

VALVULAR HEART DISEASE

CASE REPORT: CLINICAL CASE

A Novel Presentation of Eclipsed Mitral Regurgitation



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ABSTRACT

Eclipsed mitral regurgitation (MR) is a rare phenomenon of transient severe MR in patients with normal left ventricular function. This paper presents a case of a patient with recurrent heart failure exacerbations and transient, positional severe MR consistent with eclipsed MR, which improved after mitral transcatheter edge-to-edge repair. (JACC Case Rep 2024;29:102460) © 2024 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 PRESENT ILLNESS

An 83-year-old woman presented for outpatient evaluation of progressive dyspnea on exertion and multiple admissions for acute heart failure. She underwent bilateral pleural catheter placement at another institution for persistent transudative pleural effusions despite medical therapy for presumed heart failure with preserved ejection fraction (HFpEF). Due

to her progressive dyspnea, she was referred for further evaluation.

PAST MEDICAL HISTORY

Her medical history was significant for chronic hypertension and paroxysmal atrial fibrillation status post 2 prior pulmonary vein isolation procedures. The second ablation was complicated by acute pericarditis, which was successfully treated with medical therapy. A subsequent transthoracic echocardiogram (TTE) revealed mild mitral and tricuspid regurgitation.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for her progressive dyspnea, recurrent heart failure exacerbations, and pleural effusions included HFpEF, stiff left atrial (LA)

LEARNING OBJECTIVES

- To define eclipsed MR.
- To identify underlying mechanisms of eclipsed MR using imaging and provocative maneuvers.
- To identify treatment strategies of eclipsed MR based on underlying mechanisms.

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**ABBREVIATIONS
AND ACRONYMS****HFpEF** = heart failure with preserved ejection fraction**LA** = left atrial**LLD** = left lateral decubitus**LV** = left ventricular**MR** = mitral regurgitation**MVR** = mitral valve replacement**RVSP** = right ventricular systolic pressure**TEE** = transesophageal echocardiogram**TEER** = transcatheter edge-to-edge repair**TTE** = transthoracic echocardiogram

syndrome, dynamic mitral regurgitation (MR), cardiac amyloidosis, and constrictive pericarditis.

INVESTIGATIONS

Due to acute heart failure symptomology, she was directly admitted to inpatient cardiology. Physical examination revealed crackles in the bilateral lung bases, jugular venous distention, and lower extremity edema. Chest radiograph showed a left-sided pleural effusion and thoracic scoliosis (Figure 1). A TTE in the semirecumbent position showed normal left ventricular (LV) size, preserved ejection fraction (62%), moderate central MR, and an estimated right ventricular systolic pressure (RVSP) of 48 mm Hg. On transition to the left lateral decubitus position (LLD), she developed new dyspnea and hypoxia, prompting additional imaging. This revealed new torrential MR with incomplete mitral leaflet coaptation and an increase in RVSP to 75 mm Hg (Figure 2, Video 1). These findings, in addition to new pulmonary vein systolic flow reversals, were redemonstrated on transesophageal echocardiogram (TEE) (Figure 3, Video 2) after additional diuresis and optimization of her

volume status. With positional changes, 3-dimensional modeling of the mitral valve using the 3-dimensional TEE datasets showed no significant difference in mitral valve annular shape or measured diameter; however, there was an increase in tenting volume from 3.9 to 5.3 cm³ (Figure 4). Despite aggressive diuresis, repeat TTE showed similar findings including positional worsening of pulmonary edema by lung ultrasound with increased B-lines while positioned LLD (Figure 5).

MANAGEMENT

She was deemed a high-risk surgical candidate due to her age and frailty; therefore, a mitral transcatheter edge-to-edge repair (TEER) was pursued. Under TEE guidance, transeptal puncture was performed for LA access with pressure transduction showing severely elevated mean LA pressure of 45 mm Hg with V waves reaching 79 mm Hg. A single mitral valve clip was deployed in the A2-P2 segment of the mitral valve with immediate improvement in mean LA and V-wave pressures to 15 and 22 mm Hg, respectively (Figure 6). Intraprocedural TEE showed improvement in MR severity (Video 3), resolution of pulmonary vein systolic flow reversals, and improvement in mitral valve tenting volume to 3.3 cm³.

DISCUSSION

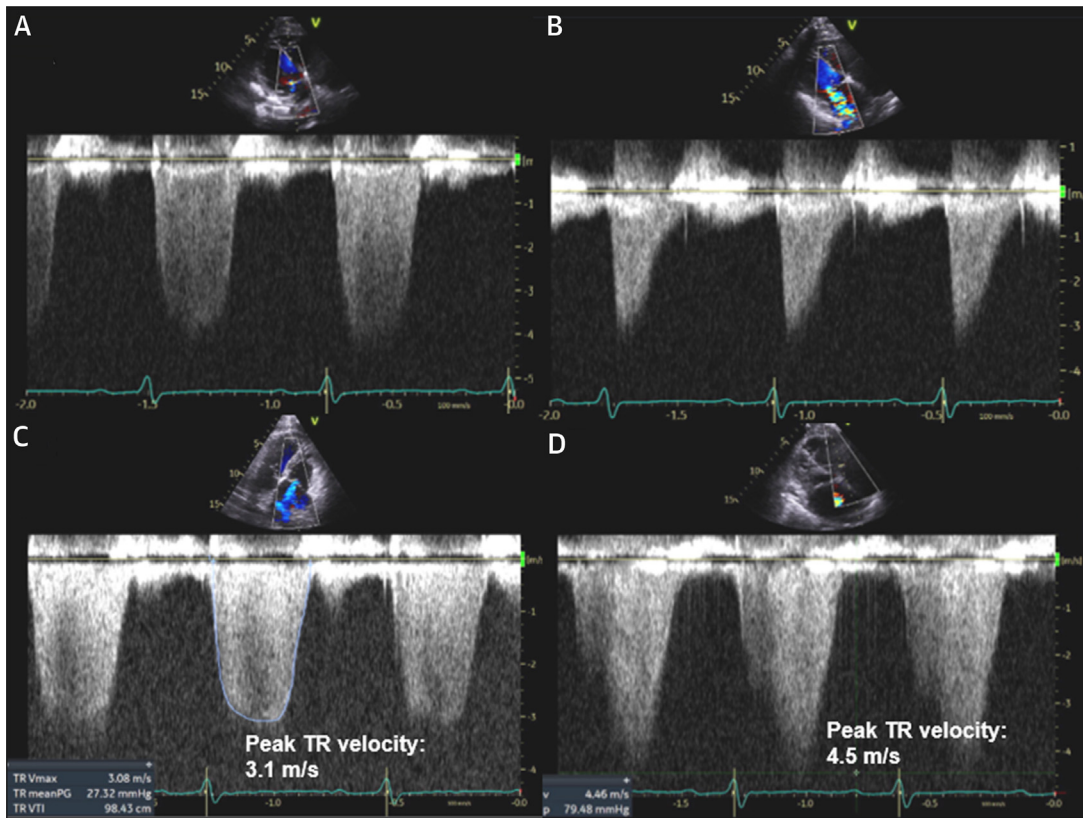
Eclipsed MR was originally described in 2008 and was defined as transient severe MR in patients with normal LV function and dimensions in the absence of epicardial coronary artery disease.¹ There are few cases reported to date; therefore, the true prevalence remains unknown. This patient's baseline characteristics share many common features with those previously reported,^{1,2} including postmenopausal women with multiple cardiovascular risk factors (eg, hypertension, diabetes), microvascular dysfunction, and conduction or rhythm disorders (eg, atrial fibrillation). Patients often presented with recurrent, severe heart failure exacerbations and pulmonary edema, frequently requiring intensive care admission.¹⁻³ In many cases, the patients' presentations were previously attributed to HFpEF because the features of eclipsed MR were frequently absent on imaging without provocation. The dynamic nature of this condition may contribute to this being a clinically under-recognized, and therefore poorly understood, entity.

Various underlying mechanisms of eclipsed MR have been described in the literature. In a case series of 3 patients, Avierinos et al¹ described transient massive MR with apical leaflet tenting triggered by

FIGURE 1 Chest Radiograph

Chest radiograph showing pulmonary vascular congestions, left pleural effusion, normal cardiac silhouette size, and thoracic scoliosis.

FIGURE 2 Mitral and Tricuspid Continuous-Wave Doppler Waveforms in Semirecumbent and Left Lateral Decubitus Positions

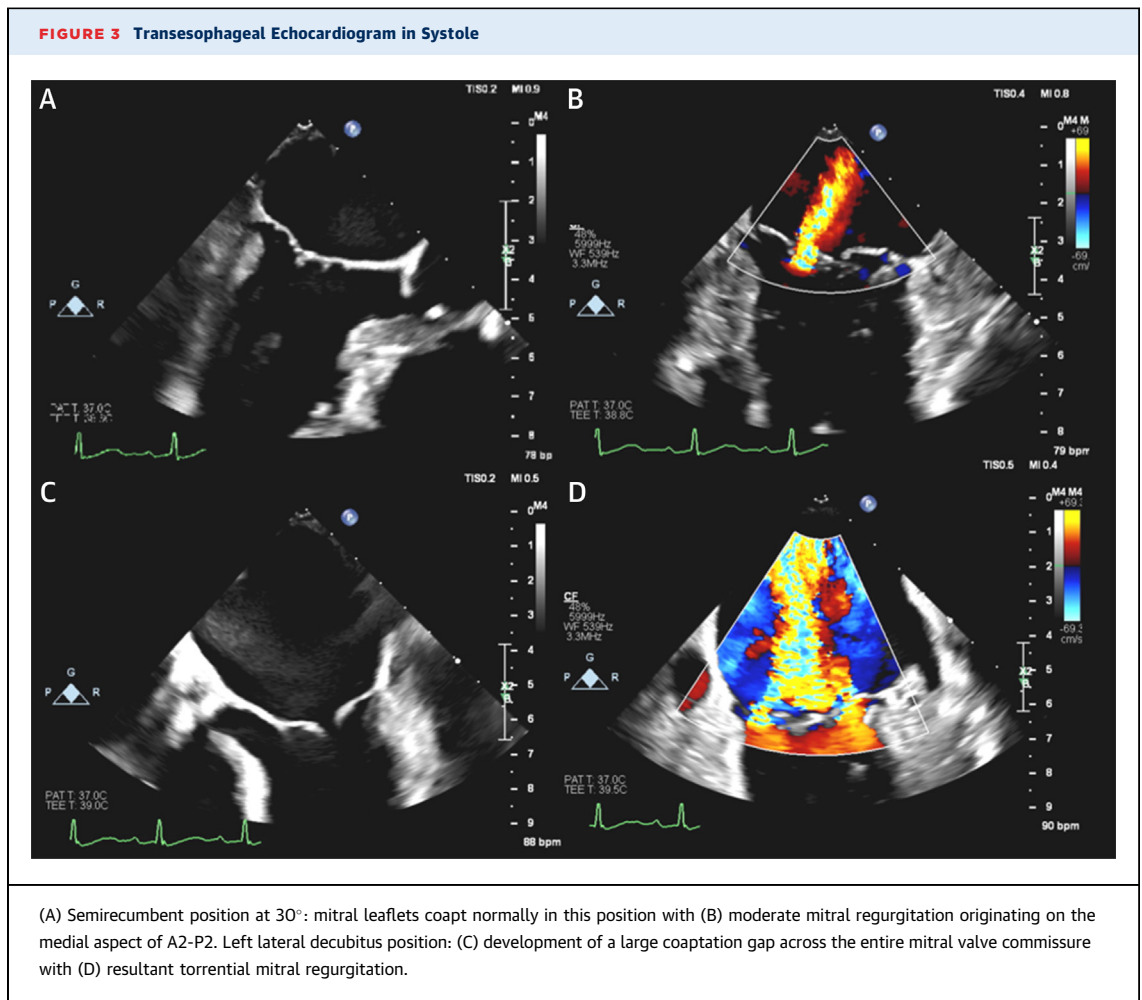


Supine position: (A) baseline mitral regurgitation waveform and (C) peak tricuspid regurgitation velocity of 3.1 m/s and right ventricular systolic pressure of 48 mm Hg. Left lateral decubitus position: (B) triangular-shaped mitral regurgitation Doppler waveform consistent with rapid equalization of pressures between the left atrium and left ventricle and (D) acute increase in peak tricuspid regurgitation velocity to 4.5 m/s and right ventricular systolic pressure to 75 mm Hg.

methylergonovine injection. Nitroglycerin administration resulted in resolution of these findings in all 3 patients, leading the authors to conclude that epicardial coronary vasospasm was the likely culprit.¹ A few other cases reported similar associations,² but not all. In a case series of 6 patients with eclipsed MR, Breen et al² described additional mechanisms including a rate-dependent left bundle branch block, provoked with exercise, resulting in apical leaflet tenting and reduced coaptation. Additionally, they described 2 patients with eclipsed MR that was provoked with maneuvers to increase LV preload (eg, leg elevation, LLD positioning). TEE in these patients showed an increase in the mitral annular diameter

with severe MR; however, no leaflet tenting was observed.² We hypothesize that the mechanism of eclipsed MR in the present case was due to papillary muscle displacement with movement to the LLD position, possibly related to the patient's severe scoliosis, leading to leaflet tenting and malcoaptation. Increased LV loading conditions in the LLD position may have contributed to these dynamic changes as well. The lack of significant change in mitral annulus dimensions with 3-dimensional modeling argues against changes in the mitral annulus as a cause of the transient MR in this case.

The optimal therapeutic strategy for eclipsed MR is unclear and likely depends on the underlying



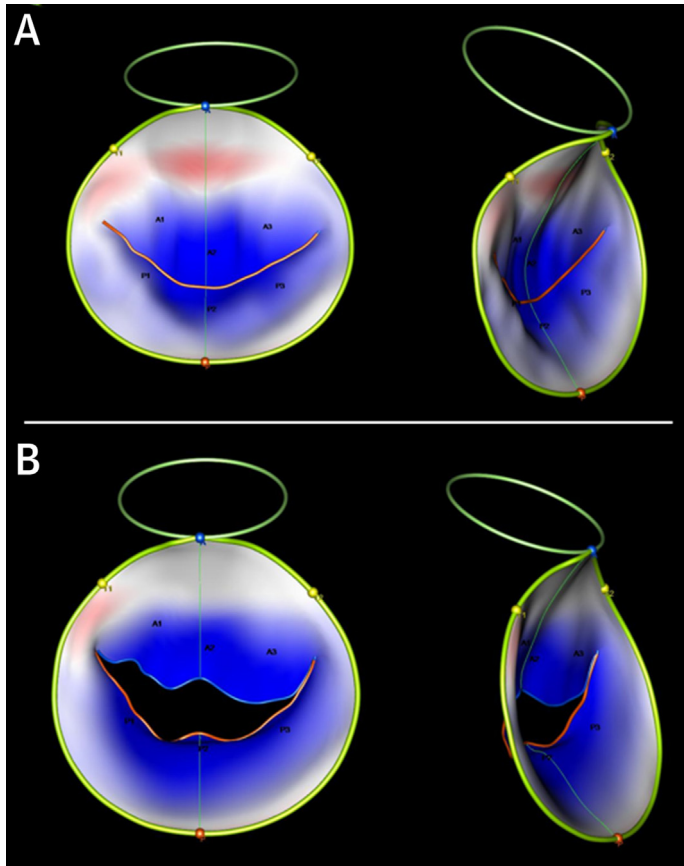
mechanism. For instance, in 2 patients with severe MR provoked by left bundle branch block reported by Breen et al,² one patient had resolution of heart failure exacerbations with cardiac resynchronization therapy, whereas another died a few days postoperatively after surgical mitral valve replacement (MVR). Similarly, those with underlying coronary vasospasm also had resolution of heart failure episodes with calcium channel blockers without the need for surgical intervention.² In the reported cases undergoing surgical MVR, many had complicated postoperative courses with high morbidity and mortality.^{2,4} In a case series by Milleron et al,⁴ 5 patients underwent MVR and 2 died a few days postoperatively, whereas the others required extended intensive care stays for inotropic support. There is only one previously reported case treated

with mitral TEER in a patient with exercise-induced eclipsed MR.³ Similar to this case, the present patient had an excellent postprocedural course after mitral TEER with a dramatic improvement in her MR, LA pressures, and symptoms. Given the high morbidity and mortality associated with surgical intervention, TEER may be an attractive option for these high-risk patients and should be considered in appropriate candidates. Further data are needed to determine the underlying prevalence, mechanisms, and optimal therapy for this complex condition.

FOLLOW-UP

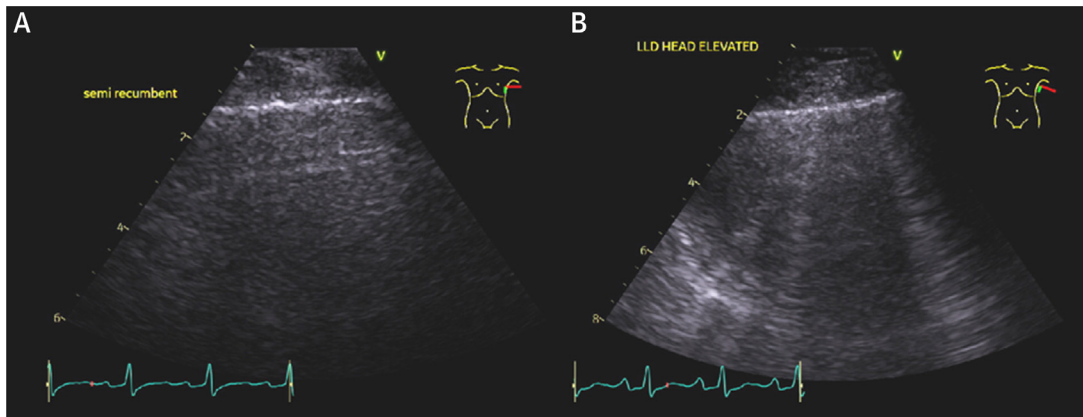
After mitral TEER, the patient reported a substantial and persistent improvement in her dyspnea and a

FIGURE 4 3-Dimensional Mitral Valve Model

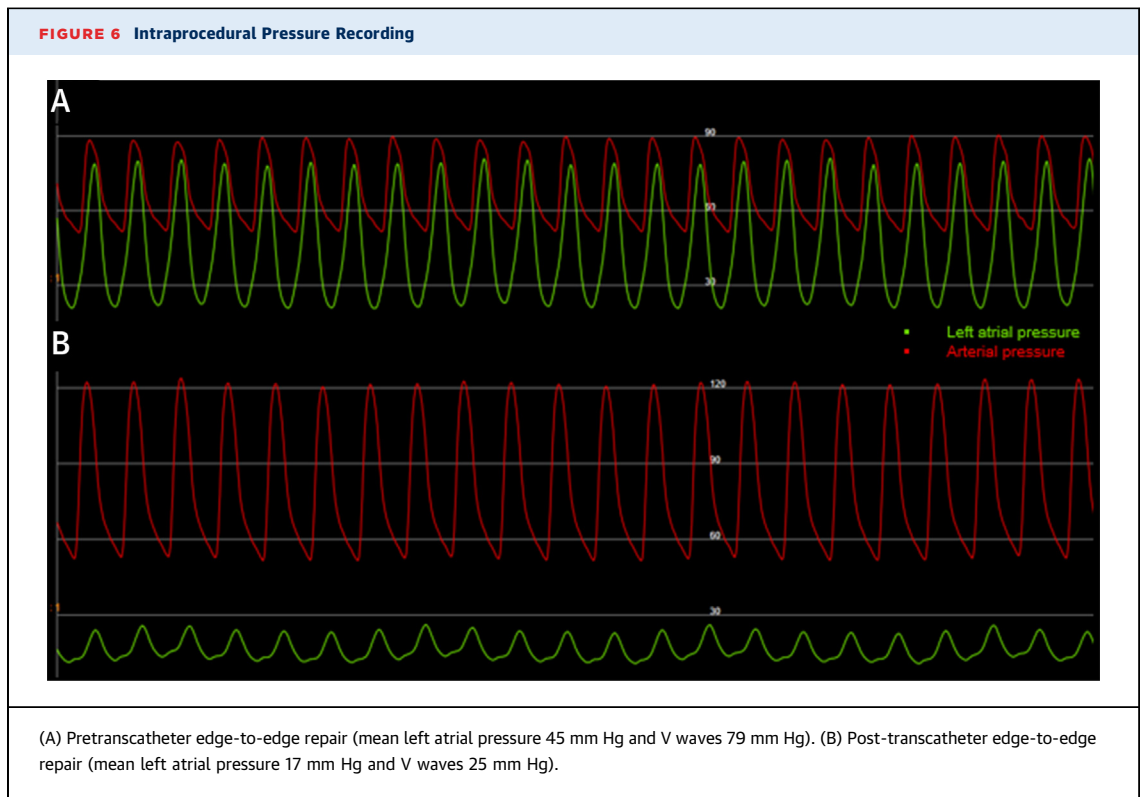


Three-dimensional mitral valve model showing an increase in tenting volume (blue shading) from (A) 3.9 cm³ in supine position to (B) 5.3 cm³ in left lateral decubitus position.

FIGURE 5 Ultrasound of Left Lower Lung Lobe



Ultrasound of left lower lung lobe showing (A) minimal pulmonary edema in supine position with (B) an acute increase in pulmonary edema and B-lines in the left lateral decubitus position.



reduction in pleural drain output. She was discharged home on low-dose diuretics, and pleural drains were removed at 3-month follow-up.

CONCLUSIONS

In postmenopausal women with cardiovascular risk factors and unexplained episodic heart failure, consider evaluation for eclipsed MR with imaging and provocative maneuvers. Treatment should be guided by the underlying mechanism. Given the high morbidity and mortality associated with surgical

MVR, mitral TEER may be an effective alternative for these high-risk patients.

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KEY WORDS cardiac imaging, echocardiography, eclipsed mitral regurgitation, heart failure, valve disease

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