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CASE REPORT
Structural intervention

Transcatheter mitral valve implantation using TENDYNE valve for the treatment of residual severe mitral regurgitation post-transcatheter mitral valve edge-to-edge repair: a case report

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Background Functional mitral regurgitation (MR) in patients with heart failure can be treated medically or by transcatheter edge-to-edge repair (TEER) if medical therapy fails. Patients who are not suitable for TEER or surgical intervention might benefit from transcatheter mitral valve implantation using the TENDYNE valve.

Case summary A 58-year-old male with a history of heart failure was admitted frequently with acute heart failure and functional MR, treated medically without significant improvement. He underwent mitral TEER therapy using MitraClip. A few months later, he was admitted with acute decompensated heart failure. Echocardiography showed severe MR with a detached clip from the posterior leaflet. He underwent redo mitral TEER using MitraClip as an option for treating single leaflet device detachment. He was readmitted with the same symptoms and his echocardiography showed detachment of both clips from the posterior leaflet. The patient underwent TMVI using the TENDYNE valve being not suitable for another attempt of mitral TEER. On follow-up, he was asymptomatic and echocardiography showed normal functioning mitral bioprosthesis with a mean gradient of 4 mm/Hg and no paravalvular leak.

Discussion Transcatheter mitral valve implantation using TENDYNE valve is an option for treating patients with functional MR and detached MitraClips.

Keywords Case report • Functional mitral regurgitation • MitraClip • Single leaflet device attachment (SLDA) • Tendyne valve

ESC curriculum 2.2 Echocardiography • 4.3 Mitral regurgitation • 6.2 Heart failure with reduced ejection fraction • 7.4 Percutaneous cardiovascular post-procedure

Learning points

- For patients with short posterior mitral leaflets undergoing transcatheter edge-to-edge repair ensuring a secure leaflet grasp before releasing the clip is crucial to avoid post-procedure single leaflet device attachment.
- For patients with functional mitral regurgitation and single leaflet device attachment and ongoing heart failure symptoms, transcatheter mitral valve replacement may be considered. In our case, we successfully implanted the Tendyne valve using a transapical approach.

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Introduction

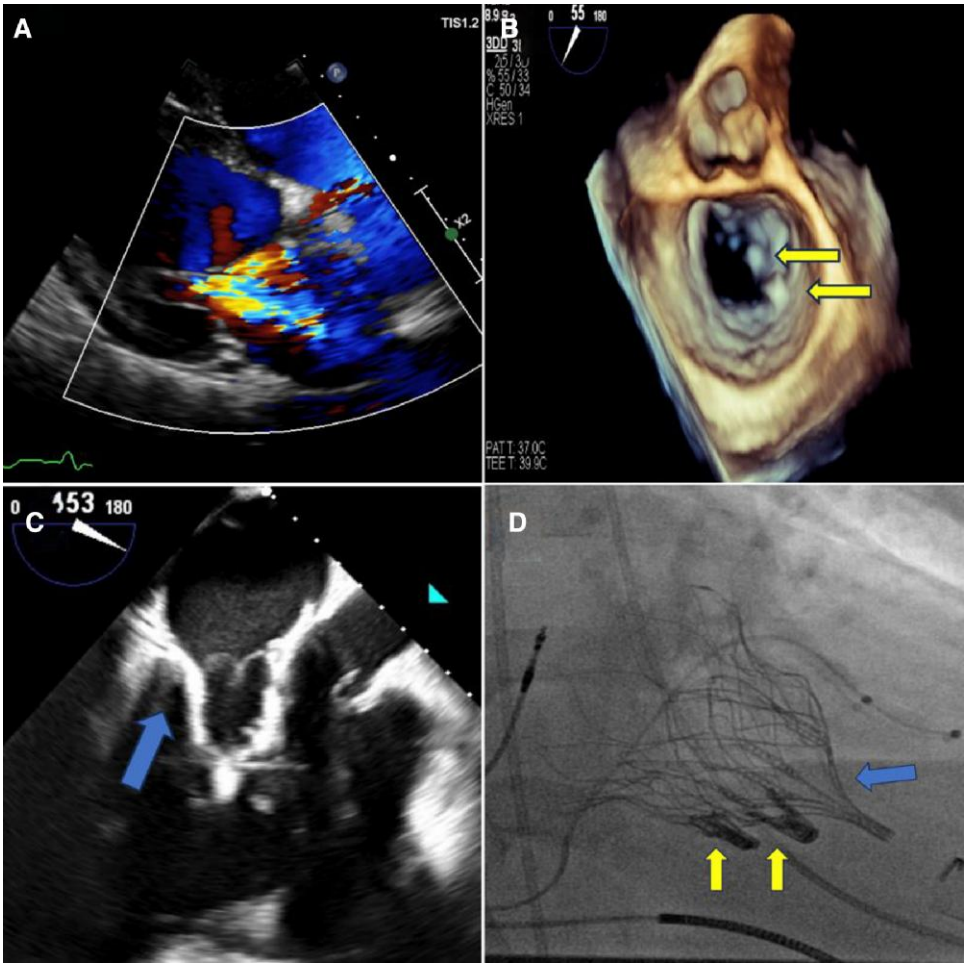
Mitral regurgitation (MR) in patients with heart failure is a known cause of mortality and morbidity and accounts for an increased rate of hospitalizations for acute decompensated heart failure (ADHF) if left untreated.[1–3] There are limited treatment options for patients with functional MR. These include optimization of guideline-directed medical therapy, percutaneous intervention with transcatheter edge-to-edge repair (TEER), transcatheter mitral valve implantation (TMVI), and conventional mitral valve surgeries. Transcatheter edge-to-edge repair (TEER) has been well studied with established outcomes in patients with severe MR at high risk for surgery.[4] Although not common, mitral TEER is associated with short- and long-term complications, like single leaflet device attachment (SLDA), which can be treated successfully by insertion of another clip.[5] The surgical intervention for a failed mitral clip carries a high risk of mortality.[6] Here, we present a case of a 58-year-old male who underwent the TEER procedure using MitraClip twice followed by partial device detachment and then treated by TMVI using Tendyne valve.

Summary figure

Transthoracic echocardiography done at the patient's first presentation showing severe mitral regurgitation (*A*). *B* shows 3D zoom view of the mitral valve with two detached clips (yellow arrows) from the posterior leaflet. Transoesophageal echocardiography (*C*) post-transcatheter mitral valve implantation using Tendyne valve showing well-seated bioprosthetic valve (blue arrow). *D* shows the cine image after Tendyne valve implantation and the previously detached MitraClips (yellow arrows) and the Tendyne valve (blue arrow).

Case presentation

A 58-year-old male known to have non-ischaemic cardiomyopathy (based on normal coronary arteries at the time of diagnosis) with an ejection fraction of 15% for 5 years. He underwent cardiac resynchronization therapy 3 years after the initial diagnosis. The patient presented to the emergency department (ED) with shortness of breath at rest, orthopnoea, and paroxysmal nocturnal dyspnoea as well as generalized oedema. On physical examination, his heart rate was 110 b.p.m. and his blood pressure was 110/75 mmHg with oxygen saturation of 88% on room air. He had a pan systolic murmur at the apex radiating to the left axilla and bilateral basal crepitation on chest examination. He was admitted and treated for ADHF. Transthoracic echocardiography



(TTE) was done and showed new severe MR secondary to annular dilatation (40 mm) and severely tethered mitral leaflets (*Figure 1*; Supplementary material online, *Videos S1 and S2*) with an ejection fraction of 15%. His left ventricle (LV) was dilated [LV end-diastolic dimension (LVEDD) = 71 mm] and right ventricular systolic pressure (RVSP) was 55 mmHg. His Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation (COAPT) score was 10 suggesting more than 80% mortality and heart failure hospitalization. He was treated conservatively, medications were optimized, and he was discharged for follow-up. Medical therapy was optimized to the maximum tolerated heart failure medications (sacubitril/valsartan 200 mg twice daily, carvedilol 25 mg twice daily, spironolactone 25 mg daily, empagliflozin 10 mg daily, and furosemide 80 mg twice daily). In the coming 4 months, he was hospitalized three times with decompensation of his heart failure. He was offered percutaneous mitral edge-to-edge repair using MitraClip as he was declined for surgical mitral intervention due to high surgical risk according to The Society of Thoracic Surgeons (STS 7.1%) and very low LV ejection fraction (15%). His echocardiographic parameters classified him as non-COAPT type [LV ejection fraction of 15% (COAPT criteria: 20–50%) and LVEDD of 71 mm (COAPT criteria: <7 mm)] but still mitral TEER was performed as he failed medical therapy. The transoesophageal echocardiography showed tethered mitral leaflets with posterior mitral leaflet length of 0.95 cm, coaptation depth of 13 mm, and coaptation length of 4 mm. Echocardiography post-mitral valve clip showed mild residual MR with a mean gradient of 3 mmHg (Supplementary material online, *Video S3*). Two months later, he presented to ED with ADHF. Echocardiography was done as a part of the workup and showed severe MR and previously implanted MitraClip was detached from the posterior mitral leaflet (*Figure 2*; Supplementary material online, *Video S4*). The patient underwent a redo mitral valve clip as a treatment option for SLDA, and the second clip was deployed medial to the first clip. The transoesophageal echocardiography at the end of the procedure showed a reduction of MR severity to moderate with a mean gradient of 3 mmHg (*Figure 3*; Supplementary material online, *Video S5*).

Seven months later, the patient was admitted again with symptoms of ADHF and echocardiography showed severe MR with the detachment of the previously implanted two mitral clips from the posterior leaflet (Supplementary material online, *Video S6*). The likely mechanism of SLDA, in this case, was the short posterior leaflet, inadequate tissue grab of the posterior leaflet, and commissural placement of the clip. The patient was discussed in the heart team meeting and planned for TMVI using Tendyne valve due to non-suitability for redo mitral TEER and high surgical risk (STS 7.1%). The Tendyne valve was implanted successfully. The Tendyne system is a transcatheter bioprosthetic valve introduced through the LV apex under TEE guidance. The valve anchors itself in the left atrium by a large atrial skirt, and the tether tendon is fixed outside the LV apex by a pad. The clips were attached to the middle and medial scallops of the anterior mitral leaflet and during implantation of the Tendyne valve, and they were pushed away from LV outflow tract (LVOT) without causing any obstruction. Transoesophageal echocardiography after the procedure showed a mild paravalvular leak with a mean gradient of 2 mmHg and no LVOT obstruction (*Figures 4* and *5* and Supplementary material online, *Video S7*).

On follow-up, the patient became asymptomatic with no further hospitalizations for ADHF. Repeated TTE 10 months later showed normal functioning mitral bioprosthesis with a mean gradient of 4 mmHg and no paravalvular leak (Supplementary material online, *Video S8*). The ejection fraction also improved to 30%.

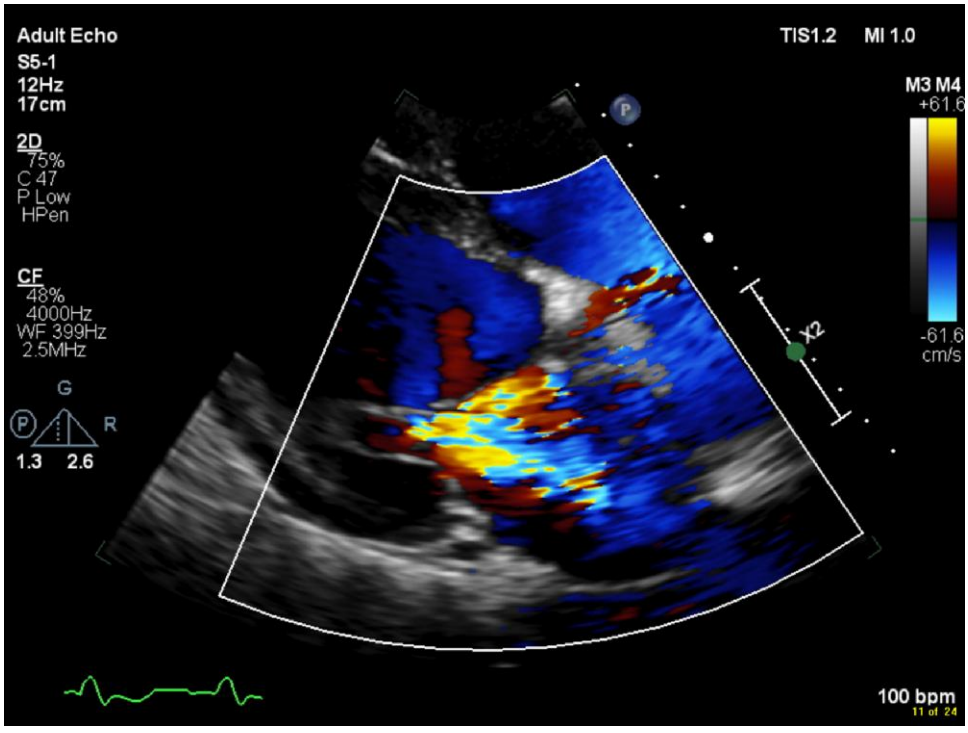


Figure 1 Transthoracic echocardiography done at the patient's first presentation showing severe mitral regurgitation.

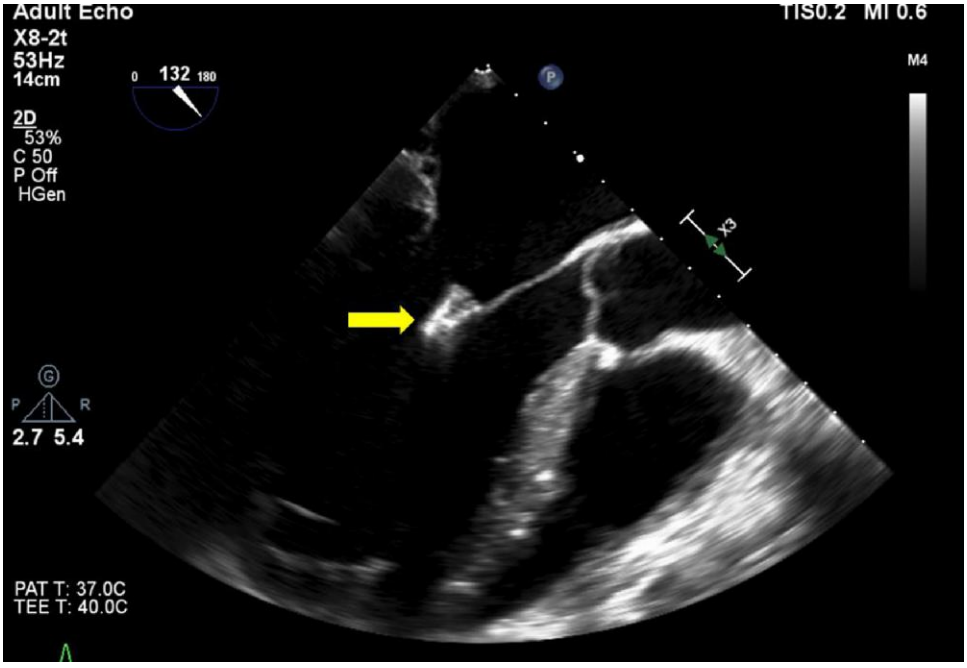


Figure 2 Transoesophageal echocardiography showing MitraClip detached from the posterior mitral valve leaflet (yellow arrow).

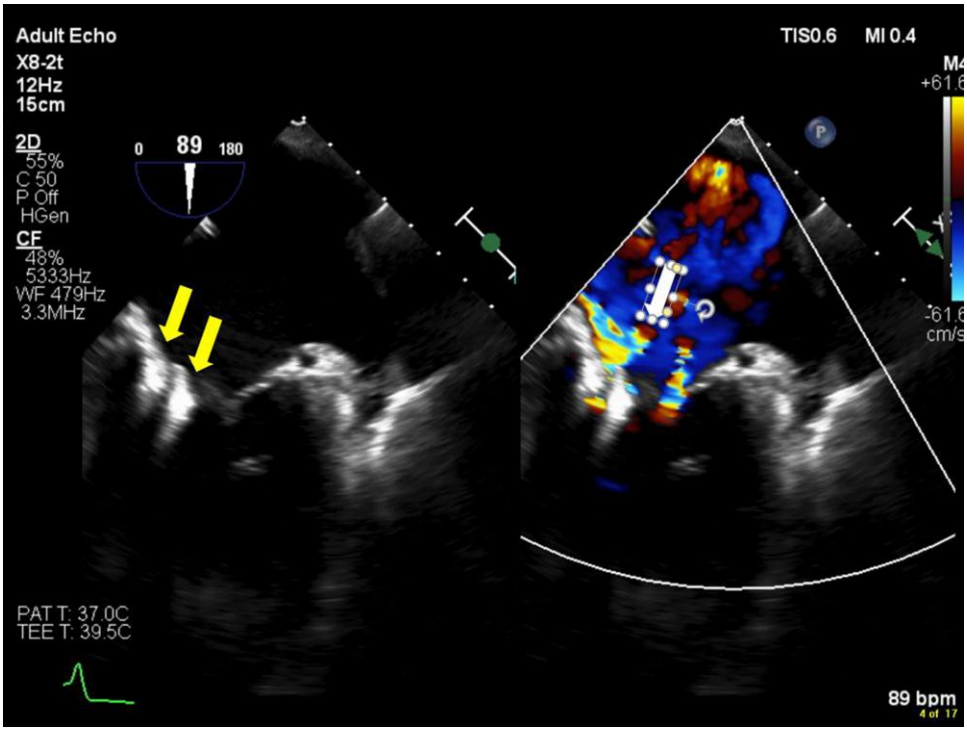


Figure 3 Transoesophageal echocardiography post-redo MitraClip showed 2 clips (yellow arrows) and moderate residual mitral regurgitation (white arrow).

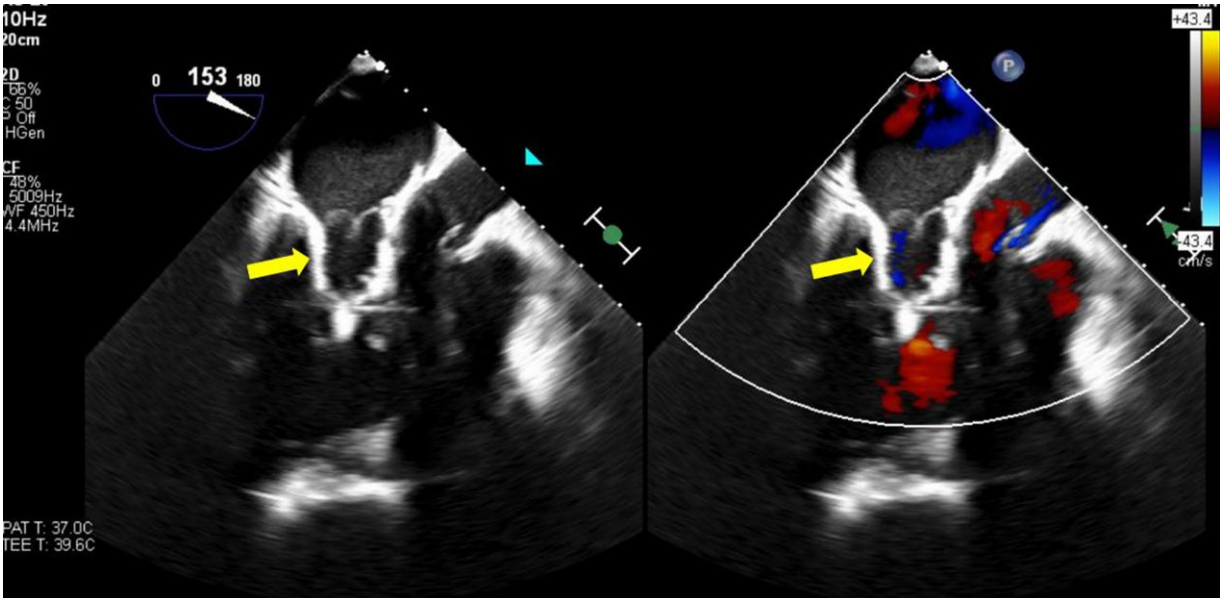


Figure 4 Transoesophageal echocardiography post-transcatheter mitral valve implantation using Tendyne valve showing well-seated bioprosthetic valve (yellow arrow).

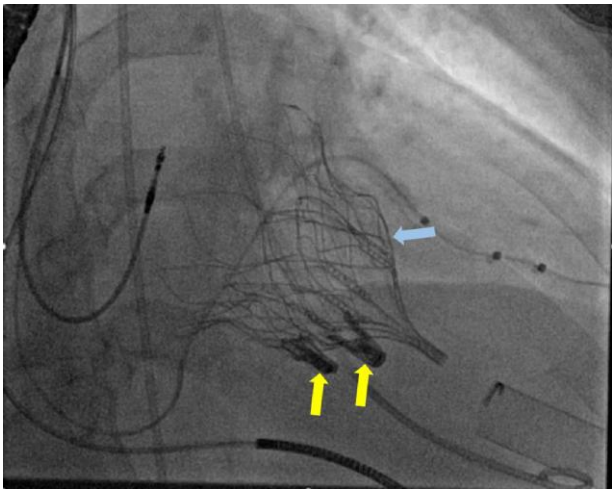


Figure 5 Angiography after Tendyne valve insertion showing the previously detached MitraClips (yellow arrows) and the Tendyne valve (blue arrow).

Discussion

Functional MR is a common cause of mortality and morbidity in patients with heart failure and reduced ejection fraction.[1–3] Treatment options include guideline-directed medical therapy, percutaneous TEER, and surgical intervention.[7] Compared with medical therapy alone, percutaneous mitral edge-to-edge repair in patients with functional MR leads to significant improvement in survival and a reduction in hospitalizations due to heart failure.[4] COAPT risk score stratifies patients using clinical and echocardiographic parameters and provides useful prognostication in terms of hospitalization and death due to heart failure.[8] The rate of complications of mitral TEER procedure is low with a high success rate; however, it is associated with an overall 4.35% risk of major adverse events like bleeding, pericardial effusion, and device-related complications including embolization and clip detachment.[9,10] Single leaflet device attachment (SLDA) is one of the known but uncommon complications of mitral TEER, and it can be treated safely by using another clip.[11] The incidence of SLDA has decreased further with the growing experience of operators and modification of mitral TEER technology. The most recent data have reported a rate of detachment as low as <2%.[11]

Our patient underwent a second mitral TEER procedure using MitraClip implantation with partial success, and unfortunately, the second clip also got detached. Transcatheter mitral valve implantation using Tendyne valve is an emerging choice for the treatment of symptomatic severe MR for patients who are not suitable for mitral edge-to-edge repair. Tendyne valve, since its first implantation in 2012,[12] has been growing slowly. It has been used successfully in patients with mitral annular calcification and prior aortic valve replacement surgically or percutaneously.[12] Lisko *et al.*[13] reported a case where prior MitraClips were removed electrosurgically followed by TMVI. In our case, prior MitraClips were buried under the Tendyne valve without any complication. This procedure provides a less invasive surgical option as not all patients are suitable for a conventional cardiac surgical approach. For patients with MR unsuitable for edge-to-edge repair (e.g. due to severe leaflet tethering, shortening, or inadequate tissue capture), Transcatheter mitral valve implantation using the Tendyne valve can be a primary treatment option. The patient in this case report underwent mitral TEER using MitraClip implantation twice followed by SLDA resulting in severe residual MR with symptoms of heart failure. He underwent TMVI successfully with good symptomatic relief and improvement in LV ejection fraction.

In summary, TMVI using Tendyne valve is an option for treating patients with functional MR and detached MitraClips.

Lead author biography

Dr Mohammed Abunab has a degree in adult cardiology from KFMC, Riyadh and he is currently a fellow of adult cardiac electrophysiology at Prince Sultan Cardiac Center, Riyadh, Saudi Arabia.

Supplementary material

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

Consent: The authors confirm that written consent for the submission and publication of this case report, including images and associated text, has been obtained from the patient and family in line with the COPE guidance.

Conflict of interest: No conflict of interset.

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Data availability

The data included in this article will be shared upon reasonable request to the 10 corresponding authors.

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