

VALVULAR HEART DISEASE

CASE REPORT: HEART CARE TEAM/MULTIDISCIPLINARY TEAM LIVE

Preconception Counseling for a Patient With a Mechanical Tricuspid Valve



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ABSTRACT

A 37-year-old woman with mechanical tricuspid valve thrombosis presented for preconception consultation. Multimodality imaging confirmed a malfunctioning bileaflet mechanical tricuspid valve with both leaflets fixed and open. This case highlights the key discussions held by the multidisciplinary pregnancy heart team. (J Am Coll Cardiol Case Rep 2024;29:102159) © 2024 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 37-year-old woman presented to the multidisciplinary cardio-obstetrics clinic for preconception consultation. Her medical history included remote intravenous drug use and tricuspid endocarditis, which led to bioprosthetic tricuspid valve replacement (Mosaic #29, Medtronic) at 31 years of age. She had early degeneration of the bioprosthetic valve and subsequently underwent redo sternotomy with mechanical tricuspid valve replacement (On-X, Life

Technologies) at 33 years of age. Seven months before the present clinic visit, she conceived a highly desired pregnancy. She had been transitioned from warfarin to low molecular weight heparin 2 months before conception. The patient developed heart failure symptoms around 10 weeks' gestation. A transthoracic echocardiogram revealed an increased gradient of 15/7 mm Hg (peak/mean) across the prosthetic tricuspid valve and mild to moderate tricuspid regurgitation. Subsequent transesophageal echocardiography (TEE) showed a similar transvalvular pressure gradient with suboptimal visualization of the leaflets, and it was attributed to mechanical valve thrombosis. Systemic thrombolytic therapy was avoided because of the pregnancy, and the patient was treated with unfractionated heparin, which was transitioned to warfarin at discharge. Her heart failure symptoms improved with medical management, but she had a miscarriage at 15 weeks' gestation.

LEARNING OBJECTIVES

- To assess and counsel risks of adverse maternal and fetal outcomes for a patient with mechanical tricuspid valve dysfunction.
- To demonstrate multidisciplinary heart team approach in the management of mechanical tricuspid valve thrombosis.

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**ABBREVIATIONS
AND ACRONYMS****TEE** = transesophageal
echocardiography

At our clinic visit, the patient expressed a strong desire for another pregnancy. She did not report any heart failure symptoms. Cardiac examination was notable for the absence of audible mechanical valve sounds. Her international normalized ratio was within the therapeutic range (2.5-3.5) on warfarin (55 mg/week). The most recent transthoracic echocardiogram before the visit showed normal biventricular function and prosthetic tricuspid valve gradient of 19/11 mm Hg (peak/mean).

QUESTION 1: WHAT ARE MATERNAL AND FETAL RISKS RELATED TO MECHANICAL PROSTHETIC VALVES? HOW SHOULD WE APPROACH PRECONCEPTION COUNSELING IN THIS PATIENT?

Although our patient was clinically stable, she remained high risk for complications during future pregnancy. The presence of a mechanical tricuspid valve, recent prosthetic valve thrombosis despite therapeutic anticoagulation, and a history of early bioprosthetic valve degeneration all raise the risk for cardiac complications during pregnancy, especially recurrent thrombosis, prosthetic valve dysfunction, and heart failure. In addition, the existing valvular dysfunction may be exacerbated by normal physiologic changes of pregnancy including increased intravascular volume, cardiac output, and hypercoagulability.

Cardiovascular risk assessment scores and classifications such as the modified World Health Organization classification, the ZAHARA (Zwangerschap bij vrouwen met een Aangeboren HARTafwijking) risk score, and CARPREG (Cardiac Disease in Pregnancy) II all place the presence of a mechanical heart prosthesis in high-risk categories.¹⁻³ The risk of a maternal adverse cardiovascular event related to mechanical valve prosthesis has been estimated to be 19% to 27% based on the modified World Health Organization classification, >70% based on ZAHARA, and 41% based on the CARPREG II study.¹⁻³ Moreover, moderate to severe atrioventricular valve dysfunction has the additional risk of adverse maternal cardiac outcomes based on the ZAHARA study.² A retrospective study using the National Inpatient Sample found that pregnant individuals with valvular disease had higher odds of adverse obstetrical events such as preeclampsia; eclampsia; intrapartum/postpartum hemorrhage; and cardiovascular events including

peripartum cardiomyopathy, pulmonary edema, acute ischemic heart disease, and arrhythmias.⁴

We discussed at length her high risk of valve complications during pregnancy. Our final recommendations were to start contraception and address the prosthetic valve dysfunction before planning another pregnancy. Therefore, a multidisciplinary heart team meeting was arranged to discuss her case.

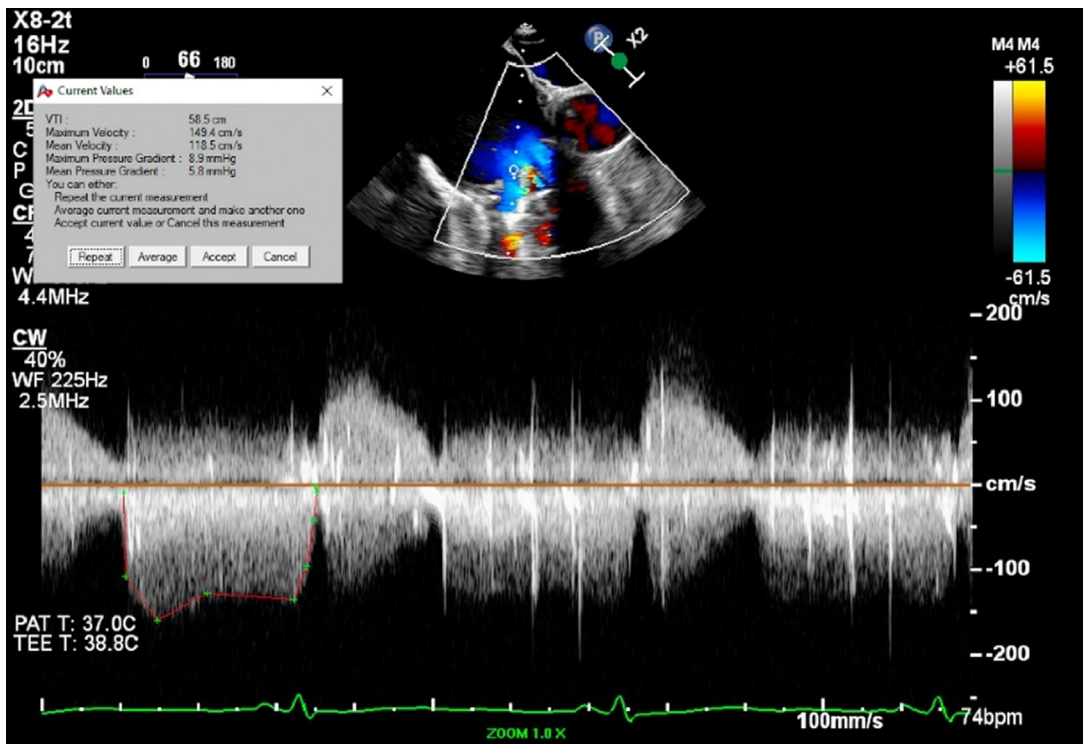
QUESTION 2: WHAT IS THE DIFFERENTIAL DIAGNOSIS FOR ELEVATED PRESSURE GRADIENT ACROSS THE PROSTHETIC VALVE?

The most common causes of mechanical prosthetic valve dysfunction are valve thrombosis and pannus formation.⁵ Differentiating thrombosis from pannus overgrowth can be challenging but essential because some patients may be eligible for thrombolytic therapy in case of acute thrombosis. Other causes of pathologic elevation of pressure gradient across the prosthetic valve include prosthesis-patient mismatch and valvular degeneration in case of a bioprosthetic valve. A mild increase in the pressure gradient across the prosthetic valve may be seen during normal pregnancy when the cardiac output increases. However, concomitant regurgitation or the development of heart failure symptoms should raise concern for prosthetic valve dysfunction.

QUESTION 3: WHAT IS THE HEART TEAM APPROACH IN ASSESSING THE MECHANICAL TRICUSPID VALVE FUNCTION AND NEED FOR INTERVENTION?

Our initial approach included assessment of the prosthetic valve function using multimodality imaging. The patient underwent TEE (Video 1), valve cinefluoroscopy (Video 2), and computed tomography angiography (Video 3), all of which confirmed a bileaflet mechanical tricuspid valve with both leaflets fixed in a partially open position with no observable movement. The fixed leaflets resulted in moderate tricuspid valve stenosis (mean gradient of 6 mm Hg at a heart rate of 74 beats/min) (Figure 1) and moderate to severe regurgitation. In general, a mean gradient ≥ 5 mm Hg or a valve area ≤ 1.0 cm² are echocardiographic indicators of severe tricuspid valve stenosis.⁶ Although there was no obvious thrombus or pannus visualized on TEE, it was thought that thrombosis was the most likely etiology of her valve dysfunction. However, the decision regarding surgical intervention was unclear in the

FIGURE 1 Continuous Doppler Across the Mechanical Tricuspid Valve



The mean pressure gradient across the mechanical tricuspid valve was 5.8 mm Hg at a heart rate of 74 beats/min.

absence of symptoms. An exercise stress test was pursued for better assessment of her functional capacity and symptomatology. She achieved a peak work level of 13 metabolic equivalents and a maximum heart rate of 157 beats/min (85% of the maximal, age-predicted heart rate) on the treadmill exercise stress test. She did not have any reportable symptoms during the test.

QUESTION 4: HOW DOES PREGNANCY AFFECT THE SAFETY OF MULTIMODALITY IMAGING STUDIES?

Multimodality cardiac imaging plays a critical role in determining the etiology and severity of prosthetic valve dysfunction. Although most imaging modalities are noninvasive and safe, special considerations need to take place when the patient is pregnant. Our team strongly recommended obtaining multimodality imaging studies before considering pregnancy because some imaging modalities may not be suitable during pregnancy because of safety concerns. An increased

progesterone level during pregnancy is thought to decrease gastric motility and increase relaxation of the lower esophageal sphincter, which may lead to an increased risk of emesis and aspiration in a patient with increased intra-abdominal pressure from a gravid uterus.⁷ This is an important consideration for sedation before TEE, and many anesthesiologists consider pregnant women's fasting status to be "full stomach" regardless of fasting duration beyond 18 weeks' gestation.⁸ According to the American College of Obstetricians and Gynecologists, absolute contraindications to submaximal exercise stress testing in pregnant women include persistent vaginal bleeding, an incompetent cervix, multiple gestation, placenta previa after 26 weeks, preterm labor, premature rupture of membranes, restrictive lung disease, pre-eclampsia/gestational hypertension, and known hemodynamically significant cardiovascular disease.⁹ Non-weight-bearing exercise on a recumbent bike is preferred to the treadmill test during pregnancy, particularly in individuals who are unaccustomed to physical exertion or experiencing gait

instability.⁸ When using cardiac imaging modalities with ionizing radiation, potential fetal radiation exposure needs to be considered, and such risk needs to be weighed against diagnostic benefit.

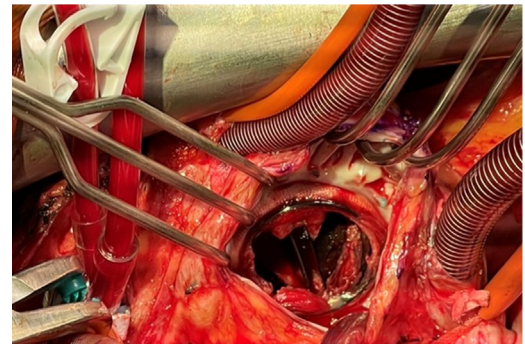
QUESTION 5: WHICH INTERVENTION WAS ULTIMATELY RECOMMENDED FOR THIS PATIENT?

Although the patient did not experience significant symptoms related to her mechanical tricuspid valve dysfunction, it was thought that her persistent mixed valve disease from chronic thrombosis would not resolve with anticoagulation alone and she would eventually require surgical intervention. Systemic thrombolytic therapy was not thought to be beneficial in this case because of the chronicity of her valve disease (longer than 6 months). Given the patient's advanced maternal age and her strong desire for future pregnancy, the recommendation was made to proceed with redo tricuspid valve replacement with a bioprosthetic valve in order to avoid long-term anticoagulation. The patient underwent successful surgical replacement of the existing mechanical tricuspid valve with a porcine mitral bioprosthetic valve (Mosaic #29). A bovine pericardial valve could not be used because of a history of nickel allergy. Intraoperative visual inspection of the mechanical prosthetic valve confirmed the presence of organized thrombus obstructing 1 of the 2 leaflets in a fixed position (Figure 2).

CONCLUSIONS

Our case highlights the importance of working in a multidisciplinary team composed of members from maternal fetal medicine, cardio-obstetrics, advanced cardiac imaging, cardiac surgery, and interventional/

FIGURE 2 Mechanical Tricuspid Valve With Chronic Thrombosis



Intraoperative visual inspection confirmed an organized thrombus obstructing 1 of the 2 leaflets of the valve.

structural cardiology when providing preconception counseling for a patient with complex prosthetic valve disease.

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KEY WORDS cardio-obstetrics, mechanical tricuspid valve, preconception counseling, prosthetic valve stenosis, prosthetic valve thrombosis

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