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CASE REPORT
Valvular heart disease

A case report of repeat clipping for recurrent severe mitral regurgitation from both sides of the clip: those who run after two hares may catch both

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Background Recurrent mitral regurgitation (MR) can occur even after successful transcatheter edge-to-edge mitral valve repair (TEER). While some reports show the utility of repeat clipping for recurrent MR, the results are unsatisfactory. We describe a patient who underwent repeat clipping for MR that recurred from both sides of the original clip.

Case summary An 89-year-old male was admitted to our hospital with congestive heart failure. Transthoracic and transoesophageal echocardiograms (TTE/TEE) revealed severe MR due to A2 (middle segment of the anterior leaflet) prolapse. Because of his high operative risk, we performed TEER. An NTW clip was placed between A2 and P2 (middle scallop of the posterior leaflet), markedly reducing MR to mild. Six months after TEER, he complained of dyspnoea, and severe MR was evident from both sides of the clip. Although the risk of iatrogenic mitral stenosis was considered, we assessed that there might be a chance to succeed in repeat clipping if the additional two clips were placed only in the P2 beside the original clip following a careful review of TEE images. We challenged repeat clipping. After we placed NT clips on each side of the original NTW clip, MR was reduced to mild without creating iatrogenic mitral stenosis, and his symptoms subsequently improved.

Discussion Anatomical features such as no valve thickening at the leaflet's grasping site and the presence of posterior leaflet indentation may increase the likelihood of a successful repeat clipping outcome. Repeat clipping should be considered after careful anatomical assessment, even in patients with challenging anatomy.

Keywords Transcatheter edge-to-edge mitral valve repair • Repeat clipping • Mitral regurgitation • Heart failure • Case report

ESC Curriculum 4.3 Mitral regurgitation • 2.2 Echocardiography

Learning points

- About 10–18% of patients who received transcatheter edge-to-edge mitral valve repair experience recurrent mitral regurgitation (MR), even after successful initial repair.
- Archiving satisfactory results of repeat clipping is not easy due to the risk of iatrogenic mitral stenosis or the need to control multiple MR jets.
- Anatomical features such as a large scallop (potential site for multiple clips), high valve mobility, no valve thickening, and deep posterior leaflet indentation may increase the likelihood of successful repeat clipping outcomes.
- Repeat clipping may be the only treatment option for recurrent MR in some patients. Physicians should consider repeat clipping after careful anatomical assessment, even in patients with challenging anatomy.

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Introduction

In recent years, the evolution of catheterization for the mitral valve has been remarkable. Transcatheter edge-to-edge mitral valve repair (TEER) with the MitraClip system (Abbott Vascular Devices, Santa Clara, CA, USA) was introduced earlier and is the most frequently applied treatment worldwide. However, 10–18% of patients who received TEER experience recurrent mitral regurgitation (MR), even after successful initial repair.[1,2] Several mechanisms of recurrent MR have been proposed. In primary MR, single leaflet device detachment (SLD), loss of leaflet insertion, leaflet tear, or prolapse can occur, while in secondary MR, left ventricular (LV)/left atrial dilation can cause worsening MR.[2,3]

The risk of a surgical approach for recurrent MR after TEER is unacceptably high, with a 30-day mortality rate exceeding 16%.[4] While some reports show the utility of repeat clipping for recurrent MR, there is always a trade-off with the risk of creating iatrogenic mitral stenosis, especially in multiple jets.[5] Further, there are only a few detailed reports of repeat clipping.[6–8] We describe successful repeat clipping for recurrent severe MR from both sides of the clip following careful preoperative anatomical assessment.

Summary figure

Date	Event
June 2020	The patient was hospitalized at another facility to treat infectious endocarditis. He was treated with antibiotics.
October 2020	He was admitted to our hospital with congestive heart failure. Transthoracic echocardiograms (TTE) and Transesophageal echocardiograms (TEE) revealed severe mitral regurgitation (MR) due to A2 (middle segment of anterior leaflet) prolapse.
December 2020	Transcatheter edge-to-edge mitral valve repair was performed. An NTW clip was placed between A2 and P2 (middle scallop of posterior leaflet). MR was reduced to mild, and his symptom improved significantly.
January 2021	He complained of dyspnea and moderate MR was confirmed by TTE.
June 2021	MR worsened to severe from both sides of the clip.
July 2021	Repeat clipping was performed. NT clips were placed on each side of the original NTW clip. MR reduced to mild without iatrogenic mitral stenosis, and his symptom improved.
Janualry 2023	He remained asymptomatic and was not hospitalized for heart failure.

Case summary

An 89-year-old male was hospitalized at another facility with infectious endocarditis and successfully treated with antibiotics. In 4 months, he presented to our hospital with dyspnoea and was admitted to our hospital with congestive heart failure. He had a history of stent graft insertion for a thoracic aortic aneurysm 12 years before. He was taking aspirin, beta-blockers, calcium channel blockers, and loop diuretics. His temperature was 36.2°C, blood pressure was 120/60 mmHg, heart rate was 60 beats/min, and pulse oximetry was 96% on room air. New York Heart Association (NYHA) was class IIm. His clinical examination revealed an apical holosystolic murmur (Levine 3/6). There was no sign of infection from a physical exam and blood test on admission. Transthoracic echocardiograms (TTE) revealed severe MR with a preserved LV ejection fraction of 63% but an enlarged LV end-diastolic/systolic dimension of 67/46 mm. Transoesophageal echocardiograms (TEE) confirmed severe MR due to A2 (middle segment of the anterior leaflet) prolapse with torn chordae (*Figure 1*). There were no signs of vegetation or valve calcification. The trans-mitral mean pressure gradient was 1.4 mmHg, the posterior leaflet length was 12 mm, and the mitral valve area was 4.8 cm^2. On three-dimensional (3D) imaging, we observed high valve mobility, no valve thickening, and deep posterior leaflet indentation. Because of his high operative risk with a 30-day mortality of 16% by the Society of Thoracic Surgeons score for mitral valve replacement, we performed TEER. Although an XTW clip was suitable for his leaflet anatomy, longer-arm devices were unavailable then. For that reason, an NTW clip was selected and placed between A2 and P2 (middle scallop of the posterior leaflet). Left atrial V wave pressure was reduced from 16 to 10 mmHg, pulmonary vein flow changed from S wave reversal to antegrade flow, and 3D vena contracta area (3D-VCA) was reduced from 0.45 to 0.17 cm^2. We comprehensively assessed that MR was reduced to mild (*Figure 2*; see Supplementary material online, *Video S1*) and finished the procedure. After TEER, his symptoms significantly improved.

However, a month after the procedure, dyspnoea reappeared, and TTE confirmed the recurrent moderate MR. Mitral regurgitation worsened to severe after 6 months from TEER. The TEE showed severe MR from both sides of the clip. The mean trans-mitral pressure gradient was 3.4 mmHg, the posterior leaflet length of each side of the clip was 11/13 mm (medial/lateral), and the mitral valve area calculated by 3D multiplanar reconstruction (3D-MPR) was 2.99 cm^2. There was no leaflet perforation, partial clip detachment, or SLD (*Figure 3*; see Supplementary material online, *Video S2*).

Our heart team considered our patient's high risk of iatrogenic mitral stenosis because of the (i) limited mitral valve area and (ii) dual acceleration flow of residual MR observed from both sides of the original clip. However, a careful review of the TEE images revealed a large P2 (potential site for multiple clips), high valve mobility, no valve thickening, and deep posterior leaflet indentation. We assessed that there might be a chance to succeed in repeat clipping if the additional two clips were placed only on the P2 beside the original clip. We presented two treatment options to the patient and his family: mitral valve replacement or repeat clipping; they selected repeat clipping.

Under general anaesthesia with TEE guidance, transseptal puncture was performed as usual. Since the residual P2 leaflet space on both sides of the original NTW clip was limited, we selected an NT clip. First, we attempted to reduce the medial side MR of the original NTW clip. An NT clip was carefully placed, avoiding placing the clip arm at the indentation for fear of SLD. Placing a first NT clip just beside the NTW clip, medial MR disappeared with a remaining mean mitral pressure gradient of 2.3 mmHg. A second NT clip was placed just lateral to the NTW clip. Left atrial V wave pressure was significantly reduced from 45 to 15 mmHg, pulmonary vein flow changed from S wave blunting to antegrade flow, and 3D-VCA was reduced from 0.57 to 0.08 cm^2. We confirmed good MR control

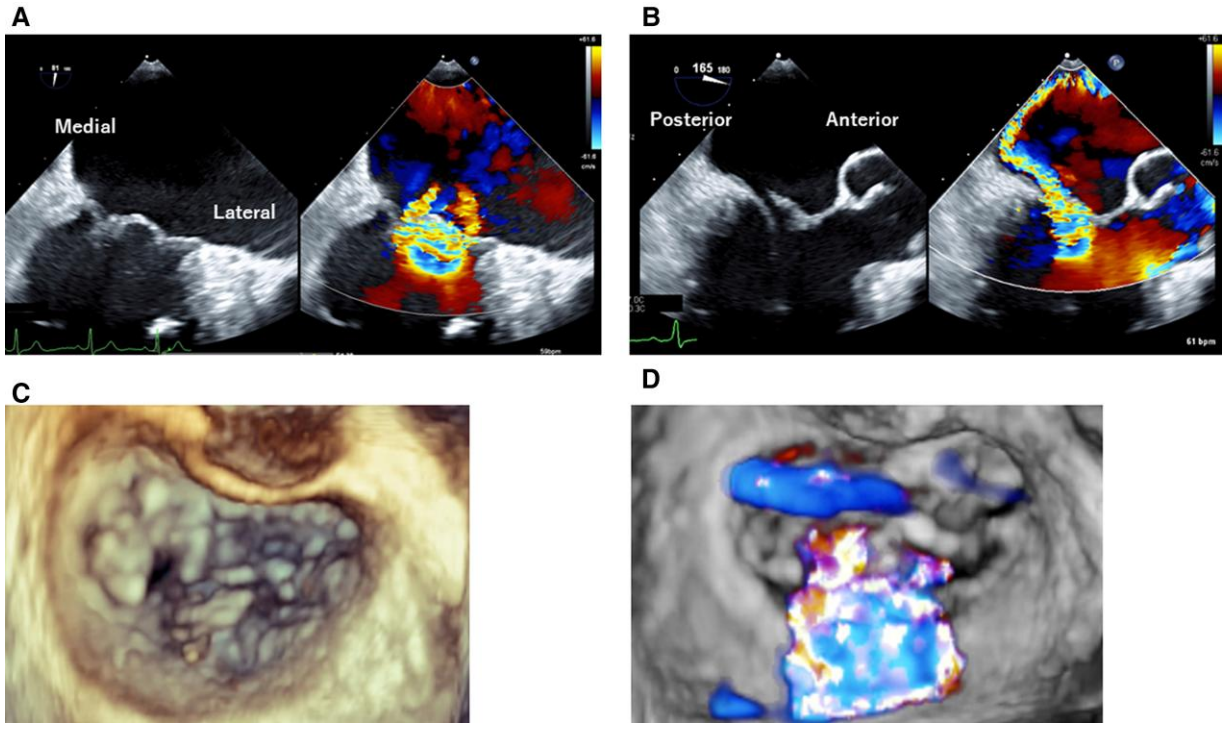

Figure 1 Transoesophageal echocardiography images at baseline before the first clipping. (*A*) Mitral regurgitation from the centre of the mitral valve in the inter-commissural view. (*B*) Severe mitral regurgitation is confirmed due to A2 (middle segment of the anterior leaflet) prolapse on the apical long-axis view. (*C*) Three-dimensional image of the mitral valve. (*D*) Three-dimensional colour image of the mitral valve.

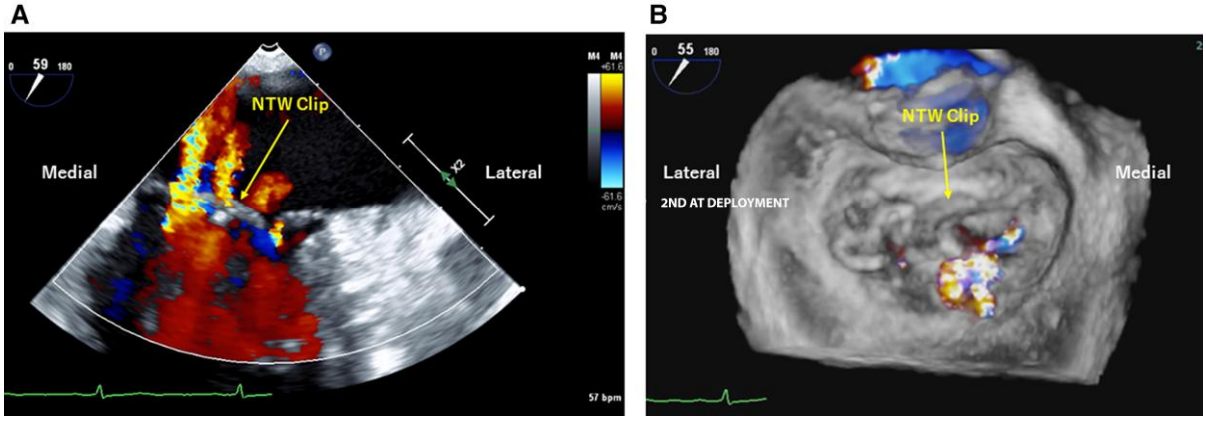

Figure 2 Transoesophageal echocardiography images after the first clipping. (*A*) Mitral regurgitation is reduced after clipping. (*B*) Improvement of mitral regurgitation is confirmed on three-dimensional colour imaging.

with a mean mitral pressure gradient of 4.8 mmHg and mitral valve area calculated by 3D-MPR of 1.95 cm^2 (*Figure 4*; see Supplementary material online, *Video S3*). After the procedure, his symptoms significantly improved. He was discharged home without any periprocedural complication.

One and a half years after repeat clipping, he remains asymptomatic without heart failure or rehospitalization. Mitral regurgitation has continued to be mild, with a mean mitral pressure gradient of 3 mmHg on TTE.

Discussion

Recently, the evolution of mitral valve catheterization has been remarkable. Despite the PASCAL system (Edwards Lifesciences, Irvine, CA, USA) being available as a new and alternative TEER device, currently, the MitraClip system is the most commonly used TEER therapy. Unfortunately, about 10–18% of patients who undergo TEER experience recurrent MR within 12 months. Another study found that

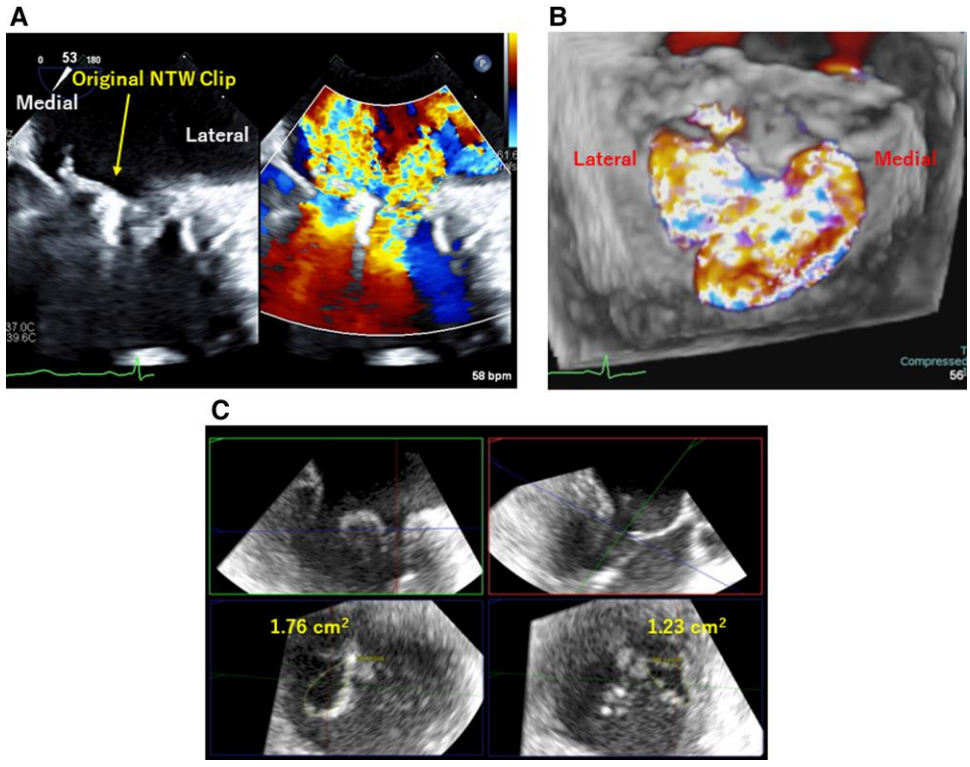

Figure 3 Transoesophageal echocardiography images 6 months after the first clipping. (*A*) Severe recurrent mitral regurgitation is observed from both sides of the clip in the inter-commissural view. (*B*) Mitral regurgitation is confirmed on three-dimensional colour imaging. (*C*) The mitral valve area calculated by three-dimensional multiplanar reconstruction is 2.99 cm^2.

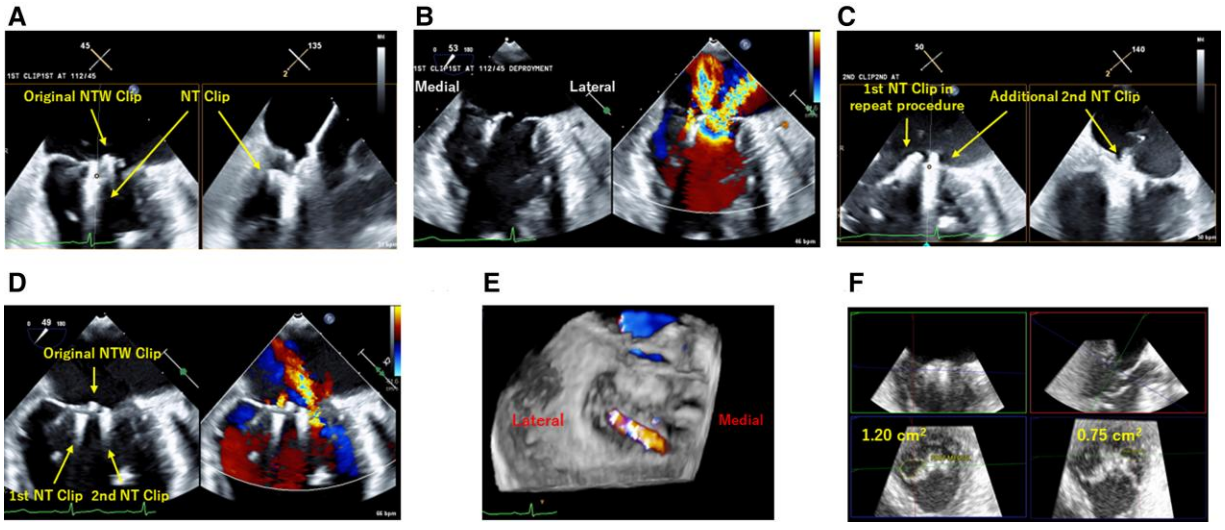

Figure 4 Transoesophageal echocardiography and fluoroscopy imaging during repeat clipping. (*A*) An NT clip is placed medial to the original NTW clip. (*B*) Mitral regurgitation on the medial side of the original NTW clip disappeared after the first clip deployment. (*C*) A second NT clip is placed lateral to the original NTW clip. (*D*) After placement of the second NT clip, mitral regurgitation is reduced to mild. (*E*) Improvement of mitral regurgitation is confirmed after placement of the second NT clip on three-dimensional colour imaging. (*F*) The mitral valve area calculated by three-dimensional multiplanar reconstruction is 1.95 cm^2.

recurrent MR was associated with a worse prognosis.[1,2] Especially in elderly and/or low LV function patients, surgical risk will be high for recurrent MR. In such patients, repeat clipping may be the only reasonable treatment option for recurrent MR.

Various success rates for repeat clipping have been reported. The heterogeneity of these results may be attributable to the relatively small study cohort sizes and the variety of patient backgrounds (age, sex, primary or secondary MR, LV ejection fraction, and the factor of recurrent MR).[5,9] A previous report found that only 61.9% (13/21) of repeat clipping procedures were successful, in contrast to 90% for first-time clip placement.[9] Yet another study showed that the high trans-mitral pressure gradient post-first procedure might relate to worse outcomes in repeat clipping.[10]

There are a few case reports of repeat clipping for recurrent MR due to SLD or papillary muscle tear.[6–8]

In this case, although we considered that repeat clipping carried a risk of iatrogenic mitral stenosis and inadequate MR control (the mean trans-mitral pressure gradient was 3.4 mmHg, mitral ventricular area was 2.99 cm^2, and MR control requires at least two clips), we assessed that there was a chance to succeed if the additional two clips were placed only in the P2 beside the original clip. Anatomical features such as a large scallop (potential site for multiple clips), high valve mobility, no valve thickening, and deep posterior leaflet indentation may increase the likelihood of successful repeat clipping outcomes.

For recurrent MR after TEER, repeat clipping should be considered after careful anatomical assessment, even in patients with challenging anatomy.

Conclusions

We experienced a successful case of repeat clipping for the patient with severe recurrent MR from both sides of the clip. For recurrent MR after TEER, repeat clipping should be considered after careful anatomical assessment, even in patients with challenging anatomy.

Lead author biography

Takuma Iwaya was born in Shiga, Japan, in 1990. He works as a cardiologist at the National Cerebral and Cardiovascular Center, Osaka, Japan.

Supplementary material

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

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

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Data availability

The data underlying this article are available in the article and in its online supplementary material.

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