

Mitral valve replacement after failed MitraClip™ therapy: report of two cases

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Abstract We report 2 cases of patients who were successfully treated surgically for remaining or recurrent mitral regurgitation after MitraClip (Abbott Vascular, Santa Clara, CA, USA) implantation. In one patient, intervention with MitraClip was indicated because of the extremely poor heart function and poor general status of the patient. However, the severe mitral insufficiency remained after the MitraClip treatment and valve replacement was required. In the other high-risk patient, severe mitral regurgitation recurred 3 years after a successful MitraClip treatment due to infective endocarditis. Our experience suggests that some patients who are considered “high-risk” before MitraClip treatment might be reasonable candidates for a straight forward mitral valve surgery, even in the re-intervention setting. We conclude that patients considered for MitraClip implantation should undergo detailed risk stratification, because we have to keep in mind that after failed clip implantation the perioperative risk increases and the chance of mitral repair decreases.

Keywords Interventional mitral valve repair · Mitral valve replacement · Infective endocarditis

Introduction

In the last decade, remarkable advances in percutaneous therapy for heart diseases have been achieved, not only for

coronary heart disease and aortic valve disease but also for mitral valve disease. Percutaneous mitral valve repair using the MitraClip (Abbott Vascular, Santa Clara, CA, USA) device has demonstrated similar efficacy in improving clinical outcome with superior safety compared with conventional mitral valve repair [1]. Based on these encouraging results, it is anticipated that an increasing number of clipping procedures will be performed in the future. However, little is known about the impact and the consequences of failing clip procedures, and the range of the indication of this therapy is still under debate [2–4].

Herein, we report 2 cases of patients who underwent mitral valve replacement after failed MitraClip therapy. We believe that this report would add significant information for future practice of MitraClip interventions.

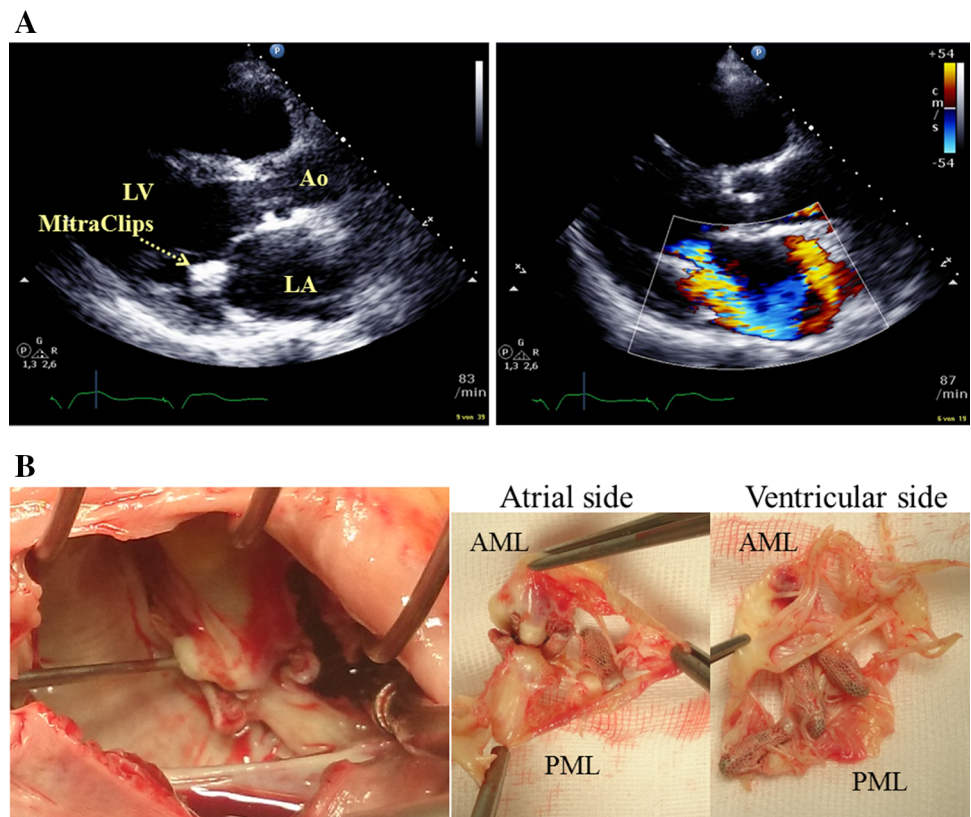
Case report

Case 1

A 66-year-old male patient with dilated cardiomyopathy (left ventricular ejection fraction [LVEF] 15 %), chronic atrial fibrillation, severe mitral insufficiency due to type 1 annular dilatation, and tricuspid insufficiency was admitted to our university hospital in February 2014 because of progressive dyspnea and edema. He had a history of cardiac resynchronization therapy (CRT) since 2003 and sigmoid colon carcinoma, but successful treatment and life expectancy of more than 2 years. Intravenous inotropic support was started, and subsequently percutaneous interventional mitral valve repair with 3 MitraClips was performed as determined by an interdisciplinary heartvalve team consisting of cardiac surgeons and cardiologists, which resulted only in slight reduction of the regurgitation

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Fig. 1 a Preoperative transthoracic echocardiographic image of the case 1. MitraClips are seen as a high echoic area between anterior and posterior mitral leaflets (*left*). The color Doppler image shows the remaining severe mitral regurgitation after the MitraClip treatment. **b** Intraoperative view of the mitral valve (*left*) and excised mitral valve of the case 1. The both leaflets are adhered to each other by three MitraClips



(Fig. 1a) and no improvement of the New York Heart Association functional status. Therefore, the patient was transferred to our cardiac surgery department and underwent mitral valve replacement with a bioprosthesis, tricuspid annuloplasty, and closure of the iatrogenic atrial septal defect made for the MitraClip implantation 11 days after the MitraClip intervention.

The operation was performed via median sternotomy and under cardioplegic cardiac arrest. Intraoperative observation of the mitral valve revealed strong adhesion of the both leaflets to the clips and extensive damages of the leaflets (Fig. 1b). Therefore, mitral valve repair could not be considered. Due to a significant dilatation of the annulus, mitral annuloplasty might have been a reasonable option before interventional treatment.

After mitral replacement, the patient was extubated and inotropes were weaned off on the first postoperative day. The postoperative course was uneventful and he was discharged from our department on the 11th postoperative day (Fig. 2).

Case 2

A 52-year-old male patient with heart failure and preserved ejection fraction (noncompaction cardiomyopathy suspected, LVEF 56 %), who had been successfully treated with MitraClip for mitral insufficiency due to type 1 annular

dilatation at our hospital in 2011, was readmitted due to the infective endocarditis of the mitral valve and the recurrence of mitral insufficiency (Fig. 3a). The patient received an implantable cardioverter defibrillator (ICD) in 2008. He was on hemodialysis due to diabetic nephropathy and *Staphylococcus epidermidis* was detected in his blood culture.

The operation was carried out in an urgent setting. Cardiopulmonary bypass was established between the femoral and the jugular veins and the femoral artery. Mitral valve replacement with a bioartificial valve, tricuspid annuloplasty, direct closure of the atrial septum defect, and explantation of the ICD lead were performed through a right-side anterolateral mini-thoracotomy with a length of 7 cm. Intraoperative observation of the mitral valve revealed that both leaflets were broadly and strongly adhered to each other in A2/P2 segments by 3 MitraClips. Vegetation with a diameter of 1.0 cm was observed on the P2 segment of the posterior leaflet (Fig. 3b).

The post-operative course was complicated with pneumonia but he was finally extubated on the 16th postoperative day and left the intensive care unit on the 18th postoperative day (Fig. 2). Although readmission to the intensive care unit was required 2 times due to recurrence of heart failure subsequent to atrial fibrillation, he was discharged from our hospital in a stable condition on the 52nd postoperative day.

Fig. 2 Clinical courses of the 2 patients. ① Duration of the inotropic support, ② duration of continuous veno-venous hemofiltration, ③ extubation, ④ discharge from intensive care unit, ⑤ discharge from the hospital. *AST* aspartate aminotransferase, *ALT* alanine aminotransferase, *POD* postoperative days

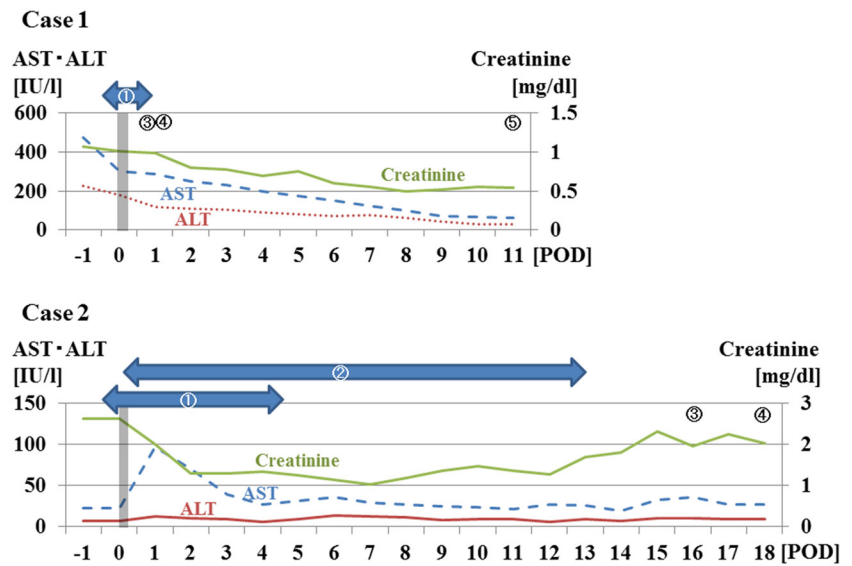
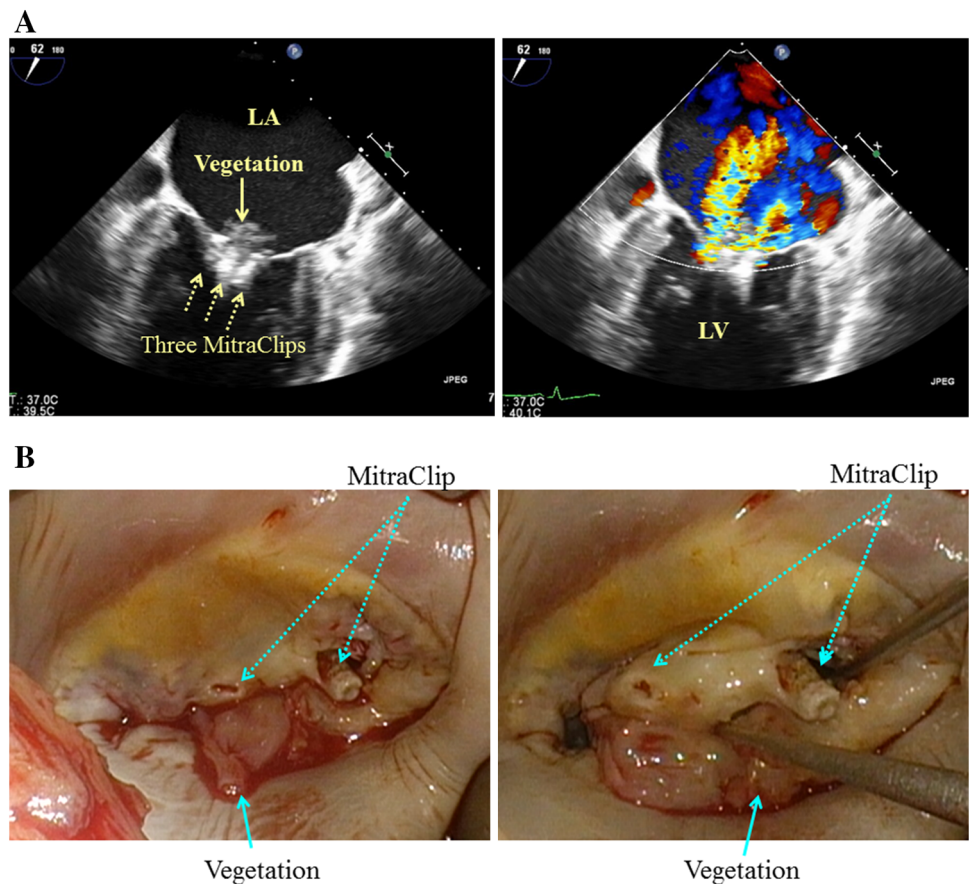


Fig. 3 a Preoperative transesophageal echocardiographic image of the case 2. An 1–1.5 cm vegetation is seen on the mitral valve leaflet where the MitraClips were implanted (left). The color Doppler image shows the recurrent severe mitral regurgitation. **b** Intraoperative view of the mitral valve of the case 2. The vegetation was located at the P2 segment of the posterior mitral leaflet. Degenerative changes were observed on the both leaflets around the MitraClips



Discussion

We reported 2 cases of high-risk patients with remaining or recurrent severe mitral regurgitation after MitraClip implantation who were successfully treated surgically. In

the first patient, intervention with MitraClip was indicated because of the extremely poor heart function and frailty of the patient. However, the severe mitral insufficiency remained after the MitraClip treatment and valve replacement was required. In the second patient, severe mitral

regurgitation recurred 3 years after a successful MitraClip treatment due to infective endocarditis.

The MitraClip offers an attractive alternative treatment for patients with Type 1 annular dilatation of the mitral valve. A recently published randomized control trial of the MitraClip versus conventional surgery revealed that the MitraClip technique was associated with a reduction in the rate of major adverse events as compared with surgery, and similar clinical improvement, as measured by quality of life, heart failure status, and left ventricular function [1]. The superiority of the MitraClip was more prominent in patient subgroups with higher age and poorer left ventricular systolic function. However, MitraClip did not reduce mitral regurgitation below grade 3+ in 23 % of patients [1]. On the other hand, it is well known that surgical mitral valve repair can be carried out with extremely low complication rates and with high success rates [5] not only in young but also in elderly patients [6]. Considering the risks associated with mitral valve surgery after primary MitraClip intervention, the superiority of the MitraClip may be offset by the low residual regurgitation after conventional surgery, rarely requiring repeat mitral valve surgery.

Argenziano and coworkers reported successful mitral valve repair in 21 patients out of 32 patients who underwent mitral valve surgery after failed MitraClip treatment [4]. However, this report includes also 9 patients who eventually had not received a clip implant owing to the inability to effectively reduce mitral regurgitation during MitraClip procedure. On the other hand, it is also reported that the patient's condition tends to deteriorate rapidly and the risk of mitral valve surgery increases dramatically when the clipping fails [2]. Geidel et al. evaluated 19 consequent patients with failed MitraClips implantation, and reported that mitral valve repair becomes almost impossible and valve replacement is required due to the tissue damage caused by MitraClip, especially when 3 or more clips are used [2]. The structural damage of the leaflets due to the clip procedure was found to be significant, leading to rupture and scarring at the free edge of the leaflets (Figs. 1B and 2B). Therefore, mitral clipping must be regarded as an option in the situation of inoperability or for “high-risk” patients only [7].

The incidence of infective endocarditis after MitraClip therapy has been thought to be extremely low. Alozie and coworkers [3] reported a case of subacute bacterial endocarditis after MitraClip implantation which was diagnosed during autopsy. The diagnosis of endocarditis was clinically and echocardiographically undetected [3]. The diagnosis of infective endocarditis post-MitraClip therapy might be very challenging, due to ultrasound artifacts of

the clip. To the best of our knowledge, this is the first case with infective endocarditis after MitraClip treatment diagnosed preoperatively and successfully treated surgically. Although the incidence may be low, the possibility of infective endocarditis should always be kept in mind after MitraClip therapy, as with other prosthetic intracardiac devices. Hybrid operating rooms should be preferred to provide the best hygienic conditions for all cardiac interventions with large alloplastic implants.

In conclusion, straight forward mitral valve surgery, in the hands of experienced surgeons, might be a reasonable option even for patients considered to be candidates for interventional mitral valve clipping. Our case report shows that the conventional operation can be successfully performed even in the urgent and re-intervention setting. This suggests that the primary decision for surgery might have been the better choice in these cases and that a reasonable chance of valve reconstruction had been missed.

Conflict of interest Saito and other co-authors have no conflict of interest.

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