

CASE REPORT: BEST TCT CASE

ADVANCED

CLINICAL CASE

Transcatheter Repair of Anterior Mitral Leaflet Perforation

Deploy, Retrieve, Redeploy



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ABSTRACT

We describe a case of anterior mitral leaflet perforation successfully treated with the Amplatzer Cribriform device, with resultant hemolytic anemia. The device was retrieved, and perforation occluded with the GORE CARDIOFORM device with resolution of hemolysis. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2019;1:689–93) © 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/>).

A 66-year-old female patient with a history of rheumatic fever, severe burns of skin requiring extensive skin grafting and bilateral hand amputations, and avascular necrosis of the hip presented following recent hospitalization for methicillin-resistant *Staphylococcus aureus* endocarditis and psoas muscle abscess. She had progressive heart failure symptoms including fluid overload, dyspnea, and fatigue. Notable physical examination finding included a 3/6 holosystolic murmur best heard at the apex with radiation to the axilla. A transesophageal echocardiogram (TEE) revealed torrential mitral regurgitation (MR) owing to 2 adjacent perforations in the A3 scallop of the anterior mitral valve leaflet (combined diameter of 10 mm), believed to be the sequelae of endocarditis.

MANAGEMENT

The patient was evaluated for surgery but declined due to comorbidities, immobility, and frailty. Transcatheter repair of the mitral valve leaflet was undertaken using an Amplatzer (St. Jude Medical, St. Paul, Minnesota) device under general anesthesia and TEE guidance. A steerable Agilis (Abbott Vascular, Santa Clara, California) sheath was advanced into the left atrium following transseptal puncture. A multipurpose catheter was advanced through the sheath and an angled GLIDEWIRE (Terumo, Somerset, New Jersey) was used to traverse the larger perforation. An 18-mm Amplatzer Cribriform device (St. Jude Medical) was deployed within the leaflet perforation, resulting in reduction of MR to moderate and elimination of pulmonary vein flow reversal (Figures 1 and 2).

Heart failure symptoms improved after treatment, but severe hemolysis developed with pigmenturia, acute kidney injury, and ongoing blood transfusion requirement. The patient was reevaluated by cardiothoracic surgery for removal of the device and open surgical replacement, but transcatheter repair was recommended. Therefore, exchange of the mitral

LEARNING OBJECTIVES

- To learn the transcatheter technique for repair of mitral valve leaflet perforation.
- To understand the pitfalls and shortcomings of various available occluder devices when used in high-pressure areas.

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Informed consent was obtained for this case.

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**ABBREVIATIONS
AND ACRONYMS**

MR = mitral regurgitation

TEE = transesophageal
echocardiogram

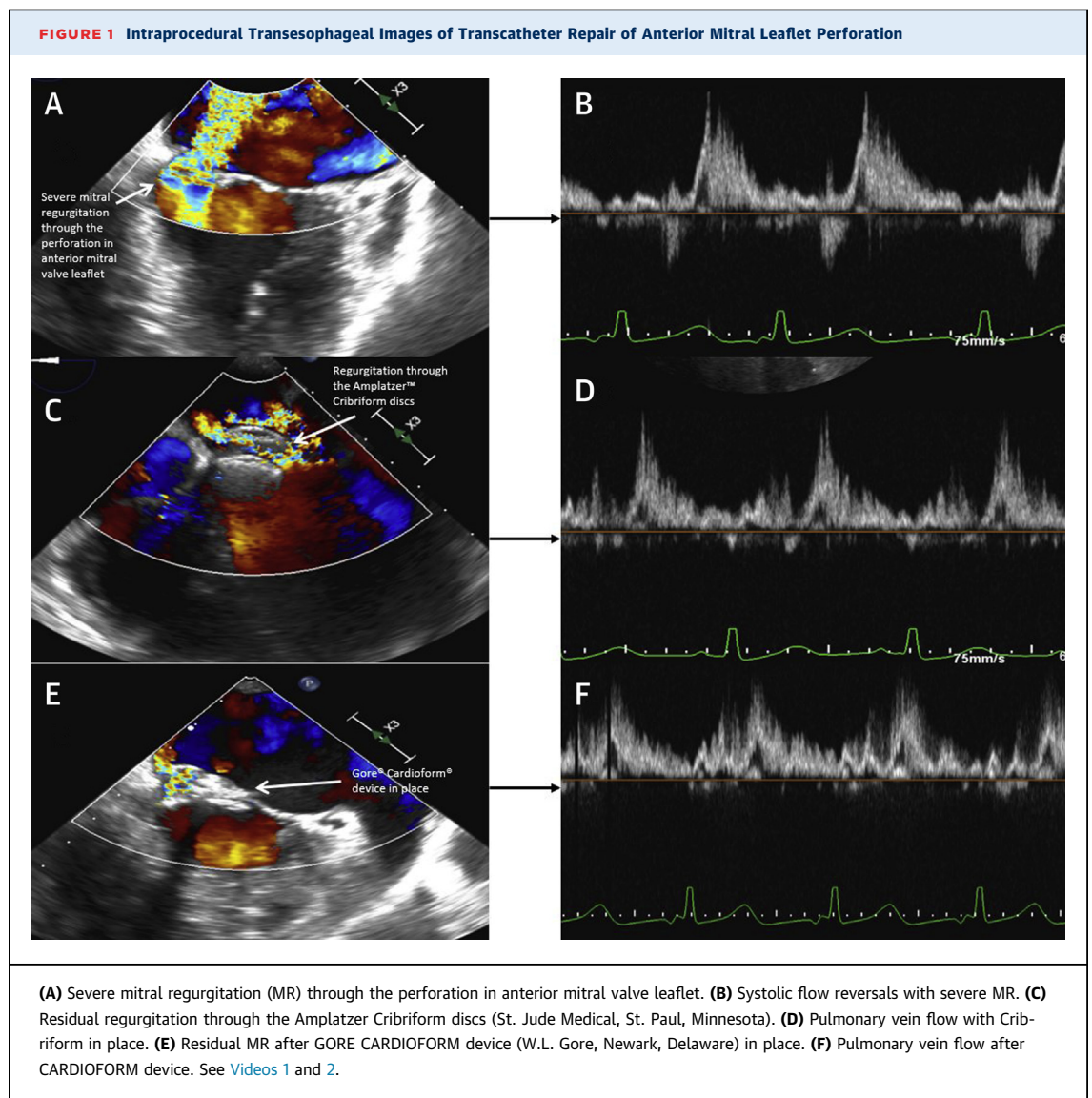
repair device was performed. A 12-F steerable sheath was advanced into the left atrium via the prior transeptal puncture site. A 20-mm Amplatzer Goose Neck (Medtronic, Minneapolis, Minnesota) snare and 6-F JR4 catheter (Cordis, Milpitas, California) were used to snare the cribriform device from the pin on the left atrial disc and remove it. The perforation was

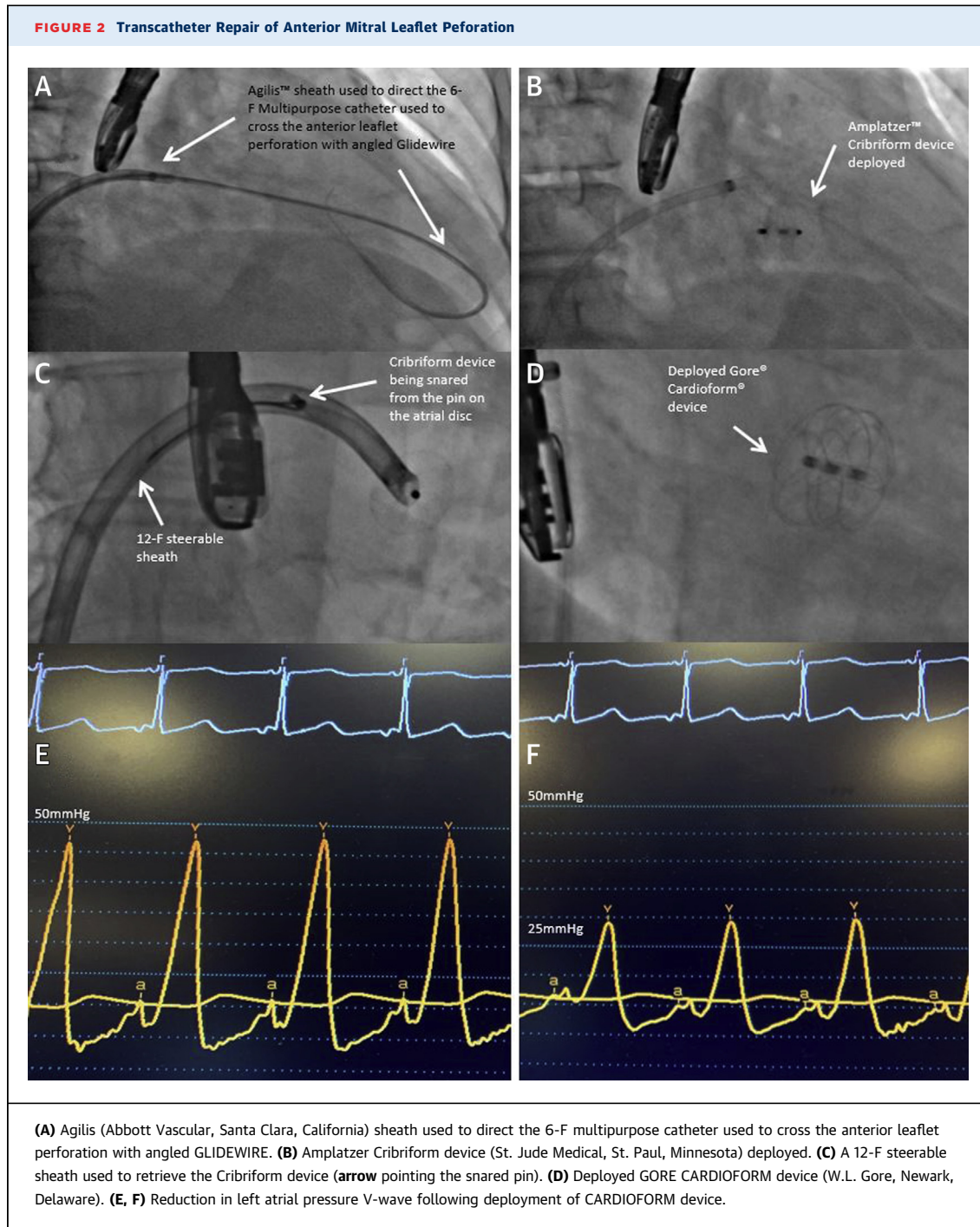
SEE PAGE 694

recrossed using an antegrade technique, as described previously. The GORE CARDIOFORM (W.L. Gore, Newark, Delaware) delivery sheath was delivered through the perforation using an 8-F TorqVue dilator (St. Jude Medical) (1). A 20-mm GORE CARDIOFORM septal occluder was deployed, covering both

perforations (Videos 1 and 2). There was significant hemodynamic improvement with reduction in left atrial pressure V-wave (Figures 1 and 2). The MR was reduced to moderate and forward systolic flow in pulmonary veins was restored. The patient's pigmenturia resolved over several days, and plasma free hemoglobin decreased from 516 mg/dl to 7 mg/dl. She improved symptomatically and was discharged to a nursing facility.

However, the patient was readmitted with worsening heart failure symptoms after a few weeks. A transthoracic echocardiogram revealed severe MR with evidence of CARDIOFORM device malformation. Repeat TEE revealed that the left atrial disc of the CARDIOFORM device had unlocked (Figure 3, Video 3) resulting in severe MR. The patient was





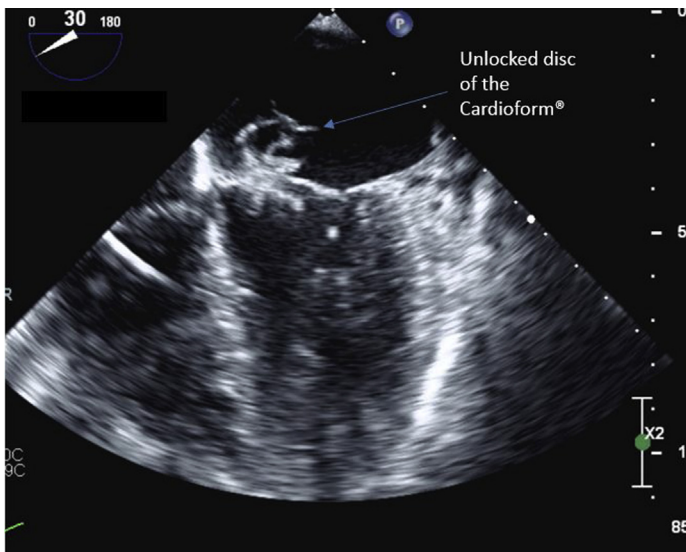
referred to another center, where urgent mitral valve replacement surgery was performed, and she recovered slowly after a prolonged post-operative course.

DISCUSSION

MR from infective endocarditis is often due to structural damage to the valve leaflets or apparatus

and the treatment is typically within the realm of the cardiac surgeon. In this report, the authors present attempts to repair mitral leaflet perforations in a patient who was a poor candidate for open repair (Central Illustration). In our patient, the Amplatzer and then CARDIOFORM devices were similarly effective in treatment of severe MR due to leaflet perforation, but severe hemolysis occurred only with

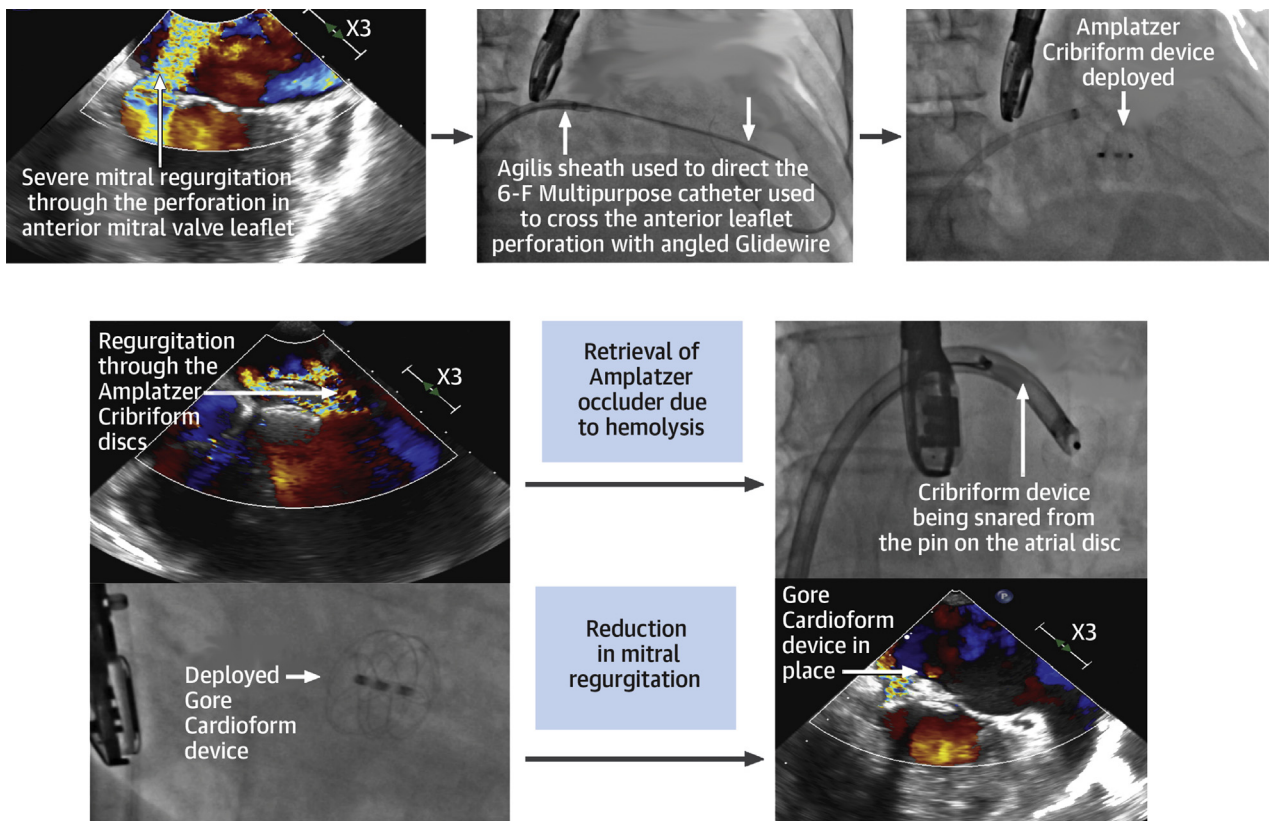
FIGURE 3 Transesophageal Image of an Unlocked CARDIOFORM Device on Follow-Up



Follow-up transesophageal echocardiogram revealed unlocked left atrial disc of the CARDIOFORM device. See [Video 3](#).

the Amplatzer device. This apparent difference in hemolysis could be related to device construction. Cribriform and similar occluder devices are made of nitinol mesh, with larger gaps allowing rapid acceleration of the jet and that might result in significant hemolysis (2). It is possible that the CARDIOFORM device is associated with less hemolysis due to an occlusive expanded polytetrafluoroethylene membrane. In a previously published series of 3 cases, mitral valve leaflet perforation was successfully treated using an occluder device in conjunction with a MitraClip (Abbott, Abbott Park, Illinois) to stabilize the mitral valve leaflets (3). Our case differed in that the patient had more than 1 perforation adjacent to the mitral valve annulus. Thus, we felt that the CARDIOFORM device would not affect the mitral valve leaflet mobility. Whether a MitraClip could be used to reduce mitral valve leaflet mobility, increase the stability of the occluder device, and lead to long-term success is speculative. We believe that the locking loop of the CARDIOFORM device slipped through the right atrial eyelet (on the left atrial side in our case) and became unlocked due to exposure

CENTRAL ILLUSTRATION Transcatheter Repair of Anterior Mitral Valve Leaflet Perforation



to high pressures from the regurgitant jet from multiple perforations or due to mobility of the mitral valve. The CARDIOFORM device is normally subjected to much lower pressures during patent foramen ovale closure.

CONCLUSIONS

Our case provides some valuable learning points. First, it is technically feasible to deploy septal occluder devices across mitral valve perforations and achieve a reduction in MR. Second, these devices could lead to hemolysis when used to plug high-pressure jets such as paravalvular leaks. Whether the design of the Amplatzer device is more prone to


this issue would have to be answered with more experience. Although the CARDIOFORM device with its expanded polytetrafluoroethylene membrane could provide better acute results with lesser incidence of hemolysis, its long-term durability in high-pressure areas needs to be evaluated.

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KEY WORDS mitral valve, occluder, valve repair

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