CASE REPORT

CLINICAL CASE

Tear of Posterior Mitral Valve Leaflet During MitraClip, Successful Bailout Using Vascular Plugs

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ABSTRACT

This case report describes a novel bailout technique (TAIBA technique) used in a MitraClip procedure that was complicated by a tear of the posterior mitral valve leaflet and caused torrential mitral regurgitation (MR). This is the first case report in which Amplatzer vascular plugs were used to treat severe MR after a tear in the posterior leaflet occurred during a MitraClip procedure. (Level of Difficulty: Advanced.) (J Am Coll Cardiol Case Rep 2019;1:197-201) © 2019 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/).

In this case, we describe a novel technique to rescue a serious complication that occurred during a mitral clip procedure. To the best of our knowledge, this is the first case report in which Amplatzer (Abbott Laboratories) vascular plugs (AVPs) were used to treat severe MR after a MitraClip procedure (TAIBA technique).

LEARNING OBJECTIVES

• Understand the possible complications of MitraClip implantation.
• Understand the feasibility and success of a novel technique using vascular plugs to treat torrential MR that results from a tear in the posterior leaflet of the MV during a MitraClip procedure.

The MitraClip (Abbott Laboratories, Abbott Park, Illinois) is a transcatheter device used to treat symptomatic patients with severe mitral regurgitation (MR) who are at high risk for surgical intervention (1). Although the EVEREST trial primarily enrolled patients with degenerative MR, MitraClip has been used for patients with functional MR (2). The Mitra-FR trial concluded that among patients with severe secondary MR, the rate of death or unplanned hospitalization for heart failure at 1 year did not differ significantly between patients who underwent percutaneous mitral valve (MV) repair and those who received medical therapy (3). The COAPT (Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart Failure Patients with Functional Mitral Regurgitation) trial concluded that at 2 years, the MitraClip substantially reduced the rate of hospitalizations and mortality, while improving quality of life and functional capacity in patients with functional MR (4). The difference in results between the trials may be because the COAPT trial enrolled a subset of patients who had more severe MR and less advanced left ventricular (LV) disease (dilation and/or dysfunction) than the MITRA-FR trial (5). In this case, we describe a novel technique to rescue a serious complication that occurred during a mitral clip procedure. To the best of our knowledge, this is the first case report in which Amplatzer (Abbott Laboratories) vascular plugs (AVPs) were used to treat severe MR after a MitraClip procedure (TAIBA technique).

HISTORY AT PRESENTATION

A 54-year-old male presented with shortness of breath with minimal exertion. He was in New York Heart Association (NYHA) functional class III. Over
the past year, he was admitted with decompensated heart failure 3 times.

MEDICAL HISTORY

He was diagnosed with dilated cardiomyopathy 3 years previously. He was on optimal heart failure therapy, including maximum tolerated doses of beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, aldosterone antagonists, and diuretics. Six months earlier, ACE inhibitors were stopped, and he was started on sacubitril/valsartan.

EXAMINATION

There was a pansystolic murmur of MR with maximum intensity at the apex with bilateral fine basal crepitations.

DIFFERENTIAL DIAGNOSIS

This was a clear case of decompensated heart failure due to dilated cardiomyopathy and severe MR.

INVESTIGATIONS

Brain natriuretic peptide was 19,000 pg/ml. Trans-thoracic echocardiography (TTE) revealed severe biventricular failure with severe functional MR and an ejection fraction (EF) of 20%. The case was discussed in the heart team meeting. The consensus was the MitraClip was the best therapeutic option.

MANAGEMENT

Pre-operative evaluation of the MV showed a coaptation depth of 15 to 16 mm (deep tenting) of the MV. This is a marker of early failure of mitral valve repair. The main jets of MR originated from A2/P2 (the middle scallops of anterior and posterior mitral leaflets); the first NTR clip was placed at A2/P2 with a sound reduction of MR (Figure 1A). Three-dimensional zoom showed the MV clip at A2/P2 with 2 nearly equal orifices of the MV (Figure 1B). The other jet was 7 mm from the A2/P2 zone, medial to the first clip. We planned a second clip NTR at the site of the jet, but the clip became entrapped in the medial commissure. The clip was grasped and was released stable, without improving MR. Further evaluation revealed moderate MR between the 2 clips (Figure 1C, Video 1). The third clip passed easily and was positioned between both clips with good grasping. After the last clip was used, new torrential MR was identified (Figure 1D, Video 2). This was related to a severe tear of the posterior mitral leaflet toward the annulus, with massive

FIGURE 1 Mitral Clip Procedure and the Bailout With Vascular Plugs

(A) Released first clip, mild lateral mitral regurgitation (MR), (B) Three-dimensional view showing the 2 mitral valve (MV) orifices after the first clip, (C) Unplanned release of the second clip due to trapping at medial commissure, moderate MR between both clips, (D) Severe MR after the release of the third clip, (E) First Amplatzer vascular plug (AVP) 16-mm device deployed, moderate residual MR, (F) Second AVP 12-mm device deployed, mild residual MR. See Videos 1, 2, 3, and 4.
incompetence away from the mitral closure line. We replaced the mitral clip system with an 8.5-F tip deflectable catheter (Agilis catheter, Abbott). The tear was crossed with a glide wire and a Torque-Vue 7-F delivery sheath (AGA Medical Corp., Plymouth, Minnesota). One vascular plug (AVP II; 16 mm) was deployed using the MV clips as an anchor, with moderate residual MR (Figure 1E, Video 3). The mean mitral gradient was 3 mm Hg. Another AVP II (12 mm) was successfully deployed in a cross with the first device with mild residual MR (Figure 1F, Video 4). At the end of the procedure, the mean mitral gradient was 4 mm Hg. Figure 2A shows the 3-dimensional zoom surgical view with the transseptal wire passing through the medial commissure medial to the 3 clips. Figure 2B and 2C show the deployment of the AVP and its release. Figure 2D shows the release of both AVP devices. Figure 2E and Video 5 show fluoroscopy of the 3 clips and deployment of the first AVP. Figure 2F and Video 6 show the deployment of the second AVP. The patient was discharged home after 2 days.

**FOLLOW-UP.** After 1 year, the patient was in NYHA functional class I with no hospitalization for heart failure. Figure 3 shows follow-up transthoracic echocardiography after 1 year. Figure 3A and Video 7 show the parasternal long-axis view of the medial half of the MV, which shows the 3 clips and the 2 devices. Figure 3B and Video 8 display the parasternal long axis-view on the lateral half of the MV, which shows mild residual MR. Figure 3C and 3D and Videos 9 and 10 show the apical 4-chamber view of the clips and the devices with mild residual MR. Figure 3E shows the apical 3-chamber view of mild residual MR. Figure 3F and Video 11 show the parasternal short-axis view of the lateral orifice of the MV, with the medial half of the MV closed by the clips and devices. The mean pressure gradient at follow-up was 5 mm Hg.

**DISCUSSION**

MitraClip implantation appears to be a safe treatment option with low rates of major adverse cardiac events...
and clip-specific complications (6). Nevertheless, MitraClip therapy is not without complications. Careful patient selection has the potential to reduce post-procedural complications and improve outcomes. Complications of the mitral clip procedure include bleeding, clip embolization, clip dislodgment, chordal entanglement and/or rupture, destruction of the MV, clip failure, and mortality. Entrapment of a clip in 1 of the commissures, especially the medial commissure with unplanned closure of the clip, is a serious complication. To prevent this complication, we suggest starting with the medial leak with the first clip, then proceeding laterally with the second clip to reduce the risk of entrapment in the medial commissure. However, sometimes entrapment in the medial commissure is unavoidable. Unplanned grasping may lead to the destruction of the subvalvular apparatus. Successful use of 2 vascular plugs to close the medial half of the MV, which eliminates MR, is a new concept for dealing with such a complication during this procedure (TAIBA technique). We want to raise the possibility of this solution and to emphasize the feasibility of deploying a vascular plug using the MV clips as an anchor to the devices. The safety of this procedure needs more research. Although the short- and medium-term follow-up in this case is encouraging, the long-term outcome had no data to discuss.

**CONCLUSIONS**

Using an AVP to manage severe MR resulting from a tear in the posterior leaflet of the mitral valve during a MitraClip procedure is feasible. Safety and long-term follow-up need more cases and more research.

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*FIGURE 3* Follow-Up TTE After 1 Year

(A) Parasternal long-axis view of the medial half of the MV shows the collection of the 3 clips and the 2 devices. (B) Parasternal long-axis view of the lateral half of the MV shows mild residual MR. (C and D) Apical 4-chamber view shows the clips and the devices, mild residual MR. (E) Apical 3-chamber view shows mild residual MR. (F) Parasternal short-axis view shows the lateral orifice of the MV, the medial half closed by the clips and devices. See Videos 7, 8, 9, 10, and 11. TTE = transthoracic echocardiography; other abbreviations as in Figure 1.
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KEY WORDS case report, mitral valve clip, plugs, regurgitation, vascular

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