMR with local remodeling on the left ventricle. We herein describe our midterm outcomes of the chordal cutting procedure in combination with ring annuloplasty for IMR, comparing those of conventional undersized ring annuloplasty only.

Materials and Methods

The data analysis for this retrospective study was approved by the Institutional Review Board of Kobe City Medical Center General Hospital. The Board waived the need for patient consent.

Patient population

We reviewed our surgical database, which includes all data about mitral valve surgeries performed in our institution. From January 1991 to December 2010, a total of 1138 patients underwent mitral valve surgery (949 mitral valve repairs and 169 mitral valve replacements) at Kobe City Medical Center General Hospital. Among them, 50 patients underwent mitral valve repair for IMR. IMR was defined as mitral regurgitation induced by chordal and/or papillary muscle displacement from mitral valve due to local remodeling of left ventricle after previous myocardial infarction. We excluded other etiologies of mitral regurgitation, complicated with coronary artery disease. We also excluded patients who underwent mitral valve replacement and patients who underwent CABG only. We began performing the chordal cutting procedure in 2003. The inclusion criteria for the chordal cutting procedure were more than 10 mm of tethering height and highly enlarged left ventricle (more than 60 mm of diastolic diameter). As a result, 15 patients underwent the chordal cutting procedure.

Patients were divided into two groups according to the operative technique: those undergoing the chordal cutting procedure (CC-group, n = 15) and those undergoing conventional undersized annuloplasty only (Conventional-group, n = 35). Patient characteristics and preoperative echocardiographic data are shown in Table 1. Of note, the CC-group patients had greater mitral regurgitant fraction and volume and tenting height was greater in CC-group preoperatively. Left ventricular diameter and ejection fraction were not different between two groups statistically.

Surgical techniques

Surgery was performed via median sternotomy in all patients. Standard cardiopulmonary bypass techniques were used, including bicaval cannulation. We performed coronary artery bypass grafting first without aortic cross clamp (on pump beating). After completing all peripheral anastomoses, we performed aortic cross clamp. Myocardial protection was achieved with antegrade and retrograde intermittent cold-blood cardioplegia. A left atrial incision was used in most patients. For mitral annuloplasty, interrupted 2-0 braided sutures without pledgets were placed circumferentially along the mitral annulus. A rigid complete annuloplasty ring (Carpentier-Edwards Physio or Physio II Annuloplasty Ring; Edwards Lifesciences Inc., Irvine, California, USA) was used for all patients in CC-group. In our early experience, a flexible Duran Annuloplasty ring (Medtronic Inc., Minneapolis, Minnesota, USA) was used for some patients in Conventional-group. The annuloplasty ring was undersized in all patients and ranged from 23 to 29 mm, depending on the patient’s body surface area.

For the chordal cutting procedure, we divided secondary chords of the anterior leaflet, posterior leaflet, and commissure that arose from the papillary muscle or muscles affected by the infarcted myocardium. The affected papillary muscle was identified by preoperative transthoracic or transesophageal echocardiography. Secondary chords were carefully separated out from primary chords with a nerve hook, confirming their attachment to the belly of the leaflets. All secondary chords from the affected papillary muscles were divided. Secondary chordal cutting was performed before insertion of the annuloplasty ring. Both sides of secondary chords were divided in 7 patients, only posterior side of secondary chords were divided in 5 patients and only anterior side of secondary chords were divided in 3 patients. Concomitant procedures were performed...
in 14 patients (93.3%) in CC-group. In patients who had left ventricular aneurysm, we performed aneurysmectomy. The details of the surgical procedures are shown in Table 2.

Definitions

Left ventricular ejection fraction was calculated by the modified Simpson and Quinones method. Right ventricular pressure was measured by Doppler echocardiography (modified Bernoulli equation: $4 \times [\text{tricuspid regurgitation jet velocity}]^2 + \text{right atrial pressure [10 mmHg]}$). Tenting height was defined as the distance from the leaflet coaptation point to the mitral annulus. Valve-related events were defined according to the guidelines for reporting mortality and morbidity after cardiac valve interventions.16)

Follow-up examination and management

Patient follow-up took place at the outpatient clinic or by telephone survey and was completed in 48 patients (96%). The median follow-up time was 4.1 years. Postoperative echocardiographic follow-up was generally performed before discharge and at the outpatient clinic at 1, 3, and 5 years postoperatively. The median echocardiographic follow-up time was 3.9 years. Follow-up echocardiographic data were obtained in 34 out of 40 patients (85%) who survived operation.

Statistical analysis

Continuous data are expressed as mean ± standard deviation and range. Categorical variables were compared with the $\chi^2$ or Fisher’s exact tests, and continuous variables were compared with unpaired t or Wilcoxon tests. Survival and freedom from events were calculated using the Kaplan-Meier method. Statistical analysis was performed with StatView software (SAS Institute, Cary, North Carolina, USA).

Results

Early outcomes

In CC-group, there was no in-hospital death. Regarding in-hospital morbidity, 4 patients (26.7%) required postoperative intra-aortic balloon pumping. Four patients (26.7%)
Midterm Outcomes of Chordal Cutting

required re-exploration for postoperative bleeding. One patient (6.7%) developed mediastinitis and underwent omental flap transposition. No patients developed stroke, renal failure requiring newly indicated hemodialysis, or respiratory failure requiring tracheotomy. There was no residual severe MR. The MR grade at discharge was mild or less in 14 (93.3%) patients and moderate in 1 (6.7%) patient.

In Conventional-group, thirty-day mortality was revealed in 7 patients (20%). The causes of death were low output syndrome in 5 and acute respiratory distress syndrome in 2. Regarding in-hospital morbidity, 10 patients (28.6%) required postoperative intra-aortic balloon pumping. Two patients (5.7%) developed intra-operative stroke, 4 patients (11.4%) developed acute renal failure requiring newly indicated hemodialysis, 4 patients (11.4%) required tracheotomy, and 2 patients (5.7%) developed mediastinitis. Among the patients who survived operation, the MR grade at discharge was mild or less in 22 (88%) patients and moderate in 3 (12%) patient.

Survival

In CC-group, there were twolate deaths. Both were due to pneumonia-induced sepsis, and both occurred in hemodialysis-dependent patients. There was no late cardiac death.

In Conventional group, there were six late deaths. The causes were cardiac in three and infection in three.

Survival

In CC-group, there were twolate deaths. Both were due to pneumonia-induced sepsis, and both occurred in hemodialysis-dependent patients. There was no late cardiac death.

In Conventional group, there were six late deaths. The causes were cardiac in three and infection in three.

**Table 2** Details of surgical procedures of patients who underwent the chordal cutting procedure (CC-group) and patients who underwent conventional undersized annuloplasty only (Conventional-group)

<table>
<thead>
<tr>
<th>Variables</th>
<th>CC-group (n = 15)</th>
<th>Conventional-group (n = 35)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of annuloplasty ring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physio ring, n (%)</td>
<td>15 (100%)</td>
<td>19 (54.3%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Duran ring, n (%)</td>
<td>0 (0%)</td>
<td>14 (40%)</td>
<td>0.011</td>
</tr>
<tr>
<td>No ring</td>
<td>0 (0%)</td>
<td>2 (5.7%)</td>
<td>0.875</td>
</tr>
<tr>
<td><strong>Size of annuloplasty ring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23–24 mm, n (%)</td>
<td>6 (40.0%)</td>
<td>15 (45.4%)</td>
<td>0.969</td>
</tr>
<tr>
<td>25–26 mm, n (%)</td>
<td>8 (53.3%)</td>
<td>12 (36.4%)</td>
<td>0.430</td>
</tr>
<tr>
<td>27–29 mm, n (%)</td>
<td>1 (6.7%)</td>
<td>6 (18.2%)</td>
<td>0.594</td>
</tr>
<tr>
<td><strong>Concomitant procedures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABG, n (%)</td>
<td>12 (80.0%)</td>
<td>33 (94.3%)</td>
<td>0.304</td>
</tr>
<tr>
<td>Tricuspid annuloplasty, n (%)</td>
<td>6 (40.0%)</td>
<td>5 (14.3%)</td>
<td>0.101</td>
</tr>
<tr>
<td>LV aneurysmectomy, n (%)</td>
<td>2 (13.3%)</td>
<td>6 (17.1%)</td>
<td>0.933</td>
</tr>
<tr>
<td>Maze procedure, n (%)</td>
<td>2 (13.3%)</td>
<td>3 (8.6%)</td>
<td>1.000</td>
</tr>
<tr>
<td>Cardiopulmonary bypass time, min</td>
<td>253 ± 77</td>
<td>299 ± 75</td>
<td>0.055</td>
</tr>
<tr>
<td>Aortic cross-clamp time, min</td>
<td>135 ± 45</td>
<td>135 ± 58</td>
<td>0.980</td>
</tr>
</tbody>
</table>

CABG: coronary artery bypass grafting; LV: left ventricle

The overall survival rate was 92.3% ± 7.4% at 1 year and 80.8% ± 12.6% at 5 years in chordal cutting (CC)-group and 68.6% ± 7.8% at 1 year and 61.7% ± 8.4% at 5 years in Conventional-group (Log-rank, p = 0.145).

**Fig. 1** The overall survival rate was 92.3% ± 7.4% at 1 year and 80.8% ± 12.6% at 5 years in chordal cutting (CC)-group and 68.6% ± 7.8% at 1 year and 61.7% ± 8.4% at 5 years in Conventional-group (Log-rank, p = 0.145).

Late valve-related events

In CC-group, 3 patients required readmission for cardiac reasons. One patient had a stroke 1 year after the operation. No patient required reoperation for the mitral valve or coronary revascularization. The mean NYHA functional class was 1.7 ± 0.9 at follow-up; 8 patients
were in class I, 3 patients were in class II, and 4 patients were in class III.

In Conventional-group, 11 patients required readmission for cardiac reasons. Two patients developed stroke and 1 patient required reoperation for recurrent mitral regurgitation.

The freedom rate from valve-related events was 84.6% ± 10.0% at 1 year and 84.6% ± 10.0% at 5 years in CC-group and 79.3% ± 8.2% at 1 year and 65.3% ± 10.1% at 5 years in Conventional-group (Log-rank, p = 0.213).

The mean latest New York Heart Association functional class was 1.7 ± 0.9 in CC-group and 1.9 ± 0.9 in Conventional-group (p = 0.515).

Echocardiographic data during follow-up

In CC-group, the latest MR grade was mild or less in 11 (73.3%) patients, moderate in 1 patient (6.7%), and severe in 3 patients (20%). Of the 3 patients who developed recurrence of severe MR, 1 patient died of pneumonia, 1 patient was in NYHA functional class III and required readmission for congestive heart failure, and 1 patient was under close follow-up because the symptoms were relatively mild (NYHA functional class II). Preoperative data were compared between the patients with and without recurrence of severe MR (Table 3) to determine the predictors of MR recurrence. Tenting height was the significant predictor of MR recurrence. Patients with recurrence of severe MR tended to have a higher mitral regurgitant fraction, regurgitant volume, and effective regurgitant orifice as well as an enlarged left ventricle and decreased left ventricular function. Of note, 2 of the 3 patients were hemodialysis-dependent. In Conventional-group, the latest MR grade was mild or less in 15 (60%) patients, moderate in 7 patients (28%), and severe in 3 patients (12%). Of the 3 patients who developed recurrence of severe MR, 1 patient underwent reoperation and mitral valve replacement was performed. Other 2 patients were under close follow-up considering the high risks of reoperation. The freedom rate from recurrence of severe MR was not different between two groups (Log-rank, p = 0.110).

In CC-group, mean left ventricular diastolic diameter was 61.1 ± 7.2 mm preoperatively, which decreased to 55.5 ± 8.3 mm at 1–2 year after operation, 57.3 ± 6.2 mm at 3–4 years after operation and 56.5 ± 7.0 mm at 5–6 years after operation (p < 0.001). Mean left ventricular ejection fraction was 40.0% ± 13.2% preoperatively, which decreased to 38.0% ± 12.9% at 1–2 year after operation, however, increased to 46.8% ± 11.5% at 3–4 year after operation.

Table 3  Comparison of preoperative data between patients with and without recurrence of severe mitral regurgitation

<table>
<thead>
<tr>
<th></th>
<th>Recurrence of severe MR (n = 3)</th>
<th>No recurrence of severe MR (n = 12)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>60.3 ± 6.4</td>
<td>62.8 ± 11.1</td>
<td>0.719</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>2 (67%)</td>
<td>11 (92%)</td>
<td>0.849</td>
</tr>
<tr>
<td>BSA, m²</td>
<td>1.6 ± 0.2</td>
<td>1.6 ± 0.2</td>
<td>0.988</td>
</tr>
<tr>
<td>Diabetes mellitus, n (%)</td>
<td>1 (33%)</td>
<td>6 (50%)</td>
<td>0.897</td>
</tr>
<tr>
<td>Hemodialysis, n (%)</td>
<td>2 (67%)</td>
<td>2 (17%)</td>
<td>0.307</td>
</tr>
<tr>
<td>Atrial fibrillation, n (%)</td>
<td>0 (0%)</td>
<td>3 (25%)</td>
<td>0.872</td>
</tr>
<tr>
<td>NYHA functional class</td>
<td>3.0 ± 0.0</td>
<td>2.9 ± 0.7</td>
<td>0.837</td>
</tr>
<tr>
<td>MR severe, n (%)</td>
<td>3 (100%)</td>
<td>9 (75%)</td>
<td>0.872</td>
</tr>
<tr>
<td>Mitral regurgitant fraction, %</td>
<td>68.7 ± 18.1</td>
<td>58.5 ± 11.0</td>
<td>0.232</td>
</tr>
<tr>
<td>Mitral regurgitant volume, ml/beat</td>
<td>91.7 ± 31.1</td>
<td>70.0 ± 26.3</td>
<td>0.236</td>
</tr>
<tr>
<td>Mitral effective regurgitant orifice, cm²</td>
<td>0.65 ± 0.36</td>
<td>0.40 ± 0.18</td>
<td>0.206</td>
</tr>
<tr>
<td>LVDD, mm</td>
<td>62.0 ± 8.9</td>
<td>60.9 ± 7.2</td>
<td>0.834</td>
</tr>
<tr>
<td>LVDs, mm</td>
<td>54.0 ± 12.2</td>
<td>51.0 ± 7.6</td>
<td>0.585</td>
</tr>
<tr>
<td>LV EF, %</td>
<td>32.3 ± 11.2</td>
<td>41.9 ± 13.3</td>
<td>0.275</td>
</tr>
<tr>
<td>LA D, mm</td>
<td>50.3 ± 11.0</td>
<td>44.6 ± 10.0</td>
<td>0.402</td>
</tr>
<tr>
<td>RV pressure, mmHg</td>
<td>47.0 ± 10.6</td>
<td>47.4 ± 17.6</td>
<td>0.969</td>
</tr>
<tr>
<td>Preoperative TR grade</td>
<td>1.5 ± 0.9</td>
<td>1.3 ± 0.6</td>
<td>0.661</td>
</tr>
<tr>
<td>Tenting height, mm</td>
<td>24.8 ± 1.9</td>
<td>11.3 ± 2.1</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

BSA: body surface area; NYHA: New York Heart Association; MR: mitral regurgitation; LVDD: left ventricular diastolic diameter; LVDs: left ventricular systolic diameter; LV EF: left ventricular ejection fraction; LA D: left atrial diameter; RV: right ventricle; TR: tricuspid regurgitation
Mitral leaflet tethering by outward displacement of the papillary muscles caused by left ventricular remodeling is the basic mechanism of IMR. Although surgical annuloplasty for IMR is effective, a considerable number of patients develop recurrent/persistent MR, which adversely affects mortality.6–8 Several surgical options have been proposed for IMR, including edge-to-edge (Alfieri) repair,11 papillary muscle approximation, papillary muscle relocation, and left ventricular restoration. However, the amount of clinical experience with each of these techniques is very limited. We used to perform undersized ring annuloplasty with or without CABG for IMR. However, the clinical outcomes of those were not satisfactory and we encountered several cases of recurrent MR due to restrictive motion of chordae elongated by dilated left ventricle. That is why we speculated other surgical options for this pathology.

Secondary chords result in kinking of the anterior MV leaflet in chronic IMR. Messas and colleagues demonstrated that division of secondary chords in a sheep model of acute12 and chronic13 IMR resulted in improved leaflet coaptation and reduced MR without leaflet prolapse or decline in left ventricular ejection fraction. The chordal cutting operation is intended to prevent persistent leaflet tethering after mitral valve repair, an important cause of recurrent IMR.17 Borger and colleagues described the early results of chordal cutting compared with those of undersized annuloplasty only.15 They reported that patients who underwent chordal cutting had a greater reduction in tent area after surgery and were less likely to suffer from recurrent mitral regurgitation during 2 years of follow-up. However, the midterm outcomes have not been clear. In this study, we reported the midterm outcomes of the chordal cutting operation for IMR, which is a simple method we began performing in 2003.

Notably, no perioperative mortality occurred. A previous report showed a perioperative mortality of 9%.15 Other reports on surgical outcomes for IMR showed similar mortality rates.18–20 The reason of good early outcomes may be related to the simple feature of this procedure. This procedure does not require addition of long cross-clamp time. Regarding late survival, the overall survival rate was 92.3% ± 7.4% at 1 year and 80.8% ± 12.6% at 5 years, which was satisfactory considering the high-risk backgrounds of the patients. Late death occurred only in hemodialysis-dependent patients. Regarding valve-related events, we have not encountered reoperation for mitral valve.

However, despite the fact that the MR grade at discharge was well controlled, we found severe recurrent MR in 20% of patients during the follow-up. Patients with MR recurrence had a significantly higher preoperative tenting height than that of patients without MR recurrence (24.8 ± 1.9 mm vs. 11.3 ± 2.1, p <0.001). Moreover, patients with recurrence of severe MR tended to have a higher preoperative mitral regurgitant fraction, regurgitant volume, and effective regurgitant orifice as well as an enlarged left ventricle and decreased left ventricular function. Patients with MR recurrence had once decreased tenting height early after the operation, however, tethering recurred at late term with the enlargement of left ventricle. Previous studies showed chordal cutting increased leaflet mobility.21,22 That means, even if sufficient coaptation is obtained early after the operation due to increased leaflet mobility, tethering can recur after left ventricular continues to enlarge. We consider the biggest limit of secondary chordal cutting is the remaining of primary chordal tethering, which restrict the leaflet mobility. Thus, in the patients with high tenting height, alternative procedures on the left ventricle or papillary muscle might be necessary. Two of 3 patients with recurrence of severe MR were hemodialysis-dependent. Such patients may be unlikely to show reverse remodeling because of the low compliance of the left ventricle.

Chordal cutting reportedly decreases mitral leaflet tethering and improves IMR, however, it may lead to a
decrease in left ventricular function because of the loss of ventricular-valvular continuity. Rodriguez and colleagues indicated that left ventricular function worsened after chordal cutting in an acute ovine IMR model and that chordal cutting did not show a significant effect against IMR control.23) In contrast, Messas and colleagues reported that left ventricular function was maintained by chordal cutting in a normal ovine model.24) Borger and colleagues also showed that chordal cutting did not adversely affect left ventricular function.15) In this study, we required postoperative intra-aortic balloon pumping at a relatively high rate (26.7% of the patients). The reason was that our low threshold of using postoperative balloon pumping. However, all of these patients were weaned from it without significant problems. We showed late echocardiographic data after chordal cutting. The mean left ventricular ejection fraction was 38.0% ± 14.0%, which was slightly lower than the preoperative value of 40.0% ± 13.2%; however, this did not become a clinical problem. Moreover, reverse remodeling was confirmed after the procedure. The mean left ventricular diastolic diameter significantly decreased to 56.7 ± 10.5 mm at follow-up from 61.2 ± 7.2 mm preoperatively (p < 0.001).

In terms of the type of annuloplasty ring, we used a complete rigid ring in all cases of chordal cutting. Borger and colleagues used a flexible, incomplete annuloplasty band.15) However, Gorman and colleagues25) showed that progressive dilatation of both the anterior and posterior mitral annuli, increased annular area, and asymmetric ventricular dilatation combined to cause IMR by distortion of the mitral valve geometry and tethering of leaflet coaptation. Therefore, we consider that complete ring annuloplasty is superior to partial annuloplasty in the treatment of IMR. One of the reasons for high mortality and morbidity in Conventional-group may be the use of flexible ring in the early experience.

Study Limitations

There are some limitations to this study. First, the size of the cohort was small. Second, the follow-up period was relatively short. Third, the learning curve may influence the surgical outcomes. Finally, this was a single-institution, retrospective study. There must be some potential bias in patient selection. Randomized controlled trials are thus desirable for accurate assessment of the best strategy for this pathology.

Conclusions

We showed the midterm outcomes of the chordal cutting procedure in combination with downsized ring annuloplasty for IMR. It is a simple method and provides satisfactory early outcomes without impairment of left ventricular function. However, a conclusion that chordal cutting should be added to conventional ring annuloplasty could not be obtained in terms of late control of MR.

Disclosure Statement

The authors have no conflicts of interest to disclose.

References


