



*Case Report*

# Left Ventricular Rupture after Mitral Valve Replacement and Concomitant Bipolar Radiofrequency Ablation

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## Abstract

**Introduction:** Left ventricular rupture (LVR) after mitral valve replacement (MVR) is a rare and serious complication. The mortality rate is 65% to 100%. This present study reports successful treatment of two cases of LVR after MVR and concomitant bipolar radiofrequency ablation for atrial fibrillation.

**Case Presentation:** Case 1, female, 64 years old, severe stenosis of rheumatic mitral and tricuspid regurgitation, atrial fibrillation, whose LVR occurred eight hours after surgery. Case 2, female, 55 years old, severe stenosis of rheumatic mitral, atrial fibrillation, whose LVR occurred during surgery. Cardiopulmonary bypass was reconstructed immediately. Valve prosthesis was removed and the inside and outside of rupture were treated separately and the inside of the rupture was reinforced with another autologous pericardial strip. Patients survived and discharged.

**Conclusion:** MVR and concomitant bipolar radiofrequency ablation to treatment atrial fibrillation may be a risk factor of postoperative LVR.

**Keywords:** Atrial Fibrillation; Mitral Valve Replacement; Bipolar Radiofrequency Ablation; Left Ventricular Rupture.

## Introduction

Rupture of left ventricle is one of the rare and most serious complications of mitral valve replacement (MVR). It is difficult to treat accompanied by the high mortality rate. In the research studies by Roberts et al (2007) and Cheng et al (1999), they suggested that prevention is the key, and early diagnosis and timely reoperation are very important for successful treatment.

From January 2010 to July 2012, 3156 cases of mitral valve replacement surgery were performed in our hospital, 324 cases of them underwent concomitant bipolar radiofrequency ablation for atrial fibrillation. There were two cases of left ventricular rupture (LVR) and both were after MVR and concomitant bipolar radiofrequency ablation for atrial fibrillation. Both patients were successfully treated and survived.

## Case Presentation

The protocol was approved by the Review Board of Xinqiao Hospital. **Case 1** female, 64 years old, weight 51kg, who had severe rheumatic mitral stenosis and calcification, tricuspid regurgitation, atrial fibrillation, and cardiac function NYHA grade III. The echo showed that left ventricular end-diastolic diameter 45mm. Atricure TM bipolar RF ablation instrument was used to treat atrial fibrillation according to Sim's method; and then the lesion mitral valve and chordae were removed. The 27th St.Jude mechanical valve was implanted and Devaga tricuspid annuloplasty was formed. The clamping time was 50 min followed by the spontaneous cardiac rebeating. The patient had a sinus rhythm with heart rate of 80-90 beats /min and with blood pressure of 100-120 /60-80mmHg when returning the ICU. Eight hours after surgery, there was a lot of bright red blood was found to fast flow through the chest tube and the patient's blood pressure quickly dropped to about 50/30mmHg. The patient was urgently sent to the operating room. A huge hematoma was found on the left ventricular posterior wall with about 1cm hole after thoracotomy. Rapid establishment of cardiopulmonary bypass was followed by aortic clamping and exploration through the former cardiac incision. A laceration about 1.5cm long between the posterior mitral annulus and papillary muscle. The prosthetic valve was removed and interrupted mattress suture with 3-0 pledgeted prolene was used to repair outside the rupture, followed by continuous suture of the epicardium with 4-0 prolene to reinforce the repair (be careful not to damage the coronary). The inside of the rupture was then treated. The autologous pericardial strip was used for reinforcement and interrupted sutures with 3-0 pledgeted prolene was used for the repair. Suture was performed straddling the mitral annulus in from the left ventricle and out from the left atrium, followed by suture of the rest mitral part. The stitch line was still needled in from left ventricular surface and out from the left atrium surface through mitral annulus. The sewing ring of the valve prosthesis was passed through by the suture strings which were then ligated securely. There was no significant blood leakage from the rupture

area and the circulation was stable when the CPB was ceased. This patient recovered after 12-day mechanical ventilation, and was discharged 4 weeks after surgery. The patient was followed up for 6 months, whose recovery was satisfactory.

**Case 2** female, 55 years old, weight 47kg, who had severe rheumatic mitral stenosis, atrial fibrillation, and cardiac function NYHA grade III. The echo showed that the left ventricular end-diastolic diameter was 42mm. The surgical procedures of radiofrequency ablation and mitral valve replacement were described above. A 25th St.Jude mechanical valve was implanted and the clamping time was 45 min followed by spontaneous cardiac rebeating. When the circulation was stable, CPB was ceased. When closing the median sternotomy, a great deal of bright red blood was found in the pericardial cavity and the blood pressure dropped fast. A 0.3cm rupture was found on the left ventricular posterior wall and the rupture was close to the atrioventricular groove examined from the inside. Re-establishment of cardiopulmonary bypass was followed by the repair and valve re-replacement as described above. After operation, the patient's circulation was stable with blood pressure of 100-130/60-80 mmHg and with the sinus rhythm of 80-100 cardiac beats/min. This patient recovered after 3-day mechanical ventilation, and was discharged 3 weeks after surgery, who was followed up for 3 months and the recovery was satisfactory.

## Discussion

Left ventricular rupture after MVR is a serious perioperative complication. Roberts et al (2007) and Cheng et al (1999) mentioned the incidence is 0.43% to 2.00% and the mortality rate is 65% to 100%. In this group of patients, the incidence was 0.06% (2/3156) and the two patients were successfully treated. MVR was performed with interrupted sutures in all the patients.

Some risk factors for left ventricular rupture including: ① Dark et al (1984) mentioned the MVR destruction of the longitudinal ring itself can cause rupture of left ventricle. Deniz et al (2008) also suggested that the

integrity of left ventricular function is to rely on chordae, papillary muscle, a longitudinal ring composed of longitudinal myocardium of the ventricular wall and posterior leaflet of mitral valve. MVR destruction of the vertical loop function makes the occurrence of myocardial endometrial crack, leading to the transmural myocardial injury and causing left ventricular spontaneous rupture. [2] The thickness of the left ventricular wall at the different planes is not the same. Left ventricular wall under the posterior atrioventricular groove is relatively thin and weak, especially in middle-aged women with severe mitral stenosis and small left ventricle. [2] Deniz et al (2008) mentioned that operative factors include excessive excise of calcified annulus, implantation of too large prosthetic valve in the small left ventricular, too deep bite and damage of the endocardium. The authors believe that mitral valve replacement and concomitant bipolar radiofrequency ablation for atrial fibrillation should be studied more because the heart has to be moved and lifted more when the heart is beating, and ablation line from lower edge the left atrial incision to the posterior mitral annulus may injure the left ventricle under mitral annulus.

The diagnosis of left ventricular rupture is easy to find: Bleeding and pericardial tamponade occurred in the majority of patients, with the fast dropping of blood pressure and venous pressure. But, rupture of left ventricle after MVR was accompanied by the high mortality rate and prevention is particularly important. Attention should be paid to the risk factors of left ventricular rupture, such as age, severe mitral stenosis and small left ventricle. Prevention of surgical injury, including avoiding excessive resection of valve and too deep bites, reserving valve and subvalvular tissue, selection of appropriate prosthetic valve and reducing moving the heart during surgery. Milla et al (2010) and Park et al (2008) mentioned urgent reoperation is the key. Under cardiopulmonary bypass, valve prosthesis should be removed, and the inside and the outside of the rupture should be carefully repaired. When repairing the inside of the rupture, autologous pericardial strip should be used to reinforce the route

of the suture and injury of coronary vessels should be avoided.

## Conclusion

Left ventricular rupture after MVR is a rare and serious complication. Concomitant bipolar radiofrequency ablation to treat atrial fibrillation may be one of risk factor of postoperative LVR. Prevention is particularly important and urgent reoperation is the key. Under cardiopulmonary bypass, prosthetic valve should be removed, and the inside and the outside of the rupture should be carefully repaired.

## Consent

Written informed consent was obtained from the patient for publication of this case report. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

The protocol was approved by the Review Board of Xinqiao Hospital.

## Competing Interests

The authors declare that they have no competing interests.

## Authors' contributions

Lin Chen is senior author of the paper who undertook the procedure of the patient and was the primary writer of the manuscript. Yingbin Xiao contributed significantly to the discussion section of the preliminary draft of the manuscript. Ruiyan Ma and Renguo Weng took care of patient, conducted an extensive literature search, spoke with the patient and contributed significantly to the intellectual content of the report. All authors read and approved the final manuscript.

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