Revisiting Peripartum Cardiomyopathy: A Subsequent Pregnancy

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Abstract

Peripartum cardiomyopathy, or pregnancy-associated cardiomyopathy, is the development of left ventricular dysfunction usually occurring during the last trimester of pregnancy, shortly after delivery, or five months postpartum. As a result of the cardiovascular strain of pregnancy, patients who have developed peripartum cardiomyopathy, particularly those with persistent left ventricular dysfunction, are strongly advised against subsequent pregnancies. If a subsequent pregnancy should occur in the setting of a diminished left ventricular ejection fraction, the risk of fetal and maternal morbidity and mortality increases significantly. This case describes a 25-year-old Caucasian female patient who became pregnant eighteen months after developing peripartum cardiomyopathy. Several researchers have recognized the association between barriers to adequate care and increased development of peripartum cardiomyopathy in both a rural and global setting. Literature has shown that expectant mothers from under-served areas, those of African descent and those who smoke, have hypertension, or use cocaine carry a greater risk of developing peripartum cardiomyopathy. Therefore, in addition to the related complications of peripartum cardiomyopathy, practitioners in under-served areas with high-risk populations should be aware of the risk factors and pathophysiologic manifestations inherent with the disease.

Introduction

Peripartum cardiomyopathy (PPCM) or pregnancy-associated cardiomyopathy is a rare complication for expectant mothers, in which a patient develops left ventricular (LV) dysfunction typically between the last month of pregnancy and five months postpartum. Although the United States’ incidence of PPCM ranges between 1:1,300 and 1:15,000, it accounts for 11-20% of maternal mortality. Because the signs and symptoms of PPCM mimic common complaints in pregnancy—namely pedal edema and dyspnea—the diagnosis of PPCM is difficult to ascertain clinically. However, because of the high mortality associated with PPCM, prompt diagnosis and cardiac monitoring are required to prevent sudden cardiac death. Taking into account the teratogenicity of ACE inhibitors and angiotensin II receptor blockers, the preferred treatment for patients diagnosed with PPCM includes non-selective beta-blockers and diuretics, but can also require ionotropic agents, antihypertensives, vasodilators, antithrombotic therapy, ventricular assist devices and, in extreme cases, heart transplant.

After a patient’s initial presentation, the risk of PPCM remains increased throughout later pregnancies, increasing morbidity and mortality due to the added hemodynamic stress on cardiac function. This particular case highlights the importance of adequate healthcare access, which can prove challenging in under-served areas. Here we examine a patient diagnosed with PPCM who underwent a subsequent pregnancy, acknowledging the myriad factors involved in access to proper care.

Case Presentation

A 25-year-old gravida 5, para 0222 at 36 1/7 weeks was evaluated in labor and delivery for a headache and blurry vision. During this encounter, the patient was diagnosed with severe gestational hypertension, as her blood pressure increased to 162/93, which in addition to her acute neurological symptoms, warranted further investigation. The patient was admitted for maternal-fetal monitoring and administration of labetalol, as needed. Preeclampsia was ruled out with a 24-hour urine protein of 195 mg/24 hours (normal <300 mg/24 hours). Two days later, the patient spontaneously ruptured her membranes and progressed to deliver a boy weighing 7 lbs., 4 oz. by normal spontaneous vaginal delivery. Over the next few days, the patient’s blood pressure normalized, and she was sent home on postpartum day three with no need for antihypertensive medications upon discharge. Approximately two weeks later, the patient was readmitted with dyspnea, orthopnea, and edema. An electrocardiogram
showed sinus tachycardia without atrial fibrillation, and a chest x-ray showed an enlarged cardiac silhouette, indicating volume overload (Figure 1). Brain natriuretic peptide (BNP) was drastically elevated at 676.3 pg/mL (normal <100 pg/mL), and a subsequent echocardiogram showed a dilated LV with an ejection fraction (EF) of 40-45%, confirming the diagnosis of PPCM. Twelve days later, the patient’s cardiorespiratory status had stabilized, and she was discharged on carvedilol, lisinopril, and furosemide. Within the next eighteen months, her echocardiogram showed improvement, as her left ventricular ejection fraction (LVEF) increased to greater than 55%, indicating a return to normal heart function. Despite being advised that a future pregnancy could severely worsen her condition, the patient soon became an expectant mother. Since her LV function had recovered prior to the pregnancy, both Maternal-Fetal Medicine (MFM) and Cardiology consultants felt guardedly optimistic regarding the continuation of the pregnancy but discontinued her lisinopril due to its potential teratogenicity. The MFM specialist and cardiologist devised a monitoring system by which impedance cardiography and echocardiograms were scheduled every trimester, and fetal growth ultrasounds were performed monthly. Biweekly testing with a biophysical profile and non-stress test were initiated at 32 weeks. The patient went into spontaneous labor at 35 2/7 weeks and delivered a second baby boy, also weighing 7 lbs., 4oz. A postnatal echocardiogram showed LV hypokinesis and impaired relaxation, with an EF of 45%, consistent with a diagnosis of recurrent PPCM. After four weeks, the patient’s LVEF had again normalized to greater than 55%. Following the recommendation of her management team, the patient underwent a tubal ligation six weeks postpartum, and lisinopril was reintroduced into her medication regimen. Three years following her fourth delivery, the patient’s echocardiogram, and BNP have remained within normal limits, and she exhibits no symptoms of heart failure.

**Discussion**

Ritchie and Virchow in 1849 first recorded clinical presentations consistent with PPCM, but Gouley and colleagues formally recognized it as a condition in 1937, defining it as an enlarged heart occurring during pregnancy. Expectant mothers from under-served areas, those of African descent and those who smoke, have hypertension or use cocaine carry a greater risk of developing PPCM. Expectant mothers in developing countries such as Haiti and Nigeria (especially in the city of Zaria), where the incidence can be as frequent as 1:300 to 1:100, respectively. Higher rates are found in developing countries such as Haiti and Nigeria (especially in the city of Zaria), where the incidence can be as frequent as 1:300 to 1:100, respectively. Within the United States, rates of PPCM are highest in African-Americans and those who have limited access to medical care due to socioeconomic factors. It accounts for 11-20% of maternal mortality, primarily related to sudden cardiac death, progressive heart failure, and cardiac-related thromboembolism. Multiple gestations, maternal age greater than 30 years, obesity, African-American ethnicity, pre-
eclampsia, and hypertension are the most commonly cited risk factors. Additionally, viral infection, abnormal immune response, genetics and prolactin have been proposed as etiologies for PPCM. Ultimately, the definitive causal pathophysiology of PPCM has not yet been identified.

Pregnancy results in many changes in a woman’s body, with the earliest adaptations five to eight weeks into gestation. At the onset of the second trimester, circulating intravascular blood volume increases by 50% above baseline, thereby increasing preload. This increase, coupled with an afterload reduction from peripheral vasodilation and the opening of the uterine circulation beds, consequently increases cardiac output (CO). Initially, the rise in CO is primarily due to an upsurge in stroke volume (SV), as CO is the product of SV x heart rate (HR). However, in the third trimester, CO is driven 30-50% above baseline by a 15-20% increase in HR. During labor, CO naturally increases with pain-mediated sympathetic discharge and with an “auto-transfusion” of 500cc of blood, which enters the intravascular space with each uterine contraction. Further changes arise from blood loss during the third stages of labor, as well as with mobilization of interstitial fluids into the intravascular space occurring during the fourth stage. Conversely, CO can be decreased by up to 25% with left lateral decubitus positioning during labor, and peripheral vasodilation from an epidural.

Left ventricular remodeling occurs throughout pregnancy with eccentric hypertrophy; therefore, a reduced contractile reserve, especially with concomitant hypertensive disease, may place a patient at further risk for PPCM. When the adaptations above fail, signs and symptoms of congestive heart failure arise, namely, fatigue, edema, paroxysmal nocturnal dyspnea, orthopnea, chest pain, cough, pulmonary rales, regurgitant cardiac murmurs, and an elevated jugular venous pressure.

Delivery of patients with PPCM is optimally executed when the patient is managed in a facility comfortable with high-risk pregnancies, as continuous maternal-fetal monitoring is recommended. Although no established protocols for managing subsequent presentations currently exist, the standard principles of managing heart failure apply, of which beta blockers and diuretics are the mainstays. Long-acting nitrates and hydralazine can be substituted for the teratogenic angiotensin-converting enzyme (ACE) inhibitors to decrease both preload and afterload, especially during labor. At present, there are no contraindications to administration of anesthesia or induction of labor with either oxytocin or prostaglandins. Assisting maternal effort in the second stage of labor with an operative vaginal delivery is preferred to cesarean delivery, owing to the increased risk of excessive blood loss or venous thromboembolism with surgery. Positive outcomes following delivery occur when LV size and EF stabilize; however only 23% to 50% of patients fully recover within six months, and 20% of patient courses either end in maternal mortality or necessitate a transplant. Overall, 10-20% of patients with recovered EFs relapse in a subsequent pregnancy. If the LVEF is compromised at the onset of a subsequent pregnancy, the incidence of deterioration is ~45%. Likewise, persistently decreased LVEF increases the incidence of preterm delivery, maternal symptomatology, and both maternal and fetal mortality. Despite claims that exercise or dopaminergic stress testing can predict favorable outcomes in subsequent pregnancies, because gravidity is a known physiologic stressor, pregnancies following PPCM can lead to further cardiovascular compromise and are thus discouraged.

Several researchers have recognized the association between barriers to adequate care and increased development of PPCM in both a rural and global setting. Many authors conclude that higher rates in Haiti and both southern and western Africa are due to low socioeconomic status, malnutrition and poor adherence to medical recommendations — factors also present in rural, under-served regions of the United States. According to the United States Census Bureau, the vast majority of West Virginia’s counties are classified as rural areas, restricting convenient access to medical care due to their low physician-to-patient ratios. An American College of Obstetrics and Gynecology Committee Opinion in 2014 found that fewer than half of rural-dwelling patients live within 30 minutes of medical care, and nearly 14% are more than an hour away. This provides a risk of increased morbidity and mortality from PPCM for West Virginian patients, who reside in rural communities. With signs and symptoms difficult to distinguish from common pregnancy complaints, another barrier to medical resources for patients with PPCM are encountered increasing the risk of preventable consequences. Given these restrictions to hospital access, providers in under-served areas should have a low threshold for intervention in patients with suspected PPCM, and be able to provide diligent monitoring and effective continuity of care once the diagnosis has been made.
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Conclusions

In summary, PPCM can have catastrophic consequences for patients, both during and after pregnancy, hence the recommendation of medical professionals to avoid subsequent pregnancies, either through the use of consistent barrier methods, estrogen-free contraceptives, or through surgical intervention (i.e., tubal ligation or vasectomy). The risk of deterioration in cardiac function and subsequent perinatal morbidity/mortality depend upon the LVEF prior to pregnancy, as well as the duration of LV dysfunction. However, the fact that under-served populations are highly susceptible to the adverse consequences of PPCM warrants rural providers to be well aware of this life-threatening pathology and provide prompt diagnosis and management, with strict monitoring and outpatient follow-up to ensure optimal outcomes.

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