

# A Case of Transcatheter Mitral Valve Repair Under Rapid Right Ventricular Pacing Technique

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## Abstract

Mitral regurgitation is a common disease which may cause heart failure if severe. According to the 2017 guidelines of the European Society of Cardiology, surgical mitral valve intervention is indicated in symptomatic patients but transcatheter mitral valve intervention is an alternative choice in patients with high surgical risk. Transcatheter mitral valve repair is difficult in some cases due to leaflet grasping. Here, we present the case of a 99 year-old man requiring a difficult transcatheter mitral valve repair which was successful, facilitated by rapid right ventricular pacing technique.

**Keywords:** right ventricular pacing, Mitraclip, transcatheter mitral valve repair, mitral regurgitation

## Introduction

Mitral regurgitation (MR) is a common disease which may cause heart failure if severe. According to the 2017 guidelines of the European Society of Cardiology (ESC),<sup>1</sup> surgical mitral valve intervention is indicated in symptomatic patients while transcatheter mitral valve intervention is the alternative choice in patients with high surgical risk and those who are inoperable. The results of the EVEREST II trial<sup>2</sup> have shown that the procedure is safe and beneficial.

However, transcatheter mitral valve repair may occasionally encounter difficulties in leaflet grasping. Various aspects include leaflet prolapse, restriction, arrhythmia and regurgitation location,

which may result in such difficulties. Here, we present the case of a difficult transcatheter mitral valve repair which was successfully facilitated by rapid pacing (RP) technique.

## Case presentation

The patient is a 99 year old Taiwanese male with comorbidities of coronary artery disease with right coronary artery chronic total occlusion and 60% stenosis of the obtuse marginal branch, chronic kidney disease stage IV and chronic obstructive pulmonary disease. He presented to our emergency department in November 2018 due to exertional dyspnea progressing for 2 weeks, accompanied by bilateral leg edema and

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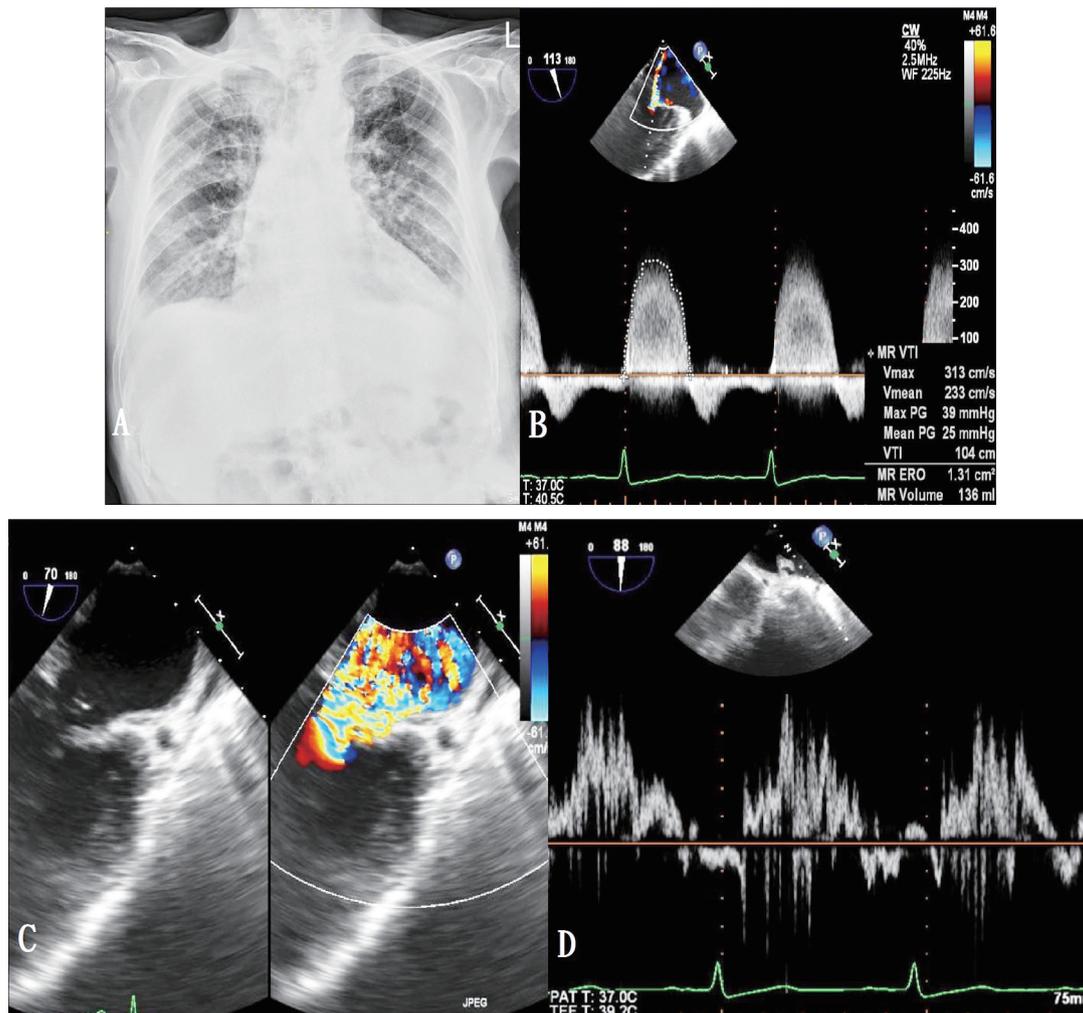
poor appetite. Chest X-ray revealed bilateral lung edema (Figure 1A). Laboratory examination showed N-Terminal Pro-B-Type Natriuretic Peptide elevation (4266 pg per ml).

Transesophageal echocardiography (TEE) revealed dilated LV with ejection fraction of 52%, accompanied by mild aortic regurgitation (AR), severe MR with effective regurgitant orifice (ERO) of 1.31 cm<sup>2</sup> due to rupture of chordae tendineae at A2 and pulmonary vein flow reversal (Figure 1B to D), and moderate tricuspid regurgitation (TR) with a pressure gradient of 56 mmHg.

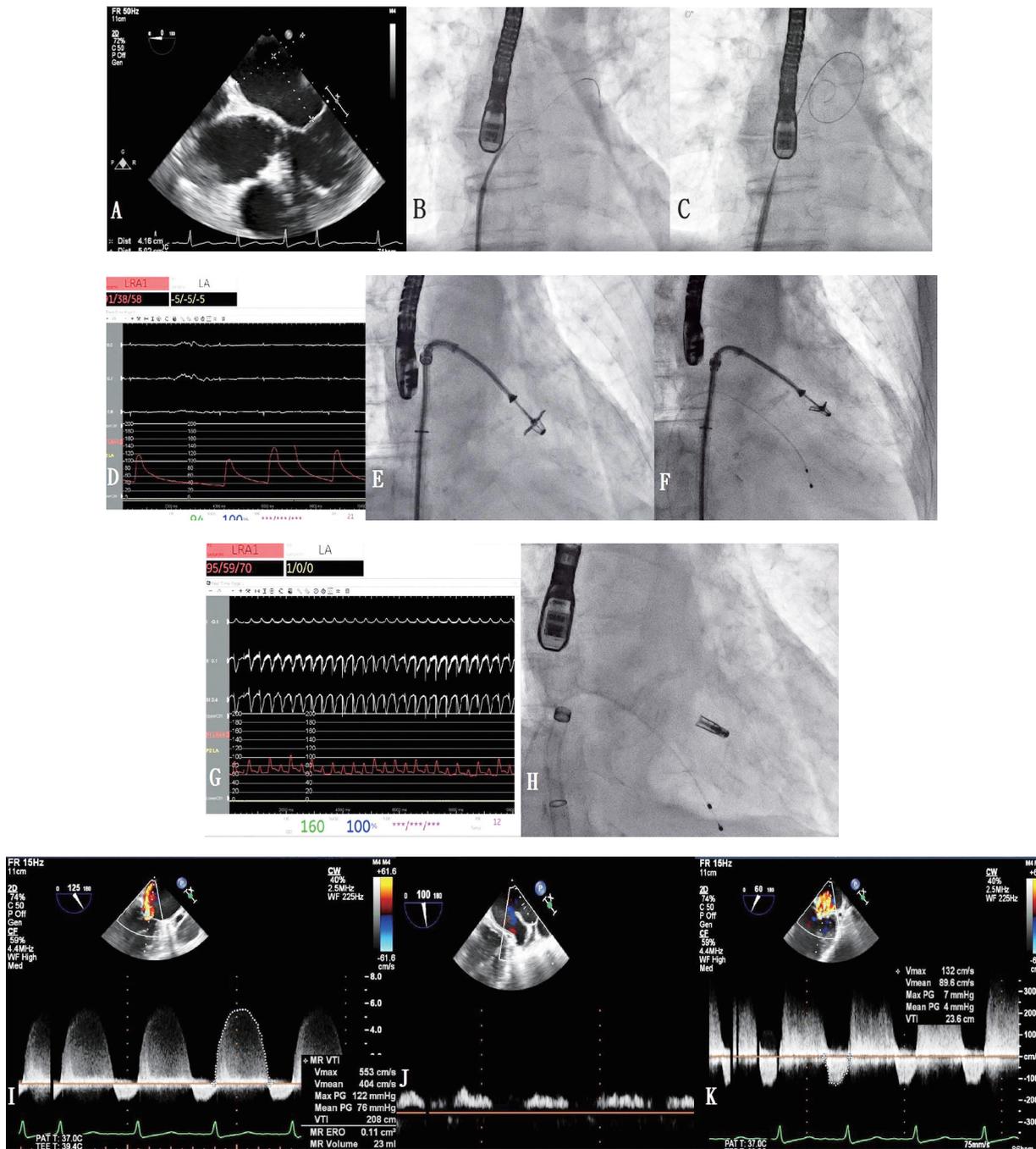
He was thus impressed as a case of acute

decompensated heart failure related to severe MR. Symptoms improved partially under high dosage intravenous furosemide use. Mitral valve repair was suggested, but he was extremely elderly and at a high operative risk of 7.69% following the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II). After thorough discussion with his family, transcatheter mitral valve repair was performed.

On the day of the procedure in December 2018, we measured the dimensions for appropriate device implantation by TEE (Figure 2A). Under general anesthesia and right femoral



**Figure 1.** (A) Lung edema was observed at hospitalization. (B-D) Transesophageal echocardiography reveals severe mitral regurgitation with effective regurgitant orifice of 1.31 cm<sup>2</sup> and significant pulmonary vein flow reversal.



**Figure 2.** (A) Measurement of the distance from trans-septal puncture site to mitral valve for appropriate device implantation. (B) Trans-septal puncture of SL1 Transseptal Guiding Introducer Sheath under guidance of Fielder FC wire and BRK needle. (C) Steerable Guide Catheter insertion into left atrium by Safari wire support. (D) Hemodynamic monitoring during adenosine-induced high degree atrioventricular block. (E) MitraClip failure due to restricted movement of posterior mitral leaflet. (F) Right ventricular pacing lead insertion via left femoral vein approach. (G) Hemodynamic monitoring during rapid pacing. (H). Successful MitraClip implantation under rapid pacing. (I-K) Residual mitral regurgitation with ERO of 0.11 cm<sup>2</sup> and resolution of pulmonary vein flow reversal, and a transmitral mean pressure gradient of 4 mmHg after the procedure.

vein approach, trans-septal puncture of SL1 Transseptal Guiding Introducer Sheath was successful under guidance with Fielder FC wire and BRK needle (Figure 2B). Steerable Guide Catheter was then inserted into the left atrium (LA) by Safari wire support (Figure 2C). MitraClip (MitraClip-System, Abbott, USA) implantation was attempted, but failed due to the restricted movement of the posterior mitral leaflet despite adenosine-induced high degree atrioventricular block (Figure 2D and 2E). Therefore, we placed a right ventricular temporary pacemaker in order to perform RP technique. One MitraClip implantation was successful at A2-P2 under RP at a rate of 160 beats per minute (Figure 2F to 2H). After the procedure, TEE revealed residual MR with an ERO of 0.11 cm<sup>2</sup>, resolution of pulmonary vein flow reversal and no formation of iatrogenic mitral stenosis (Figure 2I to 2K). The patient was discharged smoothly with stable hemodynamic status. There has been no further hospitalization due to acute decompensated heart failure since then.

## Discussion

MR is a common disease especially in the elderly, which may cause acute decompensated heart failure despite medical therapy. Our case was one of primary MR probably related to degeneration. Optimal medical therapy for the management of heart failure should be the first step in the management of all patients.

In medically refractory patients, interventions for MR are necessary after thorough evaluation. In recent years, transcatheter mitral valve repair has become viable for those at high surgical risk or who are inoperable. However, technical limitations are presented by extensively prolapsed valves and flailing leaflets. In order to overcome these limitations, adenosine-induced asystole and RP have been suggested and described.<sup>3,4</sup> These techniques lower procedure time in complex cases, but the evidence is sparse.

RP technique is frequently used in transcatheter aortic valve replacement (TAVR) and according to studies on the safety and outcome of RP technique in TAVR patients,<sup>5</sup> it is a safe and reliable technique with reduction in procedure time and radiation dose.

However, another single center non-randomized trial showed that RP of more than three episodes during TAVR is related to increased risk for peri-procedural kidney injury, atrial fibrillation, and also a higher in-hospital and 1-year mortality. These adverse outcomes may be explained by prolonged hypotension during the procedure.<sup>6</sup> In our case, we only performed 2 episodes of RP and systolic blood pressure was maintained at 80 to 100mmHg during RP.

In conclusion, RP technique is safe if RP is not performed too frequently during the procedure. Further investigation of rapid right ventricular pacing for MitraClip deployment may be necessary for technical improvement in transcatheter mitral valve repair.

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