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HEART FAILURE

CASE REPORT: CLINICAL CASE: CARDIOOBSTETRICS 2023

Diagnostic and Management Considerations in a High-Risk Pregnant Patient With Ischemic Cardiomyopathy

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ABSTRACT

Ischemic heart disease is an important cause of heart failure in pregnancy. Involvement of a cardio-obstetrics team is crucial for managing high-risk pregnant patients with cardiovascular disease. We present a case of cardiogenic shock in a pregnant woman unmasking underlying multivessel obstructive coronary artery disease. (J Am Coll Cardiol Case Rep 2024;29:102268) © 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/).

HISTORY OF PRESENTATION

A 43-year-old woman, G3P1001, at 25 weeks' gestation presented from an outside facility with 3 weeks of progressive shortness of breath and leg swelling. Two weeks before that presentation, she was evaluated at an emergency department for chest pain and shortness of breath but left against medical advice before further work-up. One week later, she sought care at a different emergency department for ongoing chest pain, acute right-side weakness, and vision loss. Brain magnetic resonance imaging (MRI) showed acute cerebral infarcts. Transthoracic echocardiography (TTE) showed severe left ventricular dysfunction with reduced ejection fraction (20%-24%) and a 1.5-cm apical thrombus. She was started on aspirin and a heparin drip and transferred to a tertiary care center for management of her heart failure.

LEARNING OBJECTIVES

- To understand the role of ischemic evaluation in pregnant patients with new heart failure with reduced ejection fraction.
- To recognize that ischemic evaluation in pregnant patients with the use of coronary angiography is safe and appropriate in selected clinical scenarios.
- To emphasize the importance of a multidisciplinary cardio-obstetrics team in the management of high-risk pregnant patients with cardiovascular disease.

On examination, she was afebrile with blood pressure 126/77 mm Hg, heart rate 109 beats/min, respiratory rate 14/min, and oxygen saturation 95%. She appeared lethargic and diaphoretic. Lungs had scattered bibasilar crackles. Heart rate was regular, tachycardic, with no murmurs and jugular venous distention of 12 cm. Abdomen was soft and nontender with a

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ABBREVIATIONS AND ACRONYMS

CAD = coronary artery disease

CAG = coronary angiography

CVD = cardiovascular disease

IHD = ischemic heart disease

MRI = magnetic resonance imaging

RHC = right heart catheterization

TTE = transthoracic echocardiography

palpable gravid uterus. Extremities were lukewarm with 2+ bilateral pitting edema.

PAST MEDICAL HISTORY

Medical history was notable for chronic hypertension, diabetes mellitus, tobacco use disorder, and polysubstance abuse (intranasal methamphetamine, oxycontin, and heroin). She had 2 previous pregnancies. The first was uncomplicated, and she delivered at term via cesarean section. The second pregnancy was complicated by spontaneous abortion.

DIFFERENTIAL DIAGNOSIS

Initial differential diagnosis included peripartum cardiomyopathy, methamphetamine-induced cardiomyopathy, ischemic cardiomyopathy, and acute coronary syndrome.

INVESTIGATIONS

Admission laboratory studies are noted in Table 1. Electrocardiography showed normal sinus rhythm with Q waves suggestive of infarction (Figure 1). Repeated TTE showed global left ventricular hypokinesis with akinesis of the anterior, apical, and inferior walls, grade 3 diastolic dysfunction, and mildly enlarged right ventricle with mildly reduced systolic function. Right heart catheterization (RHC) showed elevated filling pressures, reduced cardiac output, and increased systemic vascular resistance (Table 2).

TABLE 1 Admission Laboratory Studies

Laboratory Study	Result	Reference Range
Hemoglobin, g/dL	9.8	11.4-15.2
Hematocrit, %	31.7	34.9-44.3
Platelets, $10^3/\mu L$	342	150-393
WBC, $10^3/\mu L$	17.99	3.99-11.19
Sodium, mmol/L	139	135-145
Potassium, mmol/L	4.2	3.5-5.0
CO_2, mmol/L	23	21-31
Creatinine, mg/dL	0.73	0.50-1.20
AST, U/L	33	10-39
ALT, U/L	16	9-48
Bilirubin, mg/dL	0.7	<1.5
High-sensitivity troponin, ng/L	234	<34
BNP, pg/mL	2,717	0-100
Total cholesterol, mg/dL	175	<200
HDL, mg/dL	25	>40
Triglycerides, mg/dL	269	<150
LDL, mg/dL	96	<100
Lipoprotein A, nmol/L	14	<75
hemoglobin A_{1c}	7.8%	<5.7%

ALT = alanine transaminase; AST = aspartate transaminase; BNP = B-type natriuretic peptide; HDL = high-density lipoprotein; LDL = low-density lipoprotein; WBC = white blood cells.

MANAGEMENT

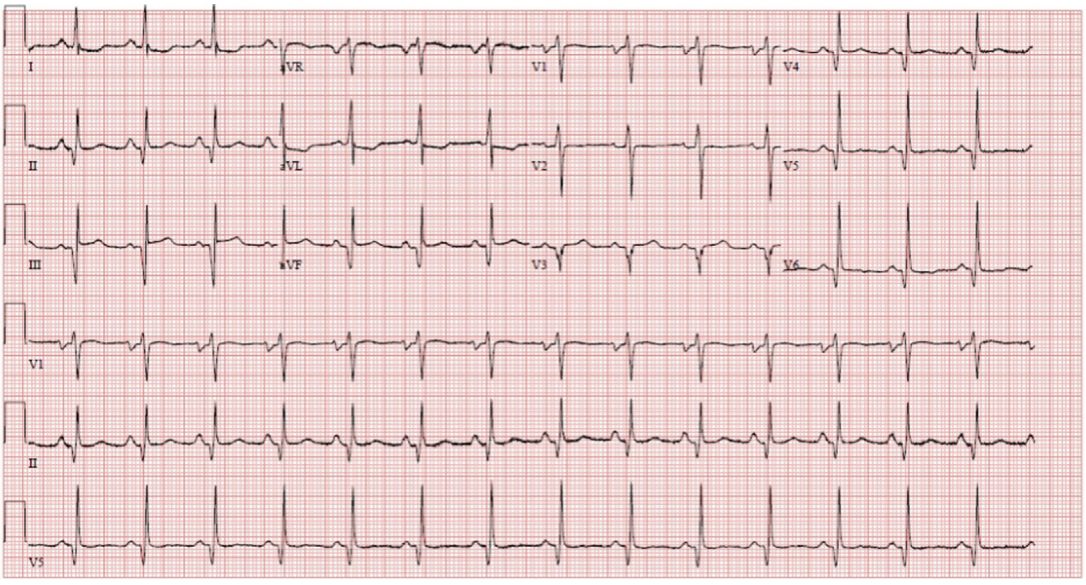
She was given intravenous diuretics and started on a nitroprusside drip for treatment of cardiogenic shock. One week into the hospitalization she developed several episodes of nonsustained ventricular tachycardia. Given concern for coronary artery disease (CAD) as the cause of her heart failure and arrhythmias, the decision was made to perform cardiac catheterization. All attempts were made to minimize procedural time at the lowest radiation dose, and the patient's abdomen was draped with lead. Coronary angiography (CAG) revealed multivessel obstructive CAD not amenable to intervention (Figure 2).

An extensive multidisciplinary discussion ensued involving cardiology, maternal-fetal medicine, obstetrics, cardio-obstetrics, electrophysiology, interventional cardiology, neonatology, heart failure, and cardiac/obstetrical anesthesia. A comprehensive treatment plan was developed through several multidisciplinary meetings to optimize the patient's condition before delivery. Part of the treatment plan involved emergency preparedness and coordination among teams in the event that maternal or fetal health declined and required emergency cesarean section. She was evaluated by the heart failure service and deemed to be not a candidate for advanced therapies owing to her active polysubstance abuse.

Ongoing interdisciplinary meetings were held to determine the best management and timing for delivery. Given early gestational age and overall cardiac and fetal stability, the decision was made to continue medical therapy. During the second week of hospitalization, lactate levels increased, with decreasing urine output concerning for refractory shock. Repeated RHC on 3 μg/kg/min nitroprusside showed improved cardiac output (2.2 L/min) but elevated filling pressures (pulmonary capillary wedge pressure 28 mm Hg). Owing to concern for fetal cyanide toxicity with sustained administration of nitroprusside over 9 days, the nitroprusside drip was weaned while oral vasodilators and milrinone were simultaneously added and uptitrated.

At 27 weeks and 4 days' gestation, the patient began having contractions with new early decelerations on fetal monitoring. After further discussion among services, the decision was made to proceed with cesarean section using a multidisciplinary team approach in the cardiac operating room (Figure 3). A Swan-Ganz

FIGURE 1 Electrocardiogram on Presentation



Normal sinus rhythm, left atrial enlargement, and Q waves in the inferior and anterolateral leads suggestive of infarction.

catheter and arterial line were placed for close hemodynamic monitoring. The patient tolerated the procedure without issues and the infant was transferred to the neonatal intensive care unit for close monitoring. Milrinone was slowly weaned and goal-directed medical therapy was initiated. The cyanide level obtained on day 5 of nitroprusside was 0.60 μg/mL (potentially toxic: >0.50 μg/mL; toxic: >2.00 μg/mL) but not until after the patient underwent cesarean section. Cardiac MRI was performed and showed severe left ventricular systolic dysfunction with predominantly ischemic scar (**Figure 4**).

TABLE 2 Right Heart Catheterization Data

End-expiratory pressure, mm Hg	
Right atrium	mean 25
Pulmonary artery	44/29, mean 34
Pulmonary capillary wedge	28
Saturation, %	
Pulmonary arterial	33.1
Systemic arterial	99
Outputs and resistances	
Fick cardiac output, L/min	3.28
Fick cardiac index, L/min/m^2	1.6
Pulmonary vascular resistance, WU	1.83
Systemic vascular resistance, dyn/s/cm^5	1948

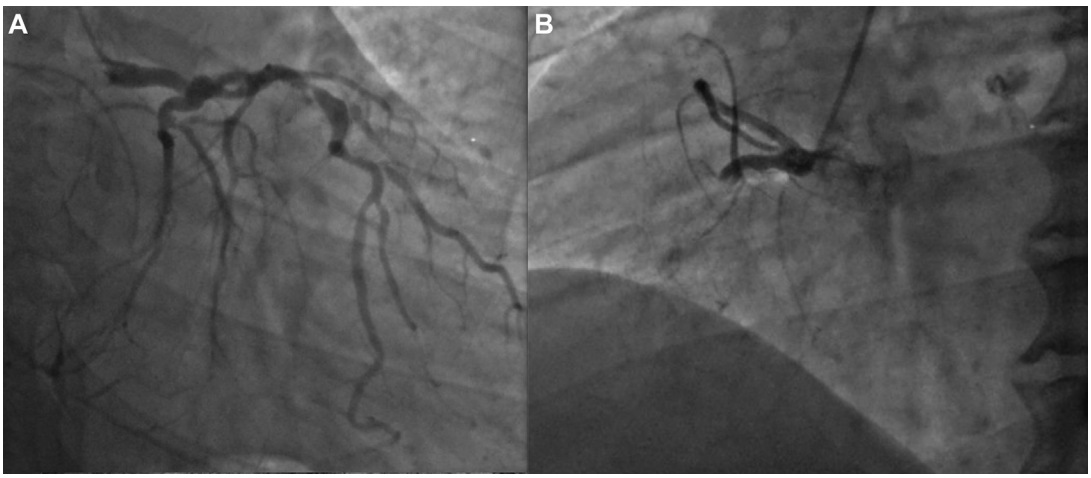
Unfortunately, the patient left against medical advice before heart failure medications were optimized. She was discharged on extended-release metoprolol, sacubitril/valsartan, dapagliflozin, and torsemide and fitted for a wearable cardioverter-defibrillator owing to the ischemic cardiomyopathy and severely reduced ejection fraction.

DISCUSSION

Pregnancy-related deaths in the United States have been increasing over the past 3 decades, and cardiovascular disease (CVD) is the leading cause.[1] Normal hemodynamic changes in pregnancy include increased cardiac output, increased stroke volume, increased heart rate, and decreased systemic vascular resistance. These changes are well tolerated in most pregnant women, but those with underlying CVD may struggle to adapt to the increased metabolic demands, leading to increased maternal morbidity and mortality.[2]

Cardiomyopathy accounts for 12.1% of pregnancy-related deaths.[1] Although peripartum cardiomyopathy is the most common cause of heart failure in pregnancy, with a reported prevalence of up to 70% of heart failure cases, it is a diagnosis of exclusion,[3]

FIGURE 2 Coronary Angiography Images



(Left) 100% occluded mid-left anterior descending artery, 90% stenosis in the first diagonal branch with left-to-right collaterals. (Right) 100% stenosis in the proximal right coronary artery.

and therefore other causes, including ischemic heart disease (IHD), must be ruled out. The incidence of CAD in women of child-bearing age is not well defined; one study reported that 2% of all pregnant women had IHD.[4]

FIGURE 3 Cesarean Section

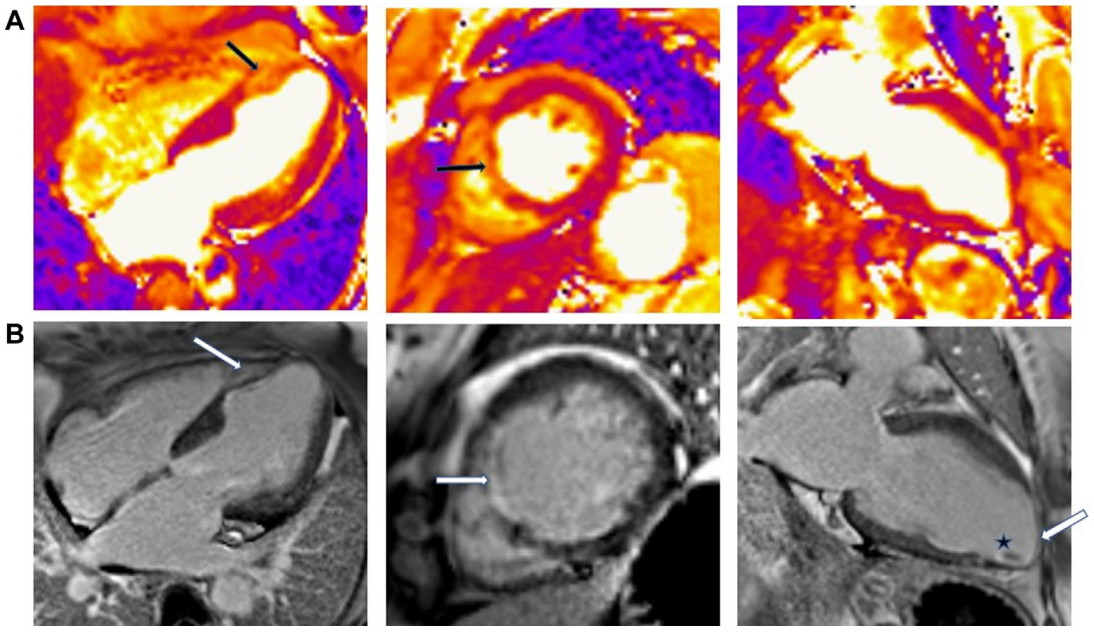
Multidisciplinary team approach in the cardiac operating room.

Diagnosis and management of acute coronary syndromes, including CAG and revascularization, are similar in pregnancy and in the general population.[5] However, their role in the work-up of new heart failure during pregnancy is not established. An invasive strategy is reasonable and warranted in cases of hemodynamic instability or when there is high suspicion of potentially intervenable CAD.[6] There are several risks of CAG unique to pregnancy, including radiation exposure to the fetus, positional hemodynamic changes, and potential need for emergency cesarean delivery. These risks can be mitigated by using shorter injection time during angiography, saving fluoroscopy images instead of cine imaging, placing lead over the patient's abdomen, and positioning the patient on her left side to avoid compression of the inferior vena cava. Although our patient did not have an intervenable lesion at the time of angiography, defining her coronary anatomy was crucial to formulating her treatment plan. In other cases, coronary intervention on high-risk lesions during pregnancy may mitigate cardiovascular risk before delivery.

FOLLOW-UP

Three months after discharge, she was seen in the heart failure clinic and goal-directed medical therapy was optimized. TTE showed improved ejection fraction to 45%-50%. She continued to report resolution of heart failure symptoms.

FIGURE 4 Cardiac Magnetic Resonance Imaging



(A) Elevated T2 signal in the apical septum consistent with myocardial edema and inflammation suggesting recent infarction. (B) Late gadolinium enhancement demonstrates extensive infarction in the apical anterior wall with thrombus (star).

CONCLUSIONS

This case illustrates the complexity of diagnosis and management of cardiogenic shock and IHD in pregnant patients, as well as the importance of multidisciplinary collaboration in high-risk cardio-obstetrics cases. Although IHD is an uncommon cause of heart failure in pregnancy, providers should remain vigilant of potential ischemic causes, including atherosclerosis, spontaneous coronary artery dissection, thrombus, and coronary spasm. Providers should consider the risks and benefits of ischemic evaluation in pregnant patients presenting with new heart failure. CAG is reasonable in select cases, may mitigate cardiovascular risk, and can provide crucial information for delivery planning. Early involvement or referral to an expert facility with a multidisciplinary cardio-obstetrics team is imperative for high-risk pregnant patients with CVD.

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