JACC: CASE REPORTS VOL. 27, 2023

CASE REPORT

CLINICAL CASE SERIES

Induced Abortion for Maternal Cardiac Indication

2 Cases of Unintended Pregnancy With LVAD

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ABSTRACT

We present 2 cases of patients with left ventricular assist device who underwent an induced abortion in the first and second trimester, respectively. Comprehensive counseling is critical for this patient population, and close coordination of interdisciplinary teams is required in the setting of continuing pregnancy or medically indicated abortion. (J Am Coll Cardiol Case Rep 2023;27:102108) © 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/).

Pregnancy in patients with left ventricular assist devices (LVADs) has been considered contraindicated because of high risk of maternal and fetal morbidity and mortality. Although 1% to 4% of individuals have cardiovascular disease during pregnancy, data regarding LVAD patient outcomes are limited.[1] We present 2 cases of pregnancy in LVAD patients who opted for termination.

LEARNING OBJECTIVES

- To review importance of preconception and contraceptive counseling as well as involvement of multidisciplinary teams and respecting patient's reproductive autonomy in care of patients with history of LVAD
- To understand the risks of pregnancy among patients with LVADs and considerations for referral for complex family planning care for pregnancy termination

CASE 1

Patient A was a 31-year-old at 8 weeks gestation with end-stage nonischemic cardiomyopathy due to rhinovirus with HeartMate 3 LVAD implanted 2 years before presentation. The pregnancy was unplanned and further complicated by history of pulmonary embolism, perinephric abscess requiring nephrectomy, and prior drive line. She was transitioned to enoxaparin on pregnancy diagnosis. She had 2 previous uncomplicated vaginal deliveries before her LVAD placement and met NYHA functional classification II at presentation. Shortly after LVAD implantation, she had received contraceptive counseling with recommendation for levonorgestrel intrauterine device (IUD); she was previously using the depot medroxyprogesterone acetate which was discouraged in favor of IUD due to evidence of higher risk for thromboembolism. She was undecided regarding contraception at time of counseling and

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received February 22, 2023; revised manuscript received June 1, 2023, accepted June 14, 2023.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2023.102108

ABBREVIATIONS AND ACRONYMS

IUD = intrauterine device

LVAD = left ventricular assist device

planned to follow-up with her local obstetrician-gynecologist.

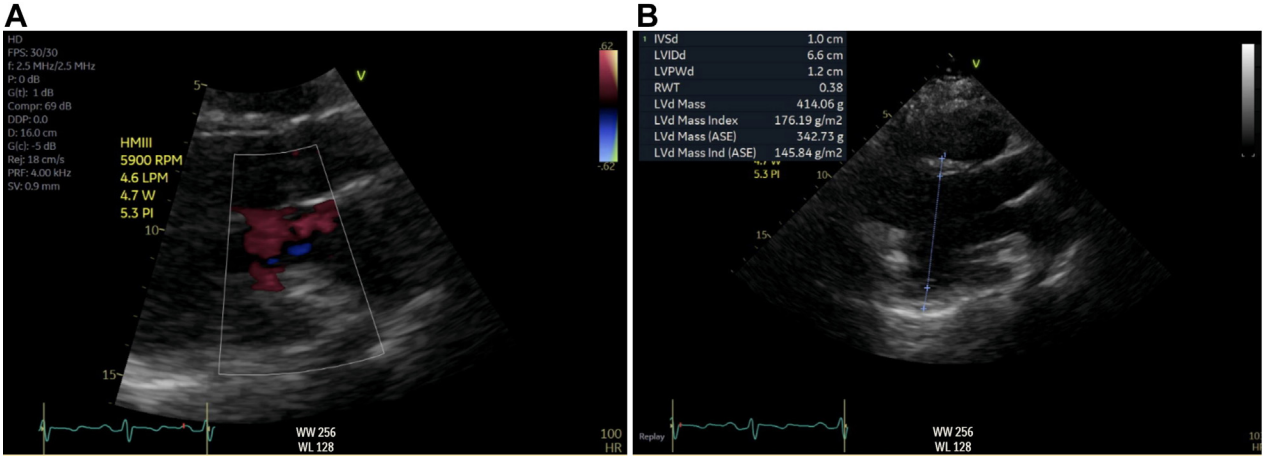
During pregnancy, she developed hyperemesis gravidarum requiring parenteral hydration and antiemetics. Her hyperemesis symptoms, concern for warfarin exposure, and maternal cardiovascular risks of ongoing pregnancy led her to request an abortion. Her echocardiogram was notable for severe left ventricular dysfunction with a left ventricular ejection fraction of 15%, moderate right ventricular dysfunction, and trivial mitral valve regurgitation (**Figure 1**, Video 1). Following admission for hemodynamic optimization, she underwent an uncomplicated uterine aspiration and levonorgestrel IUD placement. On postoperative day 1 she developed shortness of breath treated successfully with furosemide following a negative workup for pulmonary embolism. She was transitioned back to warfarin and ciprofloxacin and was discharged on postoperative day 2; she remains stable as an outpatient.

CASE 2

Patient B was a 29-year-old presenting at 6 weeks gestation. She had a history of sarcoma complicated by chemotherapy-induced cardiomyopathy with a HeartMate 3 LVAD placed 3 years before presentation. This pregnancy was unplanned but desired; she was previously not using contraception, in part, as she was told during chemotherapy that she would not be able to conceive. She also had a history of moderate right ventricular dysfunction, stage III chronic kidney disease, and methicillin-susceptible *Staphylococcus aureus* (MSSA) driveline infection. She initially presented with NYHA functional class II symptoms. An echocardiogram 8 months before pregnancy was notable for a left ventricular ejection fraction <15% with moderate right ventricular hypokinesis and moderate tricuspid regurgitation (**Figure 2**, Video 2). She had comprehensive counseling from maternal-fetal medicine and cardiology regarding risks of pregnancy continuation. This discussion included the significant cardiac demands in pregnancy and the risk for decompensation for patients with underlying cardiac pathology. In addition to maternal complications, suspected potential obstetric and fetal/neonatal complications included spontaneous abortion, fetal growth restriction, low birth weight, preterm birth, cesarean delivery and increased perinatal mortality, as well as the associated teratogenic effects of warfarin and spironolactone. Following counseling, she elected to continue pregnancy.

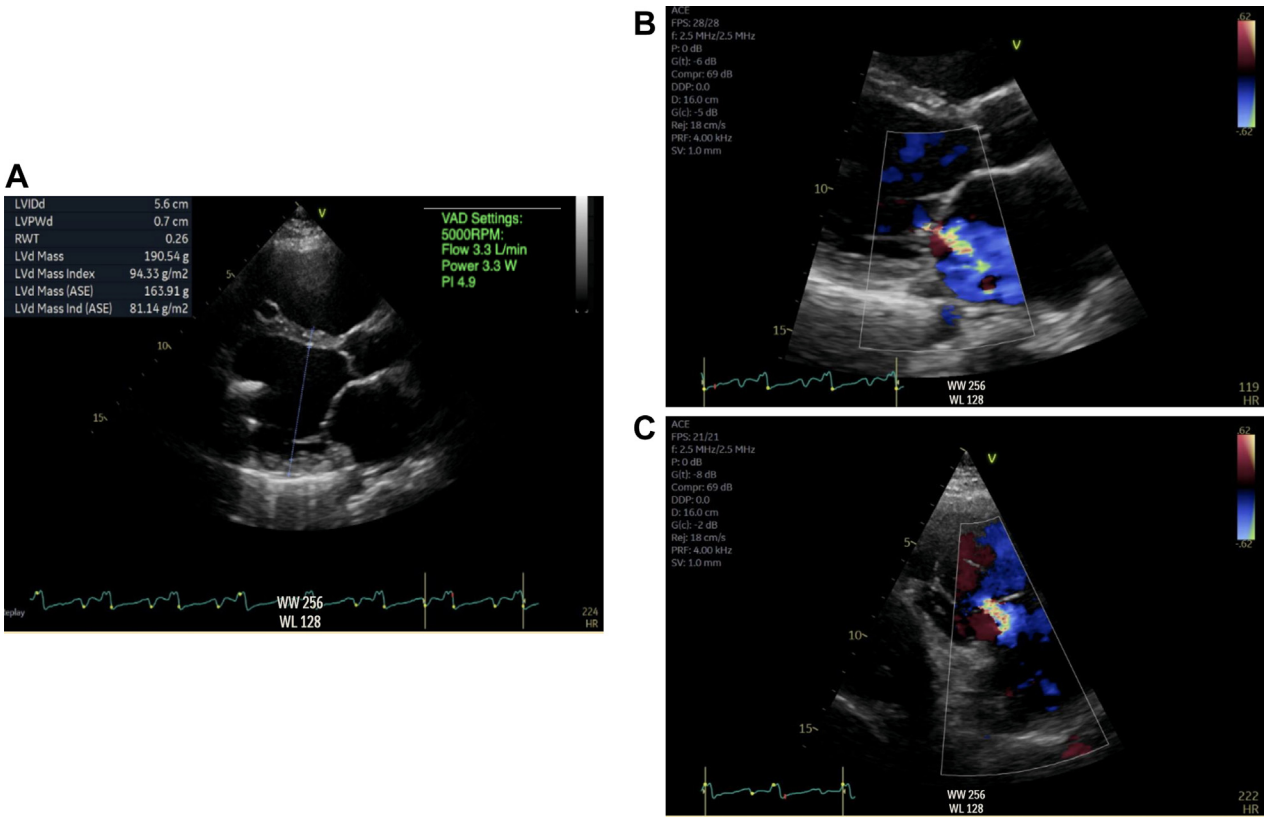
She was transitioned from warfarin to enoxaparin and a pregnancy heart team assembled with representation from cardio-obstetrics, maternal-fetal medicine, advanced heart failure, LVAD device management, and anesthesiology services. At 15 weeks gestation she required diuresis and LVAD adjustment for dyspnea, which further progressed at 18 weeks requiring increasing adjustments for volume overload and worsening right ventricular dysfunction. Fetal

FIGURE 1 Echocardiogram of Case 1 the Day Before Abortion



Severe left ventricular dysfunction with left ventricular ejection fraction of 15%, moderate right ventricular dysfunction, and trivial mitral regurgitation. (A) Parasternal long-axis image shows trivial mitral regurgitation. HeartMate III settings show speed of 5,900 RPM, flow 4.6 L/M, power 4.7 W, and pulsatility index of 5.3. (B) Parasternal long-axis image showing a left ventricular end-diastolic diameter of 6.6 cm.

FIGURE 2 **Transthoracic Echocardiogram for Case 2 Obtained at 18 Weeks Gestation 1 Week Before Abortion**

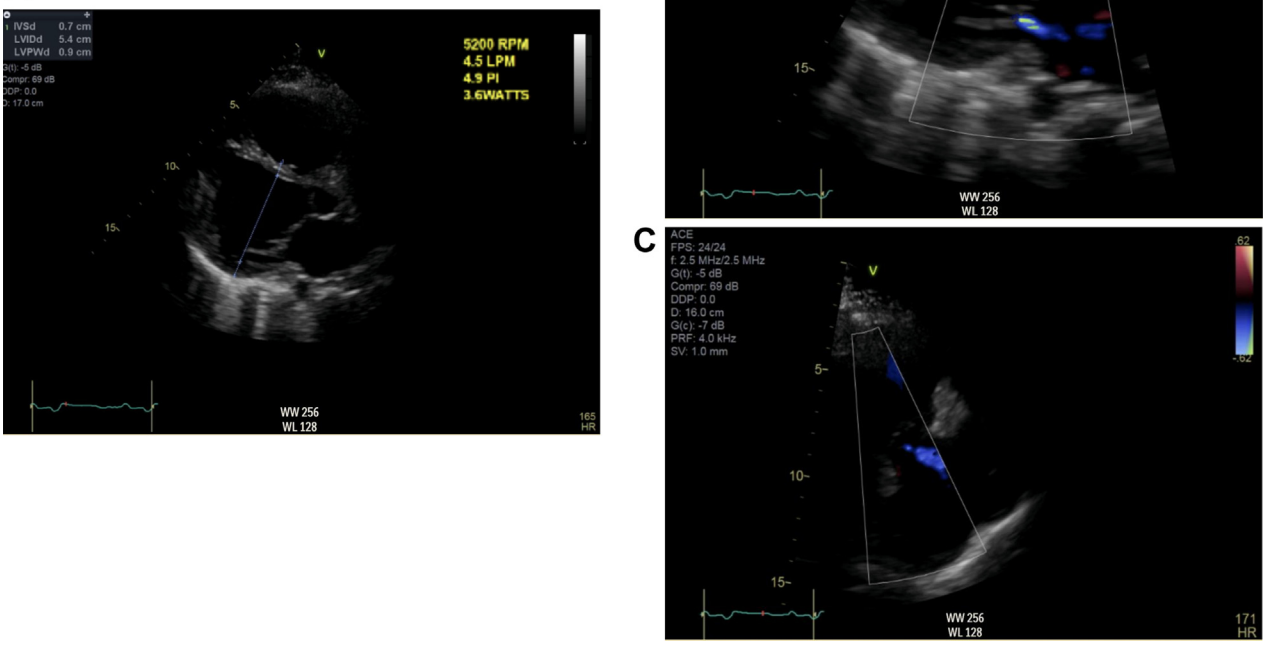


Severe left and right ventricular dysfunction with left ventricular ejection fraction <15%, moderate to severe mitral regurgitation, and severe tricuspid regurgitation. (A) Parasternal long-axis images show a left ventricular end-diastolic diameter of 5.6 cm. Ventricular assist device settings show speed of 5,000 rpm, flow 3.3 L/min, power 3.3 W, and pulsatility index of 4.9. (B) Moderate to severe eccentric mitral regurgitation. (C) Severe tricuspid regurgitation with central tricuspid regurgitation jet shown.

anatomy scan at 18 weeks gestation showed marked oligohydramnios and placentomegaly, which were concerning for severe uteroplacental insufficiency due to impaired maternal cardiac output (Video 3). After considering her worsening functional status and increased risk of adverse fetal outcome, the patient opted for an induced abortion.

She was counseled on dilation and evacuation and labor induction. She strongly desired labor induction, performed in the cardiothoracic intensive care unit. She was administered 200 mg of mifepristone and received anticoagulation bridging with intravenous heparin. Twenty-four hours later, she received her first dose of 800 μg of misoprostol vaginally and heparin was stopped, with plan for 400 μg of misoprostol every 3 hours until delivery. She opted for intravenous fentanyl patient-controlled anesthesia for analgesia. Given severe right ventricular dysfunction, she underwent close hemodynamic monitoring and hemogasanalysis with an arterial line. Following the second dose of misoprostol, she developed significant labor pain and hypoxia. She was started on low-dose dopamine for inotropic support. She requested a dilation and evacuation at that time, but before transfer to the operating room delivered a stillborn fetus. After delivery of the placenta, continued bleeding necessitated uterine aspiration under ultrasound guidance. She was restarted on a heparin drip with close monitoring given bleeding risk and pregnancy-related thrombocytopenia. After 48 hours of hemodynamic stability, she was transitioned to enoxaparin as a bridge to warfarin. She was discharged on hospital day 4. She remained stable at follow-up with improvement in her left ventricular function on echocardiogram (**Figure 3**, Video 4). She received a levonorgestrel IUD for contraception as an outpatient.

FIGURE 3 Transthoracic Echocardiogram for Case 2 Obtained 3 Months After Termination



HeartMate III speed was increased around the time of induction to 5,200 rpm. With this change in speed, flow was 4.6 L/min and power was 3.6 W. Given improvements in mitral and tricuspid regurgitation, speed was maintained the same speed during follow-up visits. (A) This image shows a slightly smaller left ventricular end-diastolic diameter at 5.4 cm compared to 5.6 cm on prior echocardiograms during pregnancy. (B) Mild mitral regurgitation (MR) compared moderate to severe MR on prior echocardiograms during pregnancy. (C) Mild tricuspid regurgitation (TR) compared to severe TR on prior echocardiograms during pregnancy.

DISCUSSION

Heart disease is now the leading cause of nonobstetric maternal mortality, with cardiovascular conditions responsible for approximately 26% of all pregnancy-related deaths.[2] Pregnancy in the setting of LVAD is a high-risk condition that may require significant inotropic support and can lead to unpredictable maternal decompensation. Additional clinical challenges include balance of anticoagulation and thrombotic risks, use of potentially teratogenic medications in pregnancy, and need for multidisciplinary coordination for either delivery or abortion. When patients present with pregnancy in the setting of LVAD in place, clinicians must engage in shared decision-making balancing the patient's reproductive autonomy with potential obstetric, neonatal, and cardiac complications.

We present 2 cases of induced abortion for maternal cardiac indication managed in the first and second trimesters by uterine aspiration and induction of labor, respectively. Although a scheduled dilation and evacuation is considered the safest method for induced abortion in the second trimester due to the unpredictable hemodynamic changes of labor, it is reasonable to proceed with induction of labor following comprehensive counseling.[3]

Assessing maternal risk for pregnancy in patients with pre-existing heart disease relies on careful cardiovascular clinical assessment.[1] Risk counseling extrapolated from the highest risk category of CARPREG II (Cardiac Disease in Pregnancy Study II) and modified World Health Organization classification IV suggest around a 40% risk of maternal cardiovascular complications for pregnant people with LVAD.[4,5] Potential complications include device thrombosis,

right ventricular failure, and LVAD dysfunction secondary to uterine size.[6] However, LVAD-specific literature related to pregnancy is limited. In 1 review of 6 cases of pregnancy in patients with LVADs, 5 resulted in uncomplicated deliveries, but 1 resulted in maternal death after intracranial hemorrhage with associated fetal demise.[7] It remains unknown whether pregnancies with LVAD are as rare as data suggest, as there appears to be a reporting bias towards live birth. Given the risk profile, it is likely that a significant proportion of patients with complex cardiac disease and unintended pregnancy would consider an induced abortion.

Preconception counseling is not included in guidelines for patients on mechanical circulatory support, yet studies show that up to 7% of patients with LVAD are capable of pregnancy.[8] All patients considering pregnancy in the setting of LVAD in place should have pre-conception evaluation and risk stratification with cardiology and obstetrics; similarly, for patients who desire contraception, the risks and benefits of contraceptive methods must be balanced against risks of unplanned pregnancy.[9] Long-acting reversible contraception methods including the progestin-containing IUD and the subdermal implant are effective (>99%) at preventing pregnancy and have an excellent safety profile; therefore, they should be recommended for women at increased risk of cardiovascular complications of pregnancy. However, shared decision-making is essential for contraceptive counseling to promote adherence and patient autonomy.

Abortion is safe in both inpatient and outpatient settings, but patients with an LVAD seeking abortion likely face a higher risk of complications. Referral to providers with expertise in medically complex abortion is recommended, and a hospital-based setting may be warranted. Patients with an LVAD may be candidates for both medical and surgical abortion. Contraindications to medication abortion such as severe anemia and anticoagulation may present an additional challenge.[10] For patients undergoing surgical abortion, anticoagulation should weigh individualized bleeding and thrombotic risks. Anticoagulation can be safely continued peri-procedurally in the first trimester for patients without additional risk factors for bleeding.[10] Immediate availability of LVAD specialists is recommended for possible intraoperative LVAD adjustments given potential for hemodynamic changes with uterine evacuation. Considerations should be given to choosing LVAD settings to optimize cardiac output, choice of anticoagulation, changes in volume status throughout pregnancy and at delivery, changes in arterial pressures affecting LVAD afterload, and minimizing need for transfusions.[6]

Finally, as restrictions to abortion increase in the United States following the *Dobbs v Jackson Women's Health* decision, patients with medical comorbidities may be forced to continue pregnancies at the expense of their own health.[11] Access to abortion services is critical for all reproductive-aged individuals capable of pregnancy. Further research is needed to guide clinical practice and risk stratification for patients with complex cardiac conditions, and advocacy efforts to advance reproductive rights for patients in which pregnancy is a life-threatening condition.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Drs Federspiel and Swartz have been supported by the Eunice Kennedy Shriver National Institute of Child Health and Human Development of the National Institutes of Health under award numbers UL1TR002553 and K12HD103083. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS induced abortion, left ventricular assist device, unintended pregnancy

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