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Treatment of severe mitral regurgitation that mimics a para-ring mitral regurgitation after failed annuloplasty ring with MitraClip: A case report

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Abstract

Background: Progressive remodelling of the left ventricle with lateral and apical displacement of one or both papillary muscles can lead to recurrence of severe mitral regurgitation (MR) in the presence of the mitral valve (MV) ring. The MitraClip (Abbott, USA) is the only option in cases with annuloplasty rings too large for implantation of a Sapien prosthesis in high surgical-risk patients. We present a case where the MR jet was directed toward a para-ring hole, and the MitraClip system was used successfully to treat this severe MR.

Case summary: An 80-year-old woman underwent coronary artery bypass surgery plus MV repair with C-shaped ring 6 years ago. In the past year, she experienced severe shortness of breath; her ejection fraction dropped to 15%. A transesophageal echocardiogram revealed that severe MR started at the level of MV leaflets and then passed to the left atrium beside the MV ring. Live 3D showed the severe MR coming through the oval-shaped hole beside the C-shaped MV repair ring. MitraClip implantation was decided, the two leaflets were grasped successfully, the clip was fully closed, and only trace MR remained at the MV leaflets with no flow to the para-ring hole. The patient was extubated after 12 hours and discharged home after 2 days. Follow-up transthoracic echocardiography after 6 months showed the clip in place and trace residual MR.

Conclusion: Implantation of MitraClip in the presence of MV repair ring is feasible and safe. The para-ring defect can be left if the origin of MR from the MV coaptation line is treated successfully with MitraClip. Symptomatic improvement with no rehospitalization was documented in this case.

Keywords: Case report, MitraClip, Mitral regurgitation, Mitral valve, Ring

1. Introduction

Progressive remodelling of the left ventricle (LV) with lateral and apical displacement of one or both papillary muscles can lead to recurrence of severe mitral regurgitation (MR) in the presence of the mitral valve (MV) ring [1]. If the patient is at high risk for redo-surgery,

percutaneous treatment approaches are good alternatives and associated with good peri-interventional success [2]. The MitraClip is the only option in cases with annuloplasty rings too large for implantation of a Sapien prosthesis [3]. Many reported cases used MitraClip in the presence of MV ring; however, in most cases the MR were through the ring itself [4–8]. We present a case

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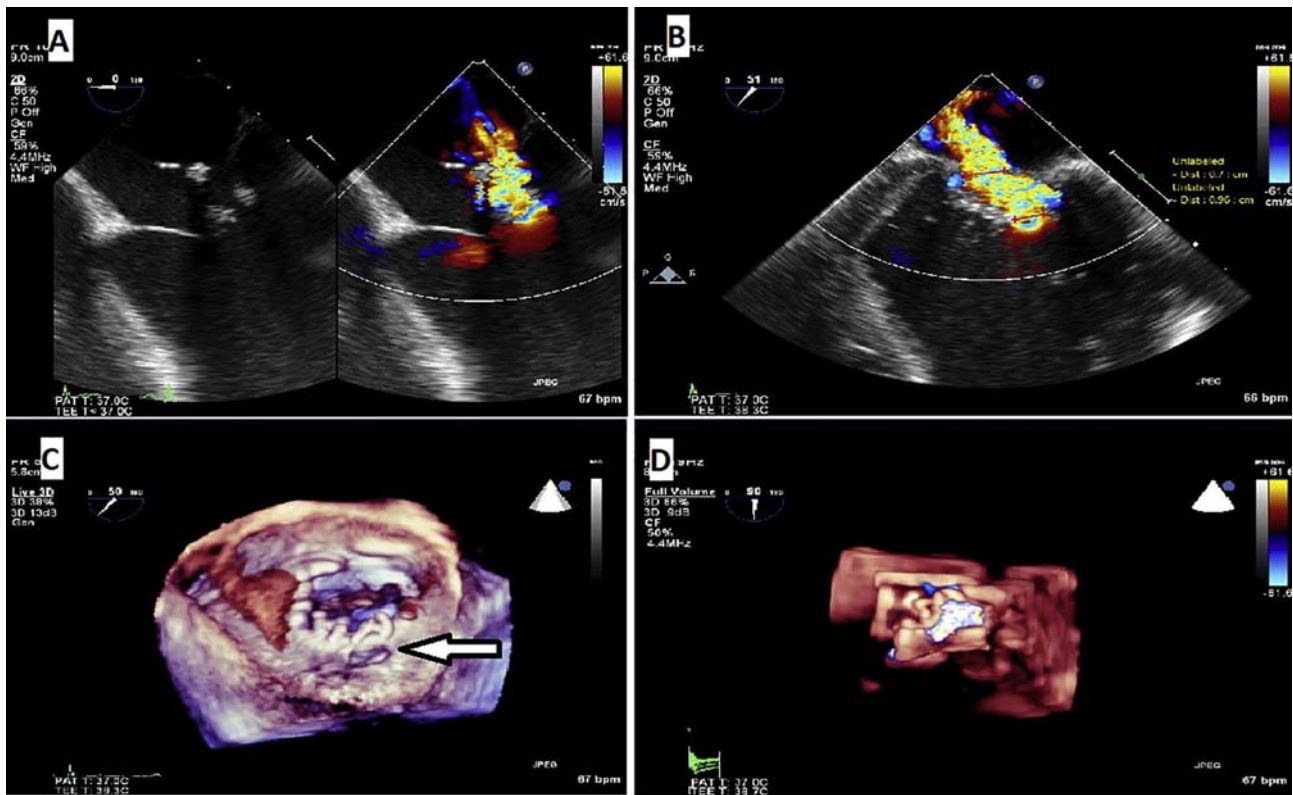


Fig. 1. (A) Mid-oesophageal four-chamber view with and without colour showed that severe mitral regurgitation (MR) started at the level of mitral valve (MV) leaflets and passed to the left atrium (LA) beside the MV ring. (B) Mid-oesophageal two-chamber view showed the vena-contracta 0.7 cm at MV leaflets and 0.96 cm at the para-ring hole. (C) Live 3D frame from the LA in surgical view showed the oval-shaped hole beside the C-shaped MV repair ring at 5 o'clock (arrow). (D) 3D full volume with colour showed the severe MR.

where the MR jet was directed toward a para-ring hole and the MitraClip system was used successfully to treat this severe MR.

2. Case report

An 80-year-old woman who was diabetic and hypertensive presented with unstable angina 6 years ago; her coronary angiography revealed multivessel disease; her echocardiography showed severe functional MR and ejection fraction (EF) of 30%. She underwent coronary artery bypass surgery plus MV repair with C-shaped ring. After 4 years, she presented with severe shortness of breath (SOB), New York Heart Association (NYHA) class III–IV, and sustained ventricular tachycardia. There was no chest pain, electrocardiogram changes, or elevation of cardiac enzymes. Her EF dropped to 20% with severe MR. She underwent implantable cardioverter-defibrillator implantation and was discharged on maximum tolerated antifailure medications. After 1 year, she continued to experience cruel SOB despite medications; her EF dropped to 15%. This year, she

was admitted to the hospital four times with decompensated heart failure. A transesophageal echocardiogram (TOE) was performed and revealed the following: mid-oesophageal four-chamber view (Fig. 1A) and mid-oesophageal two-chamber view (Fig. 1B) showed that severe MR started at the level of MV leaflets with vena-contracta 0.7 cm and then passed to the left atrium (LA) beside the MV ring with vena-contracta 0.96 cm (see online [Supplementary Videos 1 and 2](#)). Live 3D frame from the LA in surgical view (Fig. 1C and online [Supplementary Video 3](#)) and 3D full volume with colour (Fig. 1D and online [Supplementary Video 4](#)) showed the severe MR coming through the oval-shaped hole beside the C-shaped MV repair ring at 5 o'clock in the surgical view, no MR passes the ring itself. The para-ring hole area by 3D measured 0.41 cm². Because the whole MR jet came through this hole with no MR inside the MV ring, it mimics severe para-ring MR. The case was discussed in our heart team meeting; the patient was turned down from surgery due to high surgical risk. The Society of Thoracic Surgeons risk calculator showed that the

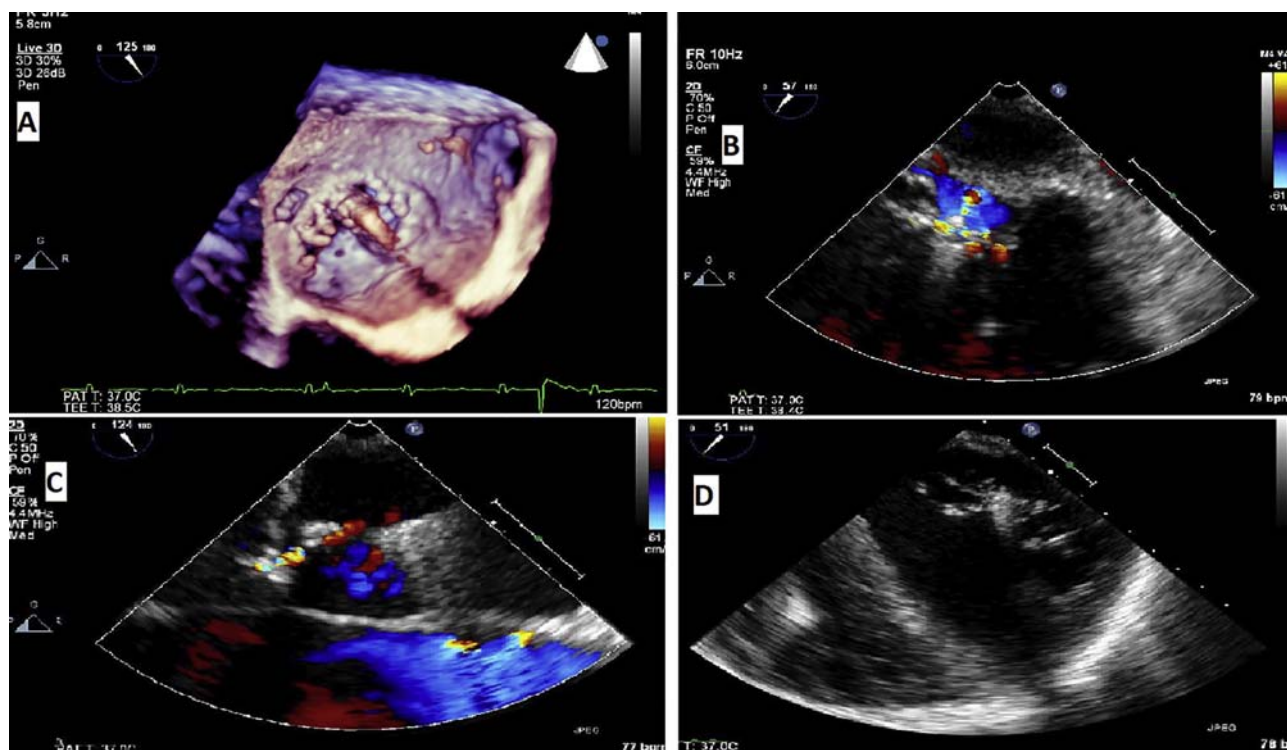


Fig. 2. (A) The clip was directed to be perpendicular to the mitral valve (MV) at A2P2 with lateral movement to target the mitral regurgitation (MR) jet. (B) The clip was completely closed, showing residual trace MR. (C) No MR through the para-ring hole. (D) Transgastric view showed the clip dividing the MV to nearly equal orifices.

mortality risk was 9.7%, whereas morbidity and mortality risks were 59.6%. One suggestion was to do device closure of the para-ring hole; this option was refused because the MR jet will find another way through the ring to the LA. One viable option was percutaneous Sapien valve in MV ring; the MV ring size was 29 mm, so the valve can be implanted. The final decision was to try MitraClip for the native MV leaflets through the MV ring.

2.1. Procedure description

Under general anaesthesia in the catheterization room, the TOE probe was inserted. After full evaluation with TOE 2D and 3D, we planned to start with one clip at A2P2 and then evaluate the MR jet behaviour and deal accordingly. Trans-septal puncture was manipulated to be 2.4 cm posterior away from the aortic root in mid-oesophageal short axis view at 44° and its height to be 4.2 cm from the MV leaflets coaptation line in mid-oesophageal four-chamber view at 0°. The catheter depth was measured, and the clip was directed toward the MV at A2P2 with little lateral movement to target the MR jet (Fig. 2A). The two leaflets were grasped successfully; the clip was fully closed, only trace MR remained at the MV leaflets (Fig. 2B) with no more

flow to the para-ring hole (Fig. 2C and online [Supplementary Video 5](#)), the MV orifice was divided into two nearly equal orifices as showed in transgastric short axis view on the MV (Fig. 2D and online [Supplementary Video 6](#)). The systolic reversal in the left pulmonary vein before the clip and the improvement of the pulmonary venous flow immediately after the clip is shown in Fig. 3A and B. The mean pressure gradient on the MV was 2 mmHg (Fig. 3C). The clip was released and the procedure was successful (Fig. 4). The patient was extubated after 12 hours; she was clinically stable with acceptable laboratory results. She was discharged home after 2 days. Follow-up transthoracic echocardiography after 6 months showed the clip in place, trace residual MR, and EF remained at 15% (Fig. 3D). Clinically the patient improved symptomatically to NYHA class II with no hospital admission in the past 6 months after discharge.

3. Discussion

In functional MR, progressive LV remodelling leads to ring failure and more adverse outcome, unlike primary MR where less ring failure was reported (59% versus 15%, respectively) [9]. Implantation of MitraClip in the presence of MV repair ring

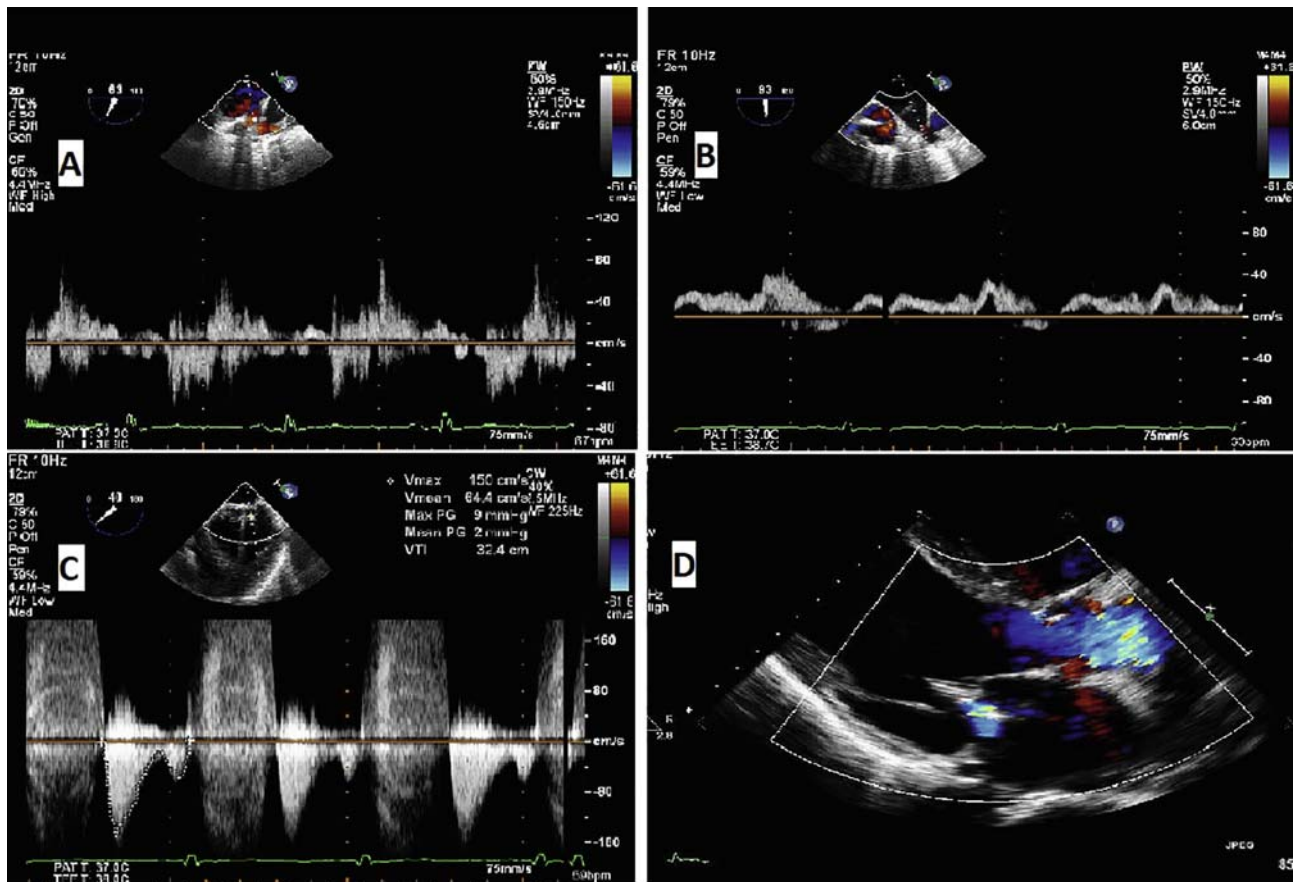


Fig. 3. (A) The systolic reversal in the left upper pulmonary vein before the clip. (B) The improvement of the pulmonary venous flow immediately after the clip. (C) The mean pressure gradient on the mitral valve after the clip was 2 mmHg. (D) Follow-up after 6 months, trace residual MR.

is a reasonable alternative for surgery in high-risk surgical patients. Presence of MV ring makes MitraClip more difficult as ring shadow impairs the leaflets visualization, especially by 3D full volume with colour, so MR jet localization depends on 2D images. In this case, we want to emphasize that MitraClip is feasible and safe to deploy in case of failure of MV repair ring provided that the ring is stable in place and the MR is originated from the leaflets coaptation line. It did not matter the way the MR jet reached the LA, either through the ring itself or through the para-ring space. This is different from the para-valvular leak where the MR reaches the LA directly from the LV through the leak. A para-ring MR due to dehiscence of the ring is similar to the paravalvular leak, where the MR passed directly from the LV to the LA through the para-ring defect. So, no MR at coaptation line; in this situation, device closure of the defect is the solution. MR in our case was not a true para-ring MR because there was no direct communication between LV and LA. However, MR mimics the para-ring MR because the jet passes beside the ring.

Bianda et al. [3] reported 11 cases of MitraClip in MV ring and concluded that the procedure is feasible and safe, associated with a lower than expected 30-day mortality, and proved effective regarding reduction in MR, lowering of pulmonary pressure, as well as symptoms. Braun et al. [4] reported follow-up of 45 patients with failed MV ring and concluded that MitraClip may be considered as an alternative treatment in selected patients at high risk for cardiac surgery. MV ring decreases MV area, so there is more possibility to have more pressure gradient with MitraClip. However, the presence of the ring may prevent subsequent annular dilation after MitraClip [4]. Kanda et al. [5] reported a case of clipping anterior mitral leaflet to MV ring; as long as the MR originated from the leaflets, MitraClip can work. Lim wrote a chapter named EVEREST II MitraClip after failed surgical mitral valve repair in atlas of percutaneous edge-to-edge mitral valve repair. [6]. Grasso et al. [10] reported six cases of MitraClip in MV ring and concluded the safety and efficacy of MitraClip therapy in patients with surgical MV annuloplasty

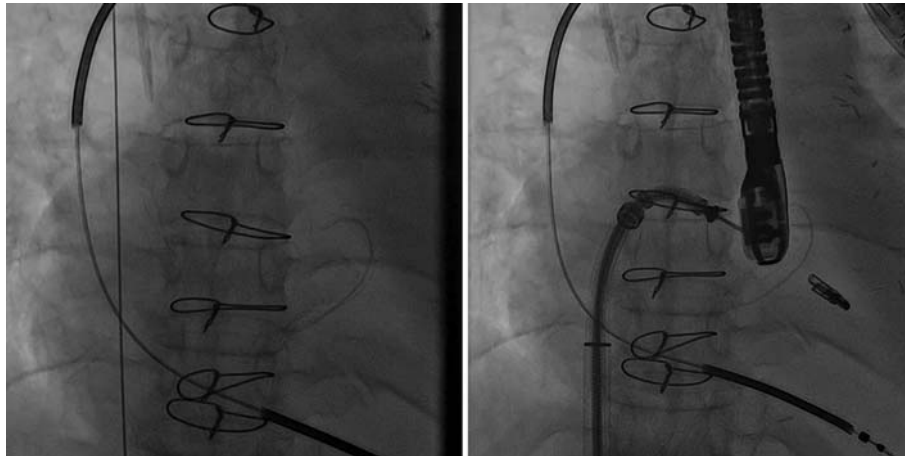


Fig. 4. Fluoroscopy showed the MV C-shaped ring and the clip after release.

failure. The mechanism of failed MV ring in secondary MR is tethering of the leaflets due to LV remodelling; in our case, we postulate that the posterior MR jet hits the para-ring space creating this hole without perforation of the leaflet and finding its particular way to the LA as there is no evidence of infective endocarditis. The MR in most of the reported cases reached the LA through the MV ring, whereas in our case, the MR jet passed to the LA from the para-ring hole.

4. Conclusion

Implantation of MitraClip in the presence of MV repair ring is feasible and safe. The para-ring defect can be left if the origin of MR from the MV coaptation line is treated successfully with MitraClip. Symptomatic improvement with no rehospitalization is documented in this case.

Conflicts of interest

All authors declare no conflicts of interest.

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