Transcatheter Mitral Valve-In-Valve Implantation: An Option for Failed Bioprosthetic Mitral Valve Stenosis During Pregnancy

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ABSTRACT
A pregnant woman presented with symptomatic bioprosthetic mitral valve stenosis. We discuss the difficulties of decision making in this particular situation where two lives are at stake, the fetus’s and the mother’s, questioning whether transcatheter mitral valve-in-valve implantation can be an effective and safe option for this challenging condition. (Level of Difficulty: Advanced.) (J Am Coll Cardiol Case Rep 2020;2:145-9) © 2020 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/).

HISTORY OF PRESENTATION
A 28-year-old woman from Chad was admitted to our cardiology department for acute dyspnea; she was 18 weeks pregnant and had a history of bioprosthetic mitral valve (BPMV) replacement 5 years earlier due to rheumatic fever.

MEDICAL HISTORY
This young woman was born and lived in Chad, where she had already given birth to 2 children. At the end of her second pregnancy, 5 years earlier, she experienced acute pulmonary edema, which revealed a severe rheumatic mitral stenosis. She was referred to our cardiovascular department for surgery 1 month later, and mitral valve replacement with BPMV Pericarbon no. 29 (SORIN, Milan, Italy) was performed. The choice of a biological valve in this young patient was justified by the absence of birth control (with a risk of unplanned pregnancies), language barrier, difficult access to medical follow-up, and, consequently, the risk of noncompliance with oral anticoagulation. She also had a history of paroxysmal atrial fibrillation. She was treated with vitamin K antagonists (VKA) and beta-blockers.

DIFFERENTIAL DIAGNOSIS
Because of her past medical history, acute dyspnea in the setting of history of BPMV replacement may reveal pulmonary edema due to valvular dysfunction or recurrence of atrial fibrillation. Premature bioprosthetic valve deterioration must be suspected.

INVESTIGATIONS
On arrival, our patient was 18 weeks pregnant, and treatment for acute pulmonary edema compounded by atrial fibrillation had already been initiated in N’Djamena, Chad, before transfer. She was hemodynamically stable on arrival, in sinus rhythm, and receiving oral diuretics; VKA had been switched for unfractionated heparin for atrial fibrillation. Blood tests showed no signs of infection; she had normal blood gas and average levels of creatinine and hemoglobin. Fetal echography showed a healthy fetus.

Transthoracic echocardiography (TTE) (Figure 1, Video 1) showed a significant reduction in BPMV opening, with 3 cusps thickened and calcified. The mitral surface was measured as 0.60 cm² in planimetry, effective orifice area was calculated as 0.67 cm², and mean transvalvular gradient was 26 mm Hg. She did not have any other significant valve disease, and left ventricular ejection fraction was normal. Severe stenotic BPMV degeneration was diagnosed. Transesophageal echocardiography was performed and confirmed the diagnosis (Figure 2, Video 2).

MANAGEMENT
After discussion with the obstetric team, percutaneous intervention was chosen over surgical valve

LEARNING OBJECTIVES
- To determine the current role of transcatheter mitral valve implantation as an alternative to surgery in the particular case of pregnant women.
- To discuss the management of valvular heart disease in pregnant women.
replacement. The patient was therefore scheduled for transcatheter mitral valve implantation (TMVI). During pre-operative assessment, we performed only computed tomography scanning centered solely on the thorax to avoid fetal radiation exposure. The TMVI procedure was done without a lead apron on the patient to decrease fetal exposure and minimize skin radiation. TMVI was performed when the patient was 20 weeks pregnant (Figure 3, Videos 3A and 3B) with a transfemoral vein approach. The procedure was a success, with a mean gradient at the end of the procedure of 6 mm Hg (Figure 4, Video 4) and no paravalvular leak or pericardial effusion. The total dose area product for this procedure was of 5,954.6 cGy/cm². The total radiation exposure for the patient was 624 mGy. The fetus was not in the primary beam and was exposed only to scattered radiation; total fetal exposure was calculated to be 20 mGy.

**DISCUSSION**

According to the modified World Health Organization classification (1), severe mitral valve stenosis (MVS) during pregnancy is classified as class IV, for which pregnancy termination should be considered. Luckily, in most cases, these young women benefit from close follow-up, and pregnancies are anticipated. These young patients are then referred to a pregnancy heart team to plan the course of pregnancy. In the case of severe MVS, intervention is recommended, with a high level of proof when mitral valve area is inferior to 1 cm², regardless of symptoms.

In the case of unanticipated pregnancy for a woman with severe MVS, such as our patient, interventional therapy should be considered instead of surgery, considering the fact that risk of fetal mortality during surgery varies from 16% to 33% (2). Percutaneous mitral commissurotomy should be considered first if the patient is eligible (in case of native valve) so that she can continue her pregnancy. If the patient does not fit the criteria for this procedure, TMVI is a promising alternative. It must nevertheless be considered as a rescue procedure because published reports lack evidence for the particular management of pregnant women with severe and unanticipated valvular heart disease. Only 1 study (3) focuses specifically on a pregnant woman who underwent a successful procedure of concomitant TMVI and transcatheter aortic valve replacement. Two larger cohort studies (4,5) dedicated to TMVI, with 70% and 54% women, respectively, reported good outcomes for TMVI in patients with degenerated BPMV (13.2% and 14% mortality at 12 months for valve-in-valve patients, respectively), which are encouraging results for the women who underwent these procedures. Furthermore, these particular patients were not eligible for surgery because of high comorbidities. Pregnant women, being young, mostly do not share this burden, leading to hope that their prognosis will be even better after TMVI, with a possible chance to defer or even never have surgery in the future.

Regarding an antithrombotic regimen, the optimal therapy after TMVI is still under debate and, because of the lack of studies, depends mostly on the team’s experience. In our center, patients are given double antiplatelet therapy for 1 to 3 months and then only aspirin. In the case of long-term treatment with anticoagulants without bleeding risk, they are given

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**FIGURE 1** Bioprosthetic Mitral Valve Stenosis–Transthoracic Echocardiography

(A) Parasternal long-axis view showing a calcified thickened mitral bioprosthesis. (B) Continuous-wave Doppler showing a transmural mean gradient of 26 mm Hg, indicating severe bioprosthesis stenosis.

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**ABBREVIATIONS AND ACRONYMS**

BPMV = bioprosthetic mitral valve
MVS = mitral valve stenosis
TMVI = transcatheter mitral valve implantation
TTE = transthoracic echocardiography
VKA = vitamin K antagonists
aspirin for 1 month and then anticoagulant treatment alone. For our pregnant patient, we considered the hemorrhagic risk and chose to give her only low-molecular-weight heparin.

FOLLOW-UP

The patient was discharged 1 week after the procedure, taking low-molecular-weight heparin and beta-blockers. The transmitral mean gradient was 8 mm Hg on discharge. TTE was scheduled every month for the rest of the pregnancy, and the mean gradient rose to 11 mm Hg at the end of the term, with higher cardiac output. She had a planned birth by cesarean and gave birth to a healthy baby boy. She was switched back to long-term VKA (warfarin) after the birth and then returned to Chad, where she is currently followed up, and so far she has not been referred again to our hospital.

CONCLUSIONS

Severe BPMV stenosis during pregnancy is challenging to manage. Indeed, 2 patients must be considered: the mother and the fetus. TMVI for failed bioprosthesis seems to be an acceptable option because it ensures protection of the fetus and shows promising results for the mother. It must nevertheless remain an exceptional situation; this clinical case stresses the importance of close follow-up for pregnant women with valvular heart diseases to anticipate pregnancies and avoid difficult situations where the mother’s and fetus’s lives are at risk.

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KEY WORDS echocardiography, mitral valve, pregnancy, valve replacement

FIGURE 4 Transcatheter Mitral Valve-In-Valve Implantation: Before and After the Procedure

Transesophageal echocardiography. (A) Before transcatheter mitral valve-in-valve implantation, the mean transmitral gradient was 26 mm Hg. (B) After the procedure, the mean transmitral gradient was 6 mm Hg.