

MINI-FOCUS ISSUE: VALVULAR HEART DISEASE

ADVANCED

CASE REPORT: CLINICAL CASE

# Severe Intermittent Transvalvular Mitral Valve Regurgitation



## Serious Complication of Mitral Valve Replacement With Subvalvular Preservation

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### ABSTRACT

Mitral valve replacement with subvalvular preservation is a favorable technique to protect left ventricular function and improve long-term survival. However, complications of the procedure should be considered. We report the case of a patient with a history of prosthetic mitral valve replacement with severe intermittent transvalvular mitral regurgitation and reduced ejection fraction. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:663-7) © 2021 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### HISTORY OF PRESENTATION

A 60-year-old woman was admitted to our hospital with exertional dyspnea (New York Heart Association

functional class III) and pre-tibial edema. Her blood pressure was 115/80 mm Hg and heart rate was 98 beats/min. Cardiac auscultation revealed a pansystolic apical murmur.

### LEARNING OBJECTIVES

- To evaluate MV apparatus volume and its relation to annulus and prosthetic valve structure to avoid post-operative mechanical valve malfunction.
- To be able to make a differential diagnosis of valve malfunction using TEE, particularly real-time 3-dimensional TEE.
- To recognize the essential role of intra-operative TEE in detecting a complication during valve replacement.
- To perform different imaging modalities including fluoroscopy and 4-dimensional computed tomography to assess mechanical valve function.

### MEDICAL HISTORY

The patient suffered from acute myocardial infarction and acute ischemic mitral regurgitation (MR) which is a mechanical complication of myocardial infarction. She had undergone coronary bypass surgery with mitral valve replacement (MVR) 4 years ago with a 27-mm bileaflet mechanical prosthesis (Sorin Biomedica, Saluggia, Italy) and preservation of the native posterior mitral leaflet and its subvalvular apparatus.

### DIFFERENTIAL DIAGNOSIS

The differential diagnosis included MV malfunction (pannus, dehiscence, thrombus, infective

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

Manuscript received November 17, 2020; revised manuscript received January 24, 2021, accepted February 28, 2021.

## ABBREVIATIONS AND ACRONYMS

EF = ejection fraction

LV = left ventricle

MR = mitral regurgitation

MV = mitral valve

MVR = mitral valve  
replacement

SVP = subvalvular apparatus  
preservation

TEE = transesophageal  
echocardiography

endocarditis, paravalvular regurgitation), acute coronary syndrome, acute heart failure, and arrhythmia.

## INVESTIGATIONS

Electrocardiogram did not show ST-segment changes or arrhythmia. Transthoracic echocardiogram demonstrated normal motion of both MV discs but impaired left ventricular (LV) function. Ejection fraction (EF) measured as 20% at the patient's 4-year follow-up was highly reduced compared to her initial post-operative EF of 40%. Transthoracic echocardiogram also showed MR; however, we could not identify the severity or location of MR, so an alternative imaging modality was needed. Because transesophageal echocardiography (TEE) is an imaging modality commonly used to identify the cause of prosthetic valve malfunction, we proceeded with this method for this case.

Fluoroscopy is an essential imaging technique for assessing mechanical prosthetic valves and identifying the type of implanted prosthesis and its function. In addition, it can evaluate valve leaflet mobility and valvular ring motion. Four-dimensional computed tomography is another important imaging modality that can provide incremental information on valvular mobility and valvular and paravalvular

pathology, including endocarditis and aneurysmal dilation (1).

TEE demonstrated severe intermittent transvalvular MR, with a mobile mass measuring 14 mm × 7 mm on the ventricular side of the MV prosthesis, and transvalvular mean diastolic gradient of 5 mm Hg (Figures 1 to 3, Videos 1 and 2). Three-dimensional TEE also demonstrated the mass as intermittently entrapped between the disc of the valve and the housing (Figure 3, Video 3).

We did not find any evidence of infective endocarditis based on symptoms and laboratory results, and the location of the mass was uncommon for thrombus. Thus, the presumed diagnosis was remnants of the subvalvular apparatus. Pre-operative coronary angiography was performed but did not demonstrate any new coronary occlusion causing LV dysfunction.

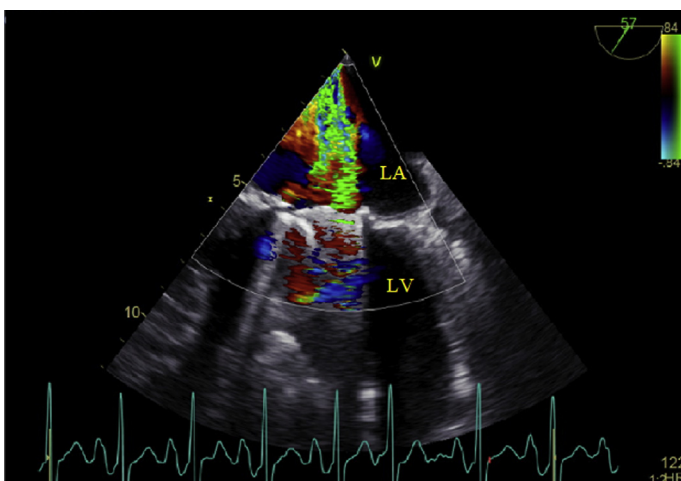
## MANAGEMENT

After a discussion with cardiovascular surgeons about the patient's reoperation risks, the decision was made for resection of remnants due to the patient's symptoms and LV dysfunction caused by MR. Intra-operative evaluation of the MV confirmed the subvalvular apparatus remnants, which interfered with prosthetic leaflet motion, and thus were excised (Figure 4, Video 4). Post-operative TEE showed normal prosthetic valve motion without abnormal jet or mass (Figure 5, Videos 5 and 6).

## DISCUSSION

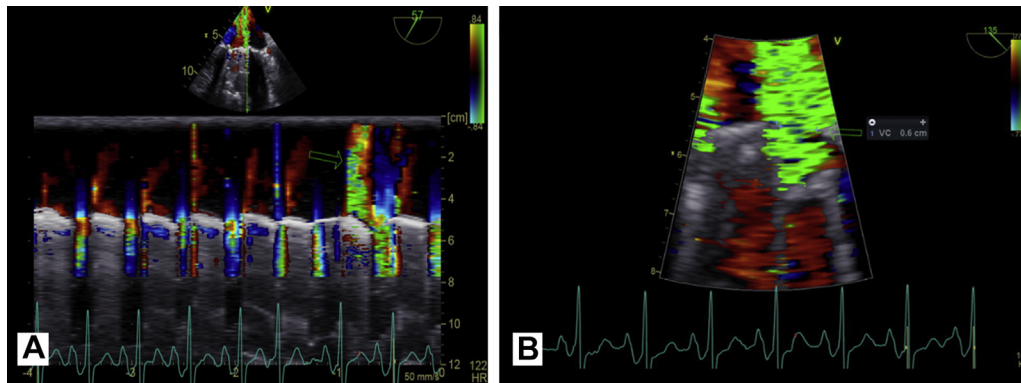
The MV apparatus consists of the annulus, leaflets, chordae tendineae, and anteromedial and posterolateral papillary muscles. All of the components work in excellent coordination to provide normal valve function during the entire cardiac cycle. Deterioration of any of the components results in MR (2). MVR is one of the common operations used to manage MR and was first performed in the early 1960s, with disruption of the leaflets, chordae tendineae, and mitral leaflets (3). However, the procedure had poor outcomes with severe LV dysfunction; therefore, a subvalvular apparatus preservation (SVP) method was developed. This procedure has many advantages, such as preserving LV function (4), reducing the risk of LV rupture, and improving long-term survival (5). SVP surgery has been performed with several techniques, such as reefing the native leaflets and compressing them between the prosthetic sewing ring and native annulus, thus preventing LV outflow tract obstruction (6).

FIGURE 1 Color Doppler View of Severe Mitral Regurgitation



Multiplane transesophageal echocardiography with color Doppler imaging revealed severe transvalvular mitral regurgitation, which was intermittent. LA = left atrium; LV = left ventricle.

**FIGURE 2** M-Mode and Vena Contracta Views of Severe Mitral Regurgitation

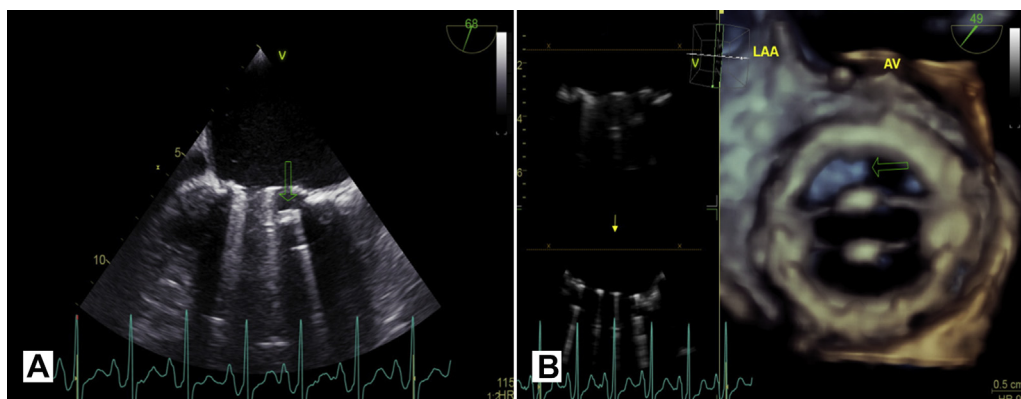


Color M-mode transesophageal echocardiographic image showing intermittent pansystolic mitral regurgitation (A) and mitral regurgitation (vena contracta [VC] width 0.6 cm) measured by color Doppler imaging (B).

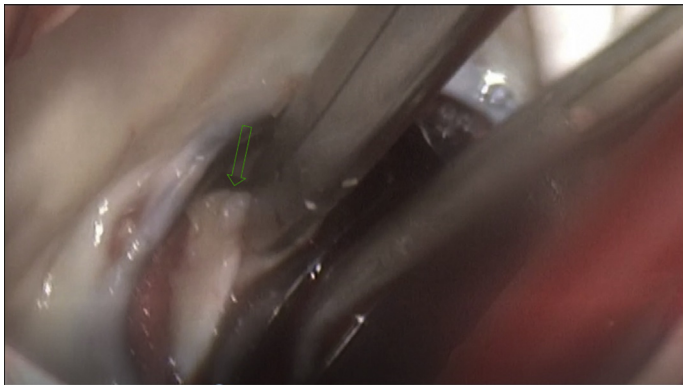
Although SVP has benefits, its potential complications resulting from use of different techniques should be considered. Preservation of the anterior leaflet may cause dynamic obstruction of the LV outflow tract, and mitral inflow obstruction may occur due to interference between the prosthetic MV and subvalvular apparatus (7). In addition, intermittent prosthetic valve obstruction due to entrapped chordal tissue between the disc of valve and housing has been reported (8). Intermittent valve malfunction

also has resulted in complications caused by pannus formation, prosthetic valve thrombosis, and vegetations. However, intermittent severe regurgitation of the prosthetic MV caused by residual chordae tendineae and posterior leaflet is a rare complication of MVR with subvalvular preservation. We report a case with the rare complication of MVR with SVP, consisting of intermittent severe intraprosthesis MR caused by remnants of posterior leaflet and chordae tendineae noted at 4-year follow-up. The patient was

**FIGURE 3** 2- and 3-Dimensional Images of Mass



(A) Two-dimensional transesophageal echocardiographic image showing the 2 leaflets of the mechanical mitral valve prosthesis in the open position, with an abnormal mass measuring 14 mm × 7 mm (arrow) on the ventricular side of the prosthesis. (B) Real-time 3-dimensional transesophageal echocardiography demonstrating impingement of a mass (arrow) between the disc of the valve and the housing. AV = aortic valve; LAA = left atrial appendage.

**FIGURE 4** Intraoperative View of the Subvalvular Apparatus Remnants

Excision of posterior leaflet and chordae tendineae remnants, which were observed during surgery.

symptomatic with heart failure and reduced EF, and her symptoms were refractory to medical treatment. Therefore, posterior leaflet remnants were excised during reoperation to repair valve malfunction. Post-operative TEE showed normal valve motion with physiological minimal MR without a mass. Gallet et al. (9) reported a case of severe intermittent intraprosthetic MR after MVR with a bileaflet mechanical prosthesis with subvalvular preservation on the sixth post-operative day. Reoperation revealed remnants of the subvalvular apparatus, which was excised during the operation. Güner et al. (10) also

reported a case with intermittent intraprosthetic MR due to impingement of subvalvular tissue between the lateral side of the annulus of the prosthetic heart valve and the lateral leaflet of the prosthetic heart valve. The patient did not undergo reoperation because she was asymptomatic, and the result at 4-year follow-up was excellent.

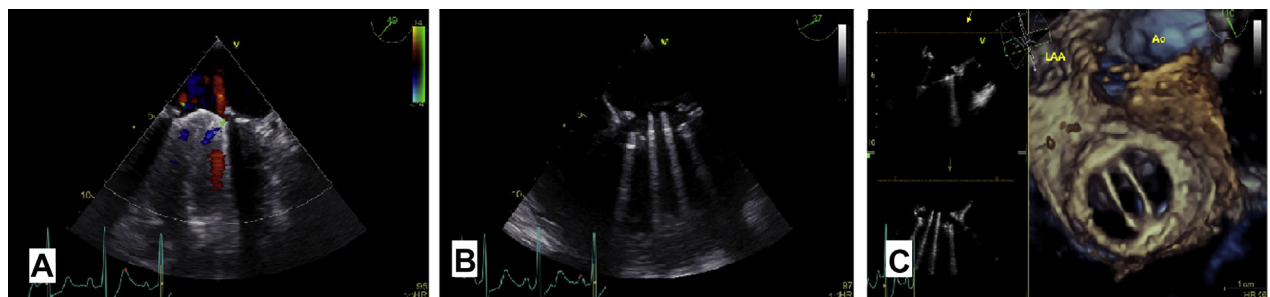
MVR with SVP uses several techniques because of the different anatomic and pathological characteristics of the MV. The volume of the MV apparatus is crucial in selecting the surgical technique, and preservation of the complete apparatus may cause interference between the valve and its remnants and lead to MV malfunction, as in our case.

#### FOLLOW-UP

At 1-month follow-up, the patient denied shortness of breath. Transthoracic echocardiogram demonstrated normal prosthetic valve motion with physiological regurgitation. EF was measured as 25%. Her medications included diuretics, beta-blocker, angiotensin-converting enzyme inhibitor, vitamin K antagonist, and aldosterone antagonist. She continued to be free of edema and shortness of breath, and she was discharged home.

#### CONCLUSIONS

Intermittent severe MR is a rare but potentially serious complication of MVR with SVP. Intraoperative TEE using color flow Doppler is a feasible and highly effective imaging modality that can detect

**FIGURE 5** Post-Operative 2- and 3-Dimensional Images of Prosthetic Mitral Valve

(A) Post-operative color Doppler transesophageal echocardiogram showing physiological transvalvular mitral regurgitation without an abnormal jet. (B, C) Two-dimensional transesophageal echocardiogram (B) and real-time 3-dimensional transesophageal echocardiogram (C) showing normal prosthetic valve motion without a mass.

intermittent MR caused by remnants of the subvalvular apparatus.

#### FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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**KEY WORDS** 3-dimensional imaging, echocardiography, mitral valve, systolic heart failure, valve replacement

**APPENDIX** For supplemental videos, please see the online version of this paper.