

MitraClip detachment after electrical cardioversion: a case report

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Background

Transcatheter edge-to-edge repair (TEER) repair is a minimally invasive procedure used for patients with severe mitral regurgitation (MR). Cardioversion is indicated for haemodynamically unstable patients with narrow complex tachycardia and is generally considered safe post-mitral clip. We present a patient who underwent cardioversion post-TEER with a single leaflet detachment (SLD).

Case summary

An 86-year-old female with severe MR underwent TEER with a MitraClip that reduced MR severity to mild. During the procedure, the patient experienced tachycardia, and cardioversion was performed successfully. However, immediately after the cardioversion, the operators noticed recurrent severe MR with a posterior leaflet clip detachment. Deployment of a new clip adjacent to the detached one was obtained.

Discussion

Transcatheter edge-to-edge repair is a well-established method for treating severe MR in patients who are not suitable for surgical intervention. However, complications can arise during or after the procedure, such as clip detachment as in this case. Several mechanisms can explain SLD. We presumed that in the current case, immediately after cardioversion, there was an acute (post-pause) increase in left ventricle end-diastolic volume and thus in the left ventricle systolic volume with more vigorous contraction, possibly pulling apart the leaflets and detaching the freshly applied TEER device. This is the first report of SLD related to electrical cardioversion after TEER. Even though electrical cardioversion is considered safe, SLD can occur in this setting.

Keywords

Mitral regurgitation • Edge-to-edge mitral repair • Mitral clip • Cardioversion • Clip detachment • Case report

ESC Curriculum

4.3 Mitral regurgitation • 5.5 Supraventricular tachycardia • 7.1 Haemodynamic instability

Learning objectives

- To illustrate the potential consequences of cardioversion after TEER.
- To highlight the relation between atrial haemodynamics and arrhythmias

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Introduction

Transcatheter edge-to-edge repair (TEER) is used for patients with severe mitral regurgitation (MR). Cardioversion is indicated for haemodynamically unstable patients with narrow complex tachycardia. Cardioversion post-mitral clip is considered a safe procedure. We present a patient who underwent percutaneous edge-to-edge mitral repair with a following cardioversion that caused clip detachment.

Timeline

2013	Echocardiogram—moderate MR (asymptomatic)
2015–2017	Recurrent echocardiograms—moderate MR without progression
2021	<ol style="list-style-type: none"> (1) Patient presented with shortness of breath and malaise (2) Echocardiogram—severe MR with apical tethering of the leaflets (3) Single-photon emission computed tomography (SPECT) thallium dipyridamole—negative for ischemia (4) Admission for elective TEER
2021 Day 0 – procedure	<ol style="list-style-type: none"> (1) Transoesophageal echocardiogram (TOE)—severe MR with jet directed to the medial commissure (2) Clip implantation—reduction of the MR severity to mild (3) Regular wide complex tachycardia with a left bundle branch block (LBBB) pattern (4) Elevated gradient on the mitral valve (5) Adenosine trial—atrial flutter, ventricular response of 70, reduced gradient, and clip released. (6) Cardioversion—patient return to sinus rhythm (7) Recurrent severe MR, diagnosis of single leaflet detachment (SLD). (8) New clip deployment with mild MR
2021 Day 2	Discharged from the hospital
2021 Day 60	Follow-up—patient stable with NYHA 1–2, mild-to-moderate MR

Case presentation

An 86-year-old woman presented with a few months of exertional shortness of breath, malaise, and paroxysmal nocturnal dyspnoea.

The patient has a history of hypertension treated with ACE inhibitors [ramipril, 1.25 mg once a day (o.d.)] and paroxysmal atrial fibrillation (AF) treated with rivaroxaban (15 mg o.d.) and beta-blockers (bisoprolol, 2.5 mg o.d.). She had a COVID-19 infection 7 months before the procedure.

The patient was first diagnosed with moderate MR in 2013, with moderate left atrial enlargement, mild tricuspid regurgitation (TR) with an estimated right ventricular (RV) systolic pressure (RVSP) of

35 mmHg, and normal left ventricular (LV) function. Mitral regurgitation severity did not progress over the subsequent 2 years.

With the appearance of symptoms, the patient underwent another echocardiogram in 2021 that showed severe MR with apical tethering of the leaflets (significantly worse than in previous echo studies) with moderate TR (RVSP, –38 mmHg). There was no evidence of ischemia on SPECT thallium dipyridamole scintigraphy.

Physical examination was unremarkable, besides mitral systolic murmur.

Because of high operative risk, a heart team discussion recommended TEER.

A TOE at the beginning of the procedure showed severe MR with a regurgitant jet originating mainly from the medial commissure ([Figure 1](#) and [Supplementary material online, Video S1](#)), and a 3D planimetric valve area of 4.12 cm². The baseline MR parameters were as follows: regurgitant volume = 71 mL; effective regurgitant orifice area (EROA) = 0.37 cm²; vena contracta diameter; 0.65 cm, pulmonary vein (PV) flow; systolic = 22.7 cm/s; and diastolic = 45.2 cm/s [blood pressure (BP) was 117/78 mmHg; heart rate (HR) –86].

Transcatheter edge-to-edge repair (MitraClip, Abbott) was performed through right femoral vein access and transeptal puncture with a BRK needle. A single XTW clip was inserted with good grasping (see [Supplementary material online, Videos S2 and S3](#)) and reduction of MR severity to mild (see [Supplementary material online, Videos S3 and S4](#)). The patient was in AF from the beginning of the procedure, with a ventricular response of 86 b.p.m. During clip implantation, the patient converted into a regular wide complex tachycardia with an LBBB pattern ([Figure 2](#)), and a HR of 130 b.p.m. During the tachycardia, diastolic mean pressure gradient on the mitral valve was 10 mmHg. The patient was then treated with 12 mg of adenosine, which revealed atrial flutter with a ventricular response of 70 b.p.m. Mean diastolic pressure gradient was then 5 mmHg. Final MR severity was mild [BP was 115/72 mmHg; HR –121] with systolic dominance of the PV flow velocities. Thus, the clip was successfully released, and grasping was assessed as stable ([Figure 3](#) and [Supplementary material online, Video S5](#)).

The patient was then treated with a loading dose of 150 mg intravenous amiodarone and underwent a successful 150 J biphasic synchronized cardioversion, returning to normal sinus rhythm. Immediately after the cardioversion, the operators noticed recurrent severe MR [BP was 105/83 mmHg; HR –119].

The differential diagnosis of recurrent MR post-TEER includes single leaflet device detachment, loss of leaflet insertion, leaflet tear, leaflet prolapse, and leaflet distortion.¹

In our case, TOE demonstrated that the clip was detached from the posterior leaflet ([Figure 4](#)) causing recurrence of the severe MR.

Transseptal access was re-obtained with successful deployment of a new NTW clip adjacent to the detached one. Diastolic mean pressure gradient was 3 mmHg with marked improvement of the MR that was now mild ([Figure 5](#)). During the insertion of the second clip, the patient remained in sinus rhythm and haemodynamically stable. The patient stayed in the ICU for another 48 h on sinus rhythm with sporadic atrial premature beats (APBs) and was treated with an oral loading dose of amiodarone (400 mg BID). A follow-up transthoracic echocardiogram showed mild-to-moderate MR without stenosis. On the 2-month follow-up visit, the patient was in good condition with no shortness of breath. The patient was treated with amiodarone (100 mg). An echocardiogram showed mild-to-moderate MR with the second clip well docked.

Discussion

Transcatheter edge-to-edge repair is widely used in the treatment of patients with severe MR who are not candidates for surgical

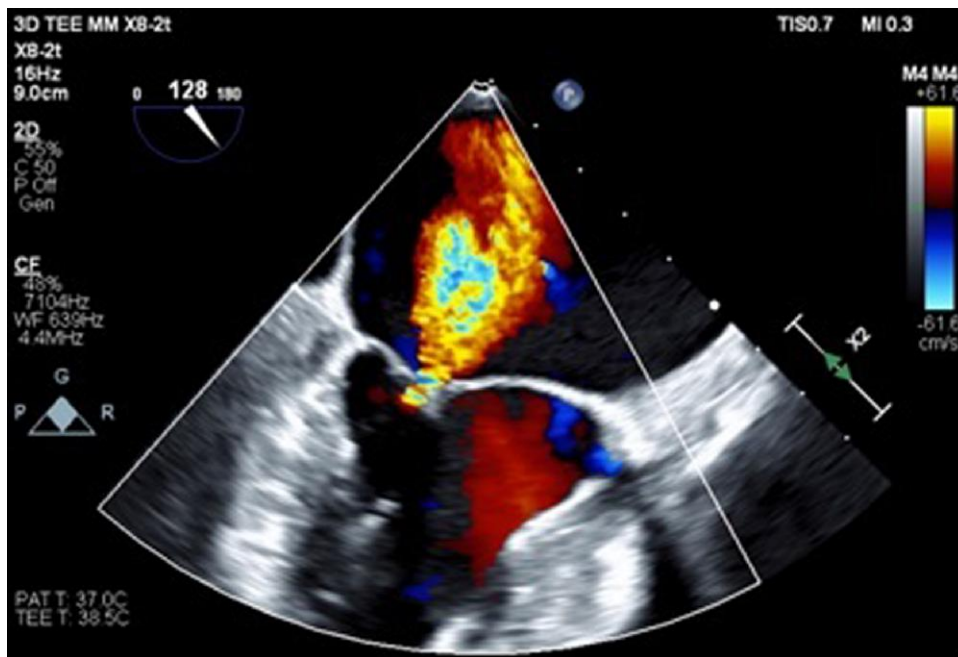


Figure 1 Echocardiogram—parasternal long-axis view—severe mitral regurgitation.

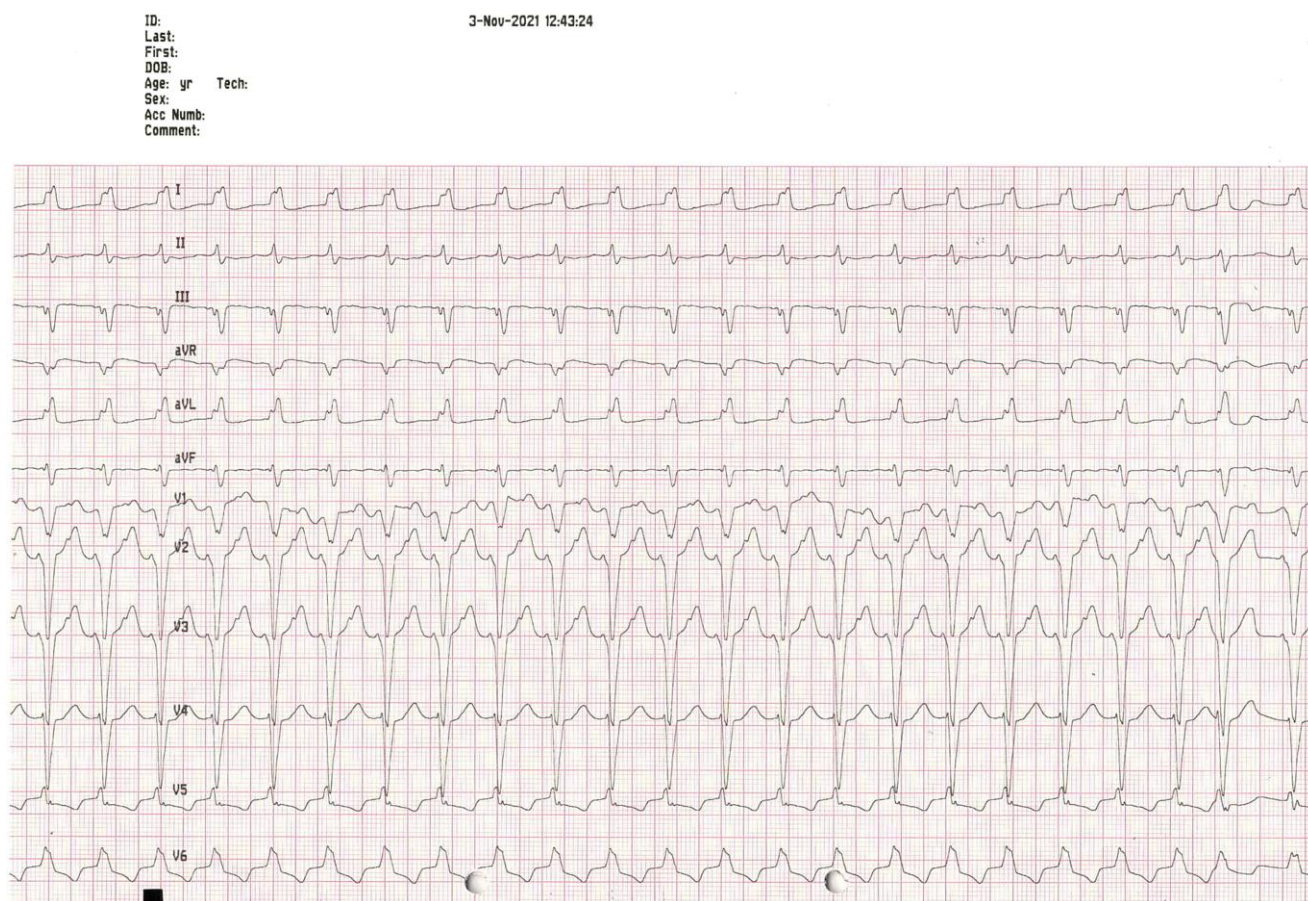


Figure 2 Electrocardiogram—regular wide complex tachycardia.

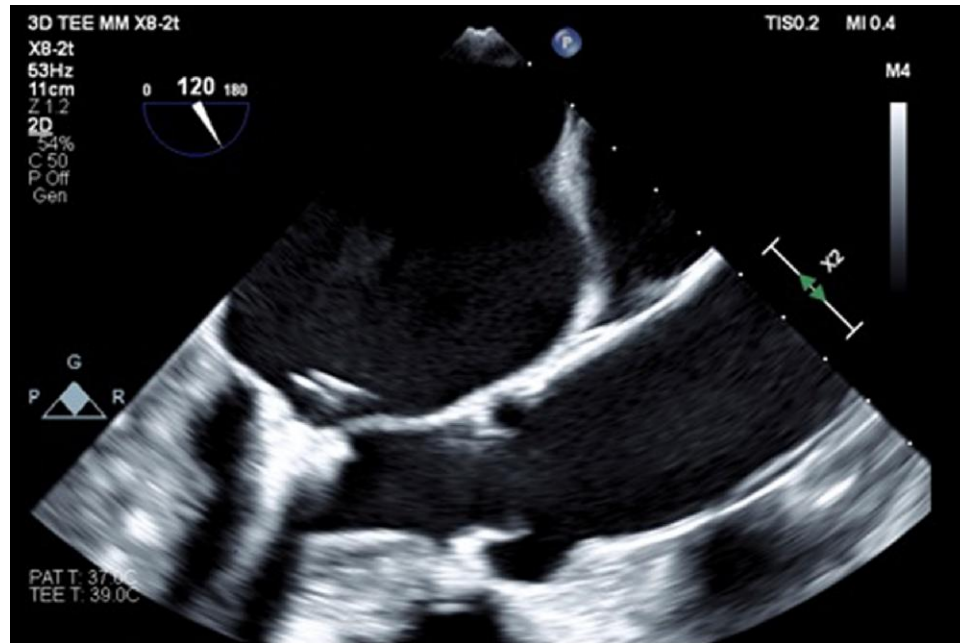


Figure 3 Echocardiogram—post-clip insertion.

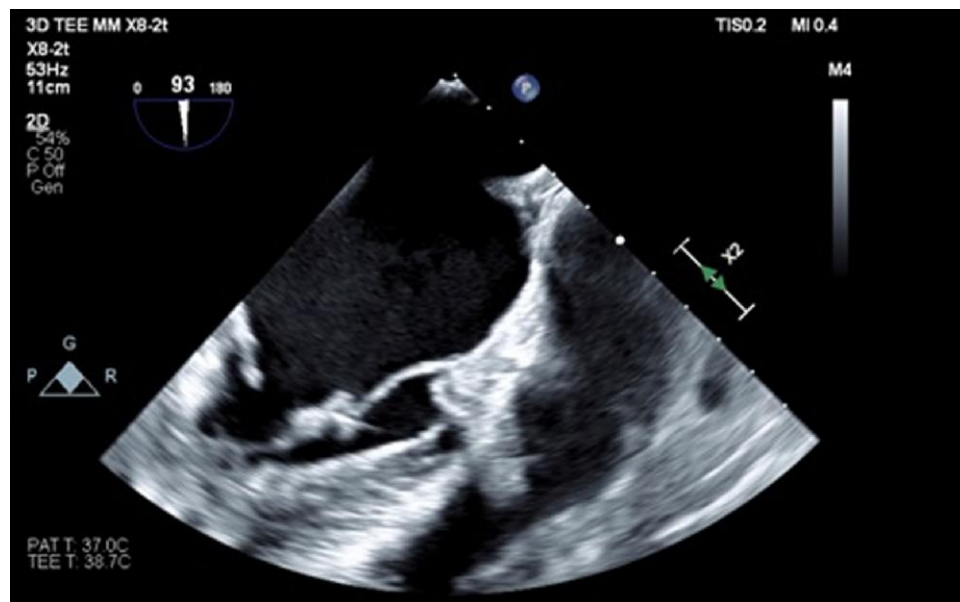


Figure 4 Echocardiogram—posterior leaflet detachment.

intervention. Fifty three per cent of patients undergoing TEER have AF.² Cardioversion is indicated (Class 1 recommendation) for haemodynamically unstable patients.³ A recent study including 30 patients who underwent electrical cardioversion immediately after TEER reported successful electrical cardioversion in 50% of patients.⁴ In addition, there was an improvement in BNP levels and in a 6-min walk test. In this study, no embolization

or SLD were reported in the short or long term after the procedure.⁴

Severe MR is associated with incident AF secondary to enlargement of the atrium and elevated left atrial pressure, reducing the success rate of cardioversion.

The treatment of MR by TEER decreases left atrial pressure and wall tension, thus theoretically increasing the chances of successful electrical

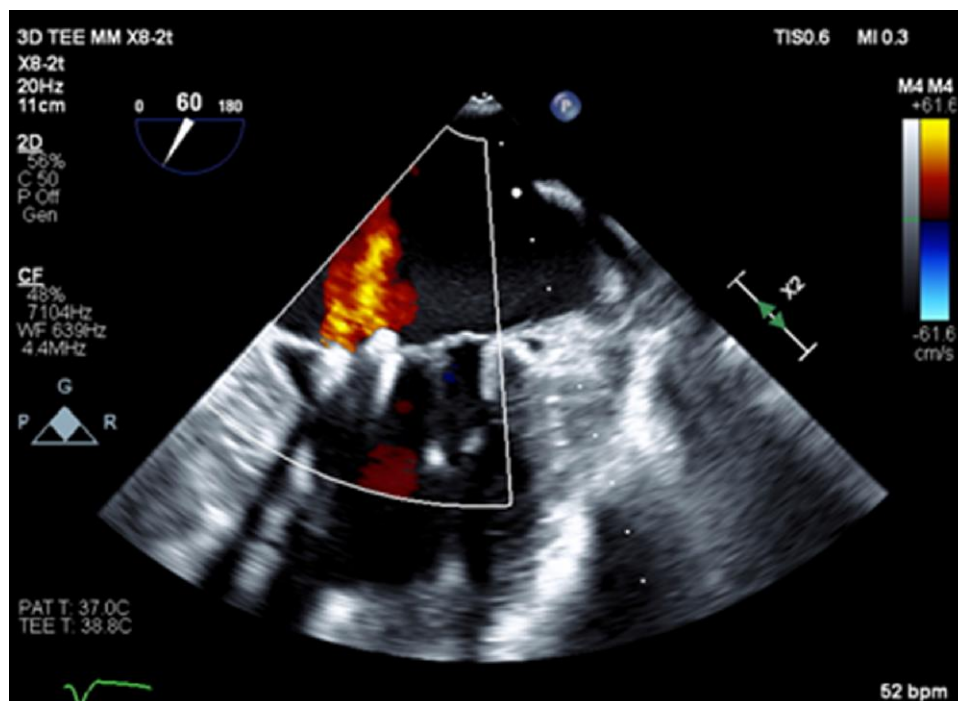


Figure 5 Echocardiogram—post second clip insertion.

cardioversion. Furthermore, performing electrical cardioversion immediately at the end of the procedure is convenient, as the patient is intubated, ventilated, and well monitored, and left atrial appendage thrombus presence has been ruled out by the TOE performed in the procedure.

Several mechanisms can explain SLD including insufficient grasping, leaflet tear, and leaflet perforation. We presumed that in the current case, immediately after cardioversion, there was an acute (post pause) increase in LV end-diastolic volume (EDV) and thus in LV stroke volume (SV) with more vigorous contraction, possibly pulling apart the leaflets and detaching the freshly applied TEER device.

To the best of our knowledge, this is the first report of SLD related to electrical cardioversion after TEER. Even though electrical cardioversion is considered a safe procedure,⁴ SLD can occur in this setting. As the advantages of maintaining sinus rhythm in these patients are clear, the safety and feasibility of cardioversion immediately after TEER should be assessed in future studies.

Lead author biography



Dr. Yagel is a graduate of the Hebrew University of Jerusalem, completed his Internal Medicine residency at Hadassah Medical Center, and served there as a chief medical resident. He completed his fellow in general cardiology at Hadassah Medical Center and is currently an Interventional Cardiology fellow.

Supplementary material

Supplementary material is available at *European Heart Journal – Case Reports* online.

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None.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as [Supplementary data](#).

Consent: The study is approved by our hospital ethical committee—HMO-1002-20. The authors confirm that verbal consent for submission and publication of this case report including images and associated text has been obtained from the patients detailed in this case report. This has been discussed with the editors

Conflict of interest: None declared.

Funding: None declared.

Data availability

The data underlying this article are available in the article and in its online [supplementary material](#).

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