

MINI-FOCUS ISSUE: VALVULAR HEART DISEASE GUIDELINES

ADVANCED

CASE REPORT: CLINICAL CASE

MitraClip for Secondary Mitral Regurgitation

Approach to the 2020 ACC/AHA Valvular Heart Disease Guidelines



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ABSTRACT

We describe the case of an 83-year-old man with a history of ischemic cardiomyopathy and severe secondary mitral regurgitation. This case highlights the role of transcatheter edge-to-edge repair with the MitraClip in the management of symptomatic functional mitral regurgitation in a surgically unfavorable patient. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:361-5) © 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

An 83-year-old man presented for routine outpatient follow-up with his heart failure physician after several inpatient admissions over the past 6 months. Despite optimal guideline-directed medical therapy, the patient exhibited stable exertional dyspnea present on ambulating 2 blocks. He presented afebrile with a blood pressure of 105/65 mm Hg, a heart rate of 84 beats/min, and oxygen saturation of 98% on room air. His physical examination findings were

suggestive of euvoemia with a jugular venous pulse of 8 cm H₂O, trace lower extremity edema, and a grade II/IV holosystolic murmur best appreciated at the apex. His heart failure is characterized as stage C with New York Heart Association functional class III symptoms.

MEDICAL HISTORY

The patient's medical history is notable for an acute myocardial infarction of the right coronary artery in 1998 managed with 2 bare-metal stents, a subsequent left anterior descending percutaneous coronary intervention with a drug-eluting stent following a positive stress test in 2004, stage C class III heart failure with reduced ejection fraction (30%) status following use of cardiac resynchronization therapy-defibrillator (Medtronic, Minneapolis, Minnesota), severe secondary mitral regurgitation (MR), paroxysmal atrial fibrillation on warfarin, hypertension, hyperlipidemia, and obesity.

LEARNING OBJECTIVES

- To understand the role for TEER using MitraClip in the management of secondary MR.
- To provide a brief review of the 2020 ACC/AHA guidelines regarding use of MitraClip in secondary MR.

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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](#).

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**ABBREVIATIONS
AND ACRONYMS****EROA** = effective regurgitant orifice area**MR** = mitral regurgitation**TEER** = transcatheter edge-to-edge repair**TEE** = transesophageal echocardiogram**DIFFERENTIAL DIAGNOSIS**

Given the patient's history of exertional dyspnea and his physical examination, severe secondary MR is the likely culprit. The findings were nonspecific for other common differential diagnoses such as congestive heart failure, pneumonia, pulmonary embolism, or coronary heart disease.

INVESTIGATIONS

Laboratory investigations were notable for top-normal creatinine (1.21 mg/dl), an elevated prothrombin time (21.0 s), and a therapeutic international normalized ratio (2.0). The patient's electrocardiogram was notable for a ventricular-paced rhythm with underlying atrial fibrillation and unifocal premature ventricular complex (Figure 1). His pre-procedural transesophageal echocardiogram (TEE) was significant for an ejection fraction of 30%, with severe MR with moderately restricted posterior mitral valve leaflet mobility (Figure 2). The gap between the 2 leaflets at the coaptation point is 4 to 5 mm. There was a moderately dilated mitral annulus with a left ventricular end-systolic diameter of 5.7 cm, a centrally directed jet with an effective regurgitant orifice area (EROA) of 0.21 cm², a regurgitant volume

of 39.01 ml, notable systolic blunting of blood flow into the pulmonary veins, and a left atrial volume index of 46 ml/m².

MANAGEMENT

Given the patient's escalating symptoms, secondary moderate/severe MR, stable coronary disease, and high operative risk (7.57% 30-day mortality per Society of Thoracic Surgery Risk for Mitral Repair), the decision was made to proceed with elective transcatheter edge-to-edge repair (TEER) using percutaneous MitraClip therapy (Abbott, Abbott Park, Illinois). The patient underwent the implantation of 2 MitraClips with insertion at A2/P2 (an NTW medially and an NTR laterally) under TEE and fluoroscopic guidance without incident via transeptal access (Figure 3). After the procedure, the patient's MR was reduced to "trace" with a residual transvalvular peak mitral gradient of 10 mm Hg and a mean gradient 4 mm Hg (Figures 4 to 6) (Videos 1 and 2).

DISCUSSION

In secondary MR, the entity previously referred to as "functional regurgitation," the valve leaflets and chordae are structurally normal. MR results from an imbalance between the closing and tethering forces

FIGURE 1 Pre-Operative Electrocardiogram Showing a Ventricular-Paced Rhythm With Underlying Atrial Fibrillation and a Unifocal Premature Ventricular Complex

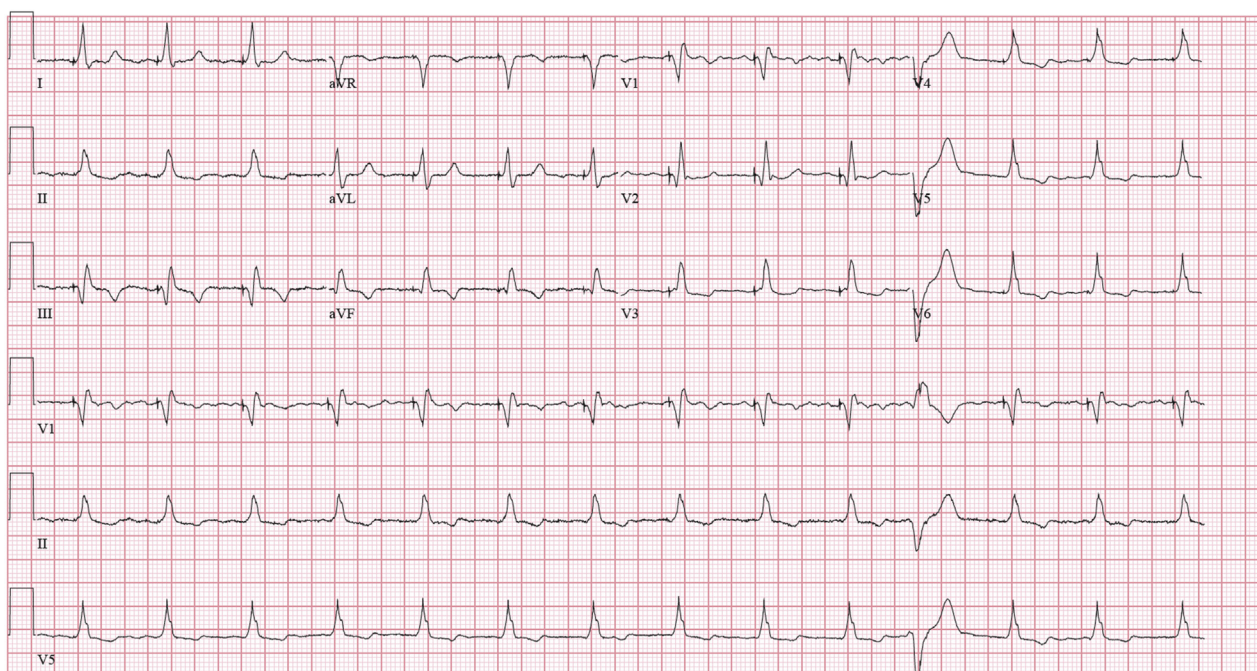
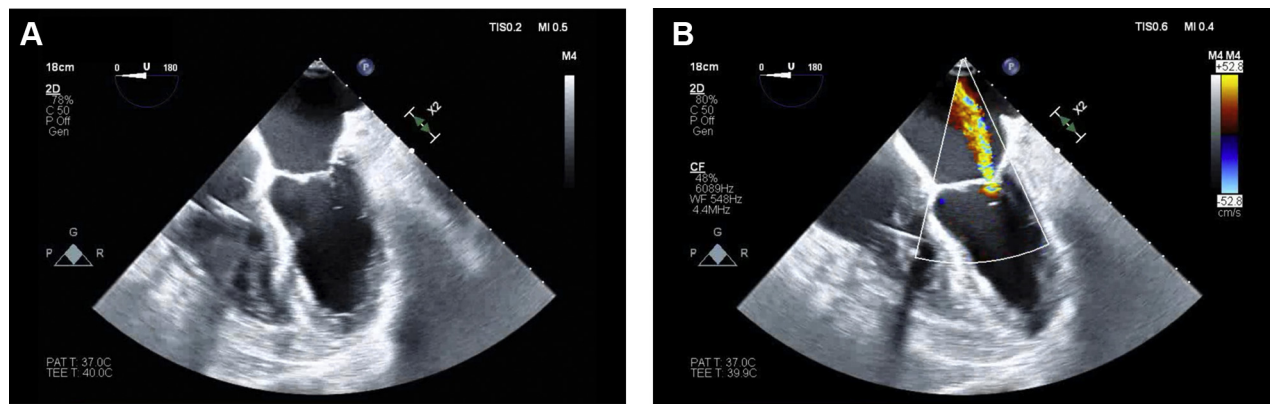


FIGURE 2 Transesophageal Echocardiographic Views



(A) Mid-esophageal 4-chamber view. (B) Color flow Doppler demonstrating severe posteriorly directed mitral regurgitation.

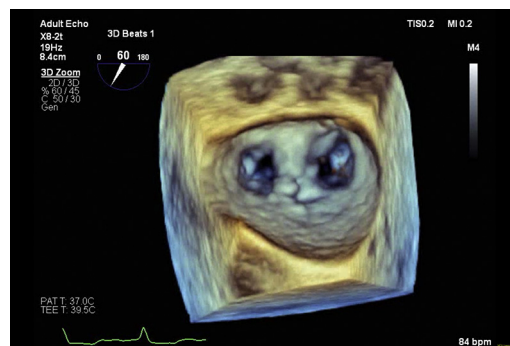
on the valve secondary to alterations in left ventricular geometry and is often most associated with dilated or ischemic cardiomyopathies (1,2). Annular dilatation can also be an underlying mechanism and is often found in patients with chronic atrial fibrillation and left atrial enlargement.

Echocardiography, both transthoracic echocardiogram and TEE, remains the gold standard for diagnosis and assessment of secondary MR. Lower thresholds have been proposed to define severe secondary MR compared with primary MR (0.20 cm² for EROA and 30 ml for regurgitant volume), owing to their association with prognosis (3,4). Of note, these values have not been validated by randomized prospective clinical trials and were obtained from retrospective observational data.

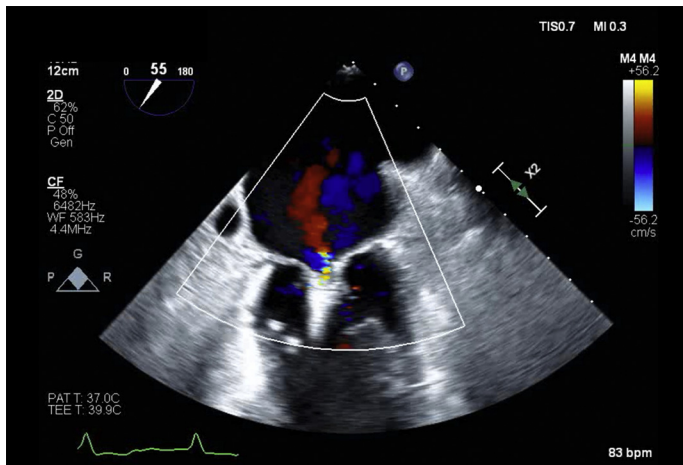
Surgical repair for secondary MR has not been definitively shown to improve long-term clinical outcomes or reduce mortality (5,6). With percutaneous TEER, as illustrated in the COAPT (Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation) trial, individuals with secondary MR and a reduced ejection fraction undergoing percutaneous edge-to-edge repair in addition to medical therapy exhibited a lower rate of hospitalization for heart failure and lower all-cause mortality within 24 months of follow-up than those receiving medical therapy alone in a select group of patients (7). Importantly, the individuals in COAPT were medically optimized, symptomatic, and reported moderate to severe or severe secondary MR before TEER. Although patients in the MITRA-FR

(Percutaneous Repair with the MitraClip Device for Severe Functional/Secondary Mitral Regurgitation) trial did not exhibit similar clinical benefits with TEER using MitraClip, important differences in the COAPT trial included higher cut points for EROA and regurgitant volume for entry into the trial and overall lower left ventricular end-diastolic volumes (7,8). Furthermore, the COAPT trial mandated maximally tolerated guideline-directed medical therapy before consideration of TEER and had higher rates of patients free from $\geq 3+$ MR at 1 year. These are important considerations moving forward to determine patient eligibility for TEER using MitraClip to treat symptomatic secondary MR.

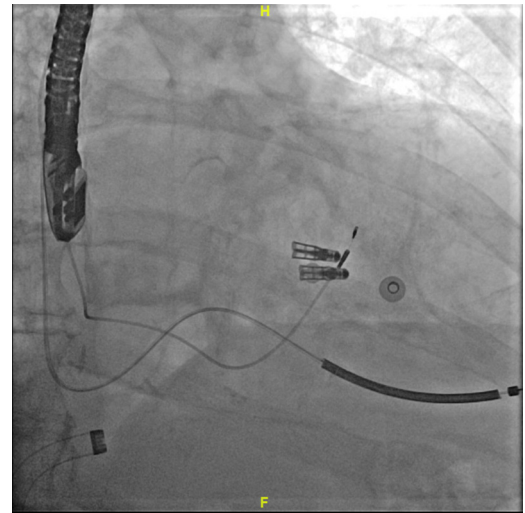
FIGURE 3 3-Dimensional Transesophageal Echocardiogram



3-dimensional transesophageal echocardiogram view of the mitral annulus from the left atrium toward the left ventricle. Note the implantation of two MitraClips with insertion at A2/P2.

FIGURE 4 Transesophageal Echocardiogram

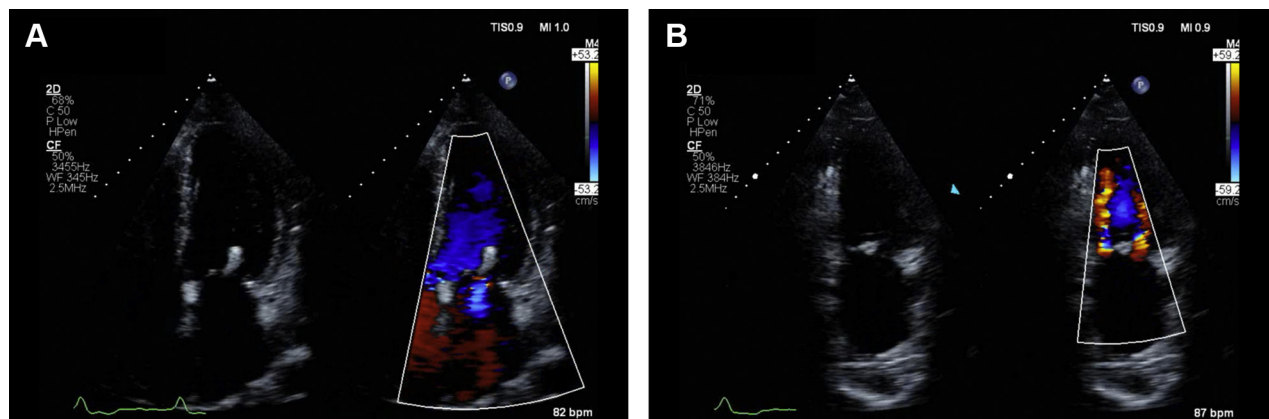
Mid-esophageal 2-chamber view with color flow Doppler showing trace mitral regurgitation post deployment of 2 MitraClips.

FIGURE 5 Fluoroscopy

Post-deployment anterior-posterior fluoroscopy showing the 2 deployed MitraClips.

The 2020 American College of Cardiology/American Heart Association (ACC/AHA) Valvular Heart Disease Guidelines now incorporate TEER using MitraClip as a Class IIa recommendation for intervention for secondary MR in patients with persistent severe symptoms (New York Heart Association functional class II to IV) (9). It is important to consider that these patients should have persistent MR and symptoms despite treatment with guideline-directed medical therapy, including cardiac resynchronization

therapy-defibrillator where applicable. A wide QRS results in uncoordinated regional left ventricular activation and may cause an imbalanced systolic force in the left ventricle, decreasing MV systolic closing forces and worsening MR (10). Furthermore, given the observed differences between the COAPT and MITRA-FR trials, it is important to emphasize that the guideline recommendations also incorporate specific

FIGURE 6 Transthoracic Echocardiogram

(A) Apical 4-chamber view showing color Doppler with trace mitral regurgitation. (B) Apical 4-chamber view demonstrating residual mitral stenosis with a peak gradient of 10 mm Hg and a mean gradient of 4 mm Hg.

anatomic criteria to clarify where TEER is applicable and most beneficial. Specifically, TEER to treat secondary MR should be an option in patients with a left ventricular ejection fraction between 20% and 50%, a left ventricular end-systolic diameter ≤ 70 mm, and a pulmonary artery systolic pressure ≤ 70 mm Hg. Isolated mitral valve surgery for patients with severe secondary MR (left ventricular ejection fraction $< 50\%$) with severe symptoms while on optimal medical therapy has a Class IIb recommendation; however, a Class IIa recommendation is given for mitral valve surgery at the time of coronary artery bypass surgery for treatment of myocardial ischemia.

FOLLOW-UP

The patient was discharged uneventfully 1 day after the procedure. At in-person follow-up 1 month later, the patient remained euvolemic with no changes noted on follow-up echocardiogram. In addition, he endorsed symptomatic improvement, now experiencing mild dyspnea on exertion after 4 blocks, previously present after 2 blocks.

CONCLUSIONS

This case illustrates the effectiveness of TEER of the mitral valve with MitraClip in patients with symptomatic secondary MR.

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Dr. Herrmann has received institutional research funding from Abbott, Edwards Lifesciences, and Medtronic; has received consulting fees from Abbott, Edwards Lifesciences, and Medtronic; and equity from Microinterventional Devices. Dr. Anwaruddin is on the advisory board and is a speaker for Medtronic; has received speaking/consulting fees from Edwards Lifesciences; is a steering committee member for Boston Scientific; has received speaking fees from Siemens; is a proctor/consultant for V Wave; and is an advisory board member for OpSens. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS echocardiography, mitral valve, valve repair

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

