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CASE REPORT

HEART CARE TEAM/MULTIDISCIPLINARY TEAM LIVE: CARDIO-OBSTETRICS 2023

Treatment of Severe Symptomatic Aortic Stenosis During Pregnancy

A Potential Role for TAVR?

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ABSTRACT

A 35-year-old woman presented at 22 weeks gestation with severe symptomatic aortic stenosis with a mean gradient of 94 mm Hg and an aortic valve area of 0.53 cm^2. After multidisciplinary discussion, she underwent transcatheter aortic valve replacement during pregnancy. (J Am Coll Cardiol Case Rep 2023;28:102134) © 2023 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/).

CASE PRESENTATION

A 35-year-old woman presented to the cardio-obstetrics clinic at 22 weeks gestation with worsening dyspnea, orthopnea, lower extremity edema, and syncope. The patient had a history of bicuspid aortic valve, with the last echocardiographic evaluation 13 years prior showing moderate aortic stenosis (AS). She was lost to follow-up and received no preconception counseling.

LEARNING OBJECTIVES

- To understand the evaluation and management of a patient with aortic stenosis during pregnancy.
- To understand the options for intervention in a patient presenting during pregnancy with symptomatic aortic stenosis.

Her blood pressure (104/65 mm Hg) and heart rate (88 beats/min) were normal. She had a V/VI crescendo systolic murmur that radiated to her carotid arteries, and the second heart sound was diminished. She exhibited respiratory distress with tachypnea and inability to speak in full sentences. Echocardiography showed reduced left ventricular ejection fraction of 45% to 50% with increased left ventricular wall thickness. The aortic valve was calcified with fusion of the left-right coronary cusps. Interrogation of the aortic valve revealed a peak velocity of 5.97 m/s, mean gradient of 94 mm Hg, peak gradient of 140 mm Hg, calculated aortic valve area of 0.53 cm^2, and dimensionless velocity index of 0.15 (**Figure 1**). She had mild-moderate aortic insufficiency and a mildly dilated ascending aorta measured at 39 mm.

Given her severe symptomatic AS, she was admitted to the hospital for aortic valvular

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ABBREVIATIONS AND ACRONYMS

AS = aortic stenosis

BAV = balloon aortic valvuloplasty

BNP = B-type natriuretic peptide

MFM = maternal-fetal medicine

SAVR = surgical aortic valve replacement

TAVR = transcatheter aortic valve replacement

intervention. Laboratory evaluation showed a B-type natriuretic peptide (BNP) level of 622 pg/mL and troponin level of 0.02 ng/mL. Cardio-obstetrics, maternal-fetal medicine (MFM), cardiothoracic surgery, structural interventional team, obstetric anesthesia, cardiac anesthesia, and neonatology specialists were consulted.

Three options for intervention were considered: surgical aortic valve replacement (SAVR), balloon aortic valvuloplasty (BAV), and transcatheter aortic valve replacement (TAVR). Ultimately, TAVR was determined to be the optimal intervention. Cardiac computed tomography was completed for preprocedural planning and showed a heavily calcified aortic valve (**Figure 2**). She underwent placement of a 26-mm Sapien S3 Ultra valve 2 days after admission. Retrograde crossing of the aortic valve was not possible because of a highly angulated, calcified, and dysmorphic valve. The aortic valve was crossed via a transseptal puncture, antegrade crossing of the aortic valve, and snaring and externalizing the wire for retrograde delivery of the TAVR. The invasive mean gradient decreased from 124 mm Hg to 8 mm Hg. Left ventricular pressures decreased from 272/53 mm Hg to 130/33 mm Hg. There was no evidence of conduction disease or aortic insufficiency. Her total radiation dose was 548 mGy.

Her symptoms improved postprocedure. A third trimester echocardiogram showed stable ascending aortic diameter, mean gradient across the bioprosthetic valve of 13 mm Hg, and normalization of her left ventricular ejection fraction. She delivered a healthy baby girl at 37 weeks.

QUESTION 1: IS AORTIC VALVE STENOSIS WELL TOLERATED DURING PREGNANCY?

The hemodynamic changes of pregnancy lead to increasing transaortic gradients, left ventricular end-diastolic pressure, and left atrial pressure, which can result in symptoms of AS including heart failure, chest pain, and syncope.

Although mild to moderate AS is generally well tolerated during pregnancy, pregnancy is considered high risk in severe AS. In the Registry of Pregnancy and Cardiac Disease, 96 patients with moderate or severe AS were identified. No deaths occurred, but heart failure complicated 26% of pregnancies with severe symptomatic AS.[1] Another study of patients with congenital severe AS found a 10% rate of cardiac complications during pregnancy.[2]

QUESTION 2: WHAT ARE THE IMPORTANT PRECONCEPTION CONSIDERATIONS FOR A PATIENT WITH AORTIC VALVE STENOSIS?

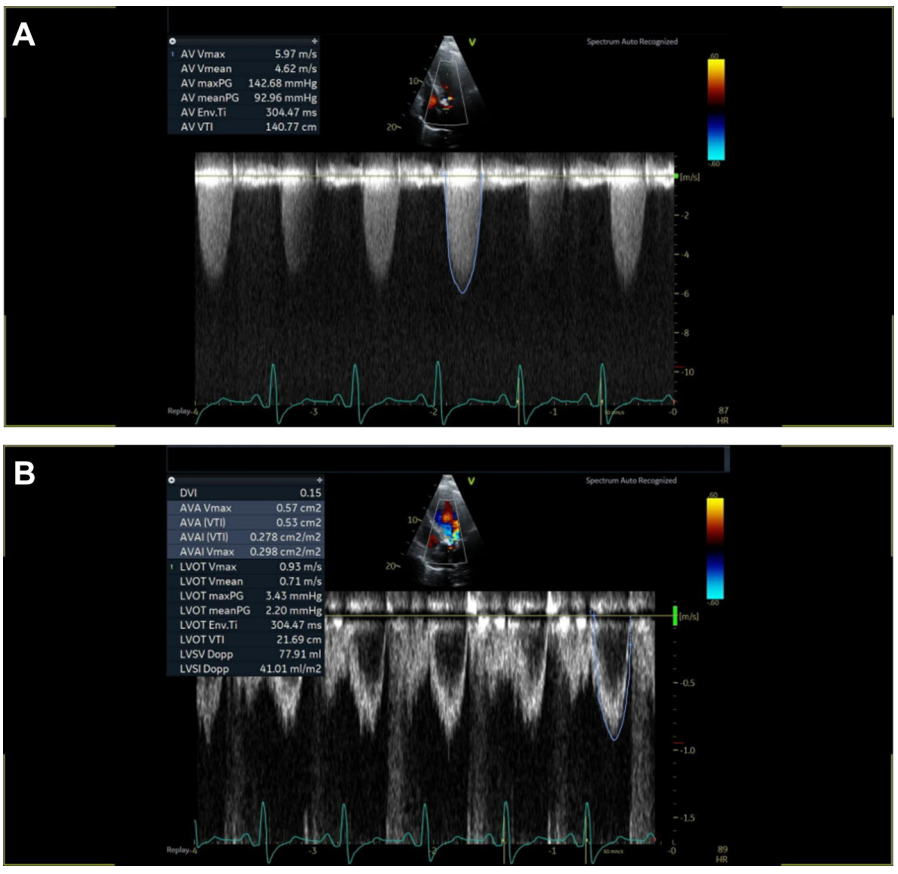
Preconception evaluation should include a comprehensive history to assess for symptoms and transthoracic echocardiography to classify the severity of stenosis. Other tests to consider for risk stratification include exercise stress testing to assess for symptoms and blood pressure response, cardiopulmonary exercise testing to ascertain functional capacity, and measurement of BNP.

If a patient has symptomatic severe AS, severe AS with left ventricular dysfunction, or an abnormal exercise stress test result, they should be referred for SAVR before pregnancy.[3] Guidelines differ in the recommendation for preconception intervention in patients with asymptomatic severe AS. The European Society of Cardiology guidelines recommend intervention if the AS is very severe with mean gradient of ≥60 mm Hg or peak velocity of ≥5 m/s or markedly elevated BNP in the absence of symptoms. The 2020 American College of Cardiology and American Heart Association guidelines recommend intervention in patients with severe AS who are contemplating pregnancy in the absence of symptoms.[3]

QUESTION 3: HOW SHOULD A PATIENT BE MANAGED WHO PRESENTS WITH SYMPTOMATIC AORTIC VALVE STENOSIS DURING PREGNANCY?

Because some of the symptoms of AS can mimic symptoms of pregnancy, it is important to take a detailed history and perform a thorough examination to ascertain the likelihood that the patient's complaints are cardiac. Patients should be followed closely during pregnancy with a low threshold for repeating a transthoracic echocardiogram. Flow-dependent parameters such as peak velocity and transaortic pressure gradients will increase ~50% during pregnancy, and the aortic valve area will remain stable.[4] Given the increase in flow-dependent parameters, data should be interpreted within the context of the patient's presentation. Measurement of BNP during pregnancy can help determine if a patient's symptoms may be cardiac. Hemodynamic measurement in the catheterization laboratory can be valuable if there is uncertainty regarding the severity of AS.[3] If a patient develops symptoms attributable to AS, management with exercise restriction and diuretics should be attempted. In patients with refractory symptoms, valvular intervention should be considered.[3,5]

FIGURE 1 Echocardiographic Assessment of the Aortic Valve



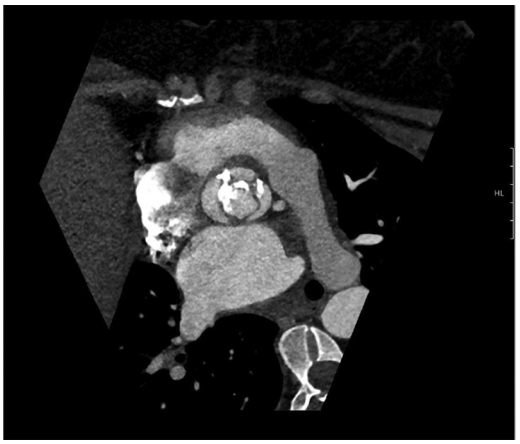
(A) Continuous-wave Doppler with a peak velocity of 5.97 m/s and mean gradient of 93 mm Hg. (B) Pulse-wave Doppler through the left ventricular outflow tract with a dimensionless velocity index of 0.15 and calculated aortic valve area of 0.53 cm^2.

QUESTION 4: WHAT ARE THE OPTIONS FOR AORTIC VALVE INTERVENTION DURING PREGNANCY?

SAVR, BAV, and TAVR are options for valvular intervention during pregnancy. Although there are no large case series of BAV during pregnancy, case reports have shown favorable results with no maternal or fetal death.[3] SAVR is associated with a high rate of prematurity (~50%) and fetal loss (~15%-25%).[6,7] Experience with TAVR during pregnancy is limited.[3] To our knowledge, this is the second case reported of native valve AS treated with TAVR during pregnancy. Because of the risk of fetal loss and prematurity with SAVR and limited experience with TAVR, BAV is often favored for the treatment of symptomatic AS during pregnancy.

In the case described, TAVR was chosen as the intervention for several reasons. SAVR would have

FIGURE 2 Gated Cardiac Computed Tomography



Bicuspid valve with an aortic calcium score of 3,581 AU.

posed high risk for fetal loss at the periviable gestational age of 22 weeks. The patient's valve was heavily calcified with baseline mild-moderate aortic insufficiency, which raised concern about the success of BAV both in terms of the durability of the result and the possibility of acutely worsened insufficiency. Finally, the severity of her gradient questioned whether a BAV would lower the gradients sufficiently to allow for successful completion of pregnancy. A multidisciplinary approach is recommended in the evaluation of valvular intervention during pregnancy including cardio-obstetrics, MFM, cardiothoracic surgery, obstetric and cardiac anesthesia, interventional and structural cardiology, and neonatology specialists.

QUESTION 5: WHAT ARE IMPORTANT PROCEDURAL CONSIDERATIONS FOR A PATIENT WHO IS UNDERGOING AN INTERVENTION DURING PREGNANCY?

Catheter-based procedures expose the fetus to ionizing radiation, which increases the risk of fetal anomalies, fetal loss, or childhood cancer in a dose-dependent manner. Because the risks to the fetus are highest in the first trimester during organogenesis, it is preferable to delay catheter-based interventions until the second trimester. In the first trimester, doses of <50 mGy are considered safe for the fetus, whereas doses above 100 mGy may have negative consequences. Doses up to 500 mGy in the second and third trimesters are generally considered safe.[8]

Abdominal shielding, collimation of windows, optimal table height, avoiding cineangiography in favor of fluoroscopy-save, and avoiding angulated views are techniques that reduce the dose of radiation to the fetus. Although providers taking care of pregnant patients should counsel on the effects of radiation to the fetus, the benefits of a clinically indicated test or procedure typically outweigh potential risks in an acutely ill pregnant patient.

Decisions regarding periprocedural fetal monitoring should be individualized and discussed with MFM, anesthesia, and neonatology specialists. Intraprocedural fetal monitoring is used if the pregnancy has reached viability, the patient consents for emergency cesarean delivery for fetal indications, and an emergent cesarean delivery is logistically feasible if indicated. If intraprocedural monitoring is not used, fetal heart rate should be obtained before and after the procedure.[9] The decision in this case to not pursue intraprocedural fetal monitoring was based on patient preferences and gestational age.

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