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Two cases of coronavirus 2019–related cardiomyopathy in pregnancy

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At our institution, 2 of the initial 7 pregnant patients with confirmed coronavirus disease 2019 severe infection (28.6%; 95% CI, 8.2%–64.1%) developed cardiac dysfunction with moderately reduced left ventricular ejection fractions of 40%–45% and hypokinesis. Viral myocarditis and cardiomyopathy have also been reported in nonpregnant coronavirus disease 2019 patients. A case series of nonpregnant patients with coronavirus disease 2019 found that 33% of those in intensive care developed cardiomyopathy. More data are needed to ascertain the incidence of cardiomyopathy from coronavirus disease 2019 in pregnancy, in all pregnant women with coronavirus disease 2019, and those with severe disease (eg, pneumonia). We suggest an echocardiogram in pregnant women with coronavirus disease 2019 pneumonia, in particular those necessitating oxygen, or those who are critically ill, and we recommend the use of handheld, point-of-care devices where possible to minimize contamination of staff and traditional large echocardiogram machines.

Key words: COVID-19, novel coronavirus, pregnancy, cardiomyopathy

Coronavirus disease 2019 (COVID-19) is a novel coronavirus disease currently responsible for the pandemic. In the largest cohort to date of more than 44,000 individuals from China with COVID-19 infection, 81% had mild symptoms up to mild pneumonia, 14% had severe disease (dyspnea, hypoxia, or greater than 50% lung involvement on imaging), and 5% had critical disease (respiratory failure, shock, or multiorgan system dysfunction).[1] It must be noted that in the original report, asymptomatic patients were not tested. Of those with severe disease, the case fatality rate was 49%, whereas the overall case fatality rate was 2.3%.[1] As most healthcare systems and countries are only testing symptomatic patients, the true prevalence of COVID-19 infection is unknown, as well as its true infection fatality rate, which has been recently estimated at about 0.66%.[2] Viral myocarditis and cardiomyopathy have been reported in nonpregnant COVID-19 patients.[3,4] A case series of nonpregnant COVID-19 patients in Washington State demonstrated that 33% of those in intensive care developed cardiomyopathy.[3] Information on COVID-19 in pregnancy is currently limited.[4-6] We are not aware of cardiomyopathy reported in pregnant women with COVID-19 infection. We present 2 of the first 7 pregnant patients with confirmed COVID-19 at a single tertiary care center who presented during March 2020 and developed cardiomyopathy.

Case Series

Case 1

A 45-year-old, gravida 4, para 2, African American at 39 weeks and 2 days of gestation presented with contractions and emesis on March 25, 2020. The patient had a history of 2 full-term vaginal deliveries and was a diet-controlled gestational diabetic (GDMA1). Her body mass index (BMI) was 44.6 kg/m^2. Her medical history was significant just for obesity and advanced maternal age. Her only medication was a daily prenatal vitamin. The patient had no known contact with COVID-19 cases and had not traveled outside of the United States in the past month. She was found to have tachycardia with a heart rate (HR) of 120s beats/min, fetal tachycardia with baseline fetal heart rate of 170 beats/min, and initial temperature of 99.6°F. She was admitted for intravenous (IV) fluid hydration and prolonged monitoring. A fever of 100.8°F developed in the patient 2 hours after admission, and workup revealed a chest radiograph with pulmonary edema and a ground-glass appearance. Six hours after presentation, she developed severe range hypertension with blood pressure of 183/114 mm Hg, HR of 130 beats/min, respiratory rate (RR) of 26 breaths/min, temperature of 100.7°F, and oxygen saturation (SpO_2) of 96%. Given the severe range blood pressures, a preeclampsia panel was sent that revealed proteinuria of 1+, platelets of 274,000 per mcL, aspartate aminotransferase (AST) of 32 IU/L, and alanine aminotransferase (ALT) of 24 IU/L. A diagnosis of preeclampsia was established, and magnesium sulfate was initiated for seizure prophylaxis. The patient's RR increased to 40 breaths/min and SpO_2 dropped to 80% on oxygen via nasal cannula. After discussion with maternal-fetal medicine, anesthesia, general obstetrics and gynecology, and cardiology, the decision was made to deliver the fetus to aid maternal resuscitation. The patient underwent a primary cesarean delivery 7.5 hours after presentation on March 26, 2020. On postoperative day (POD) 0, maternal arterial blood gas (ABG) showed a pH of 7.27, pCO_2 of 31 mm Hg, pO_2 of 117 mm Hg, HCO_3 of 16 mEq/L, and a base excess (BE) of −11 mmol/L. A repeat chest radiograph revealed small peripheral bilateral opacities with differential diagnoses including atypical pneumonia, viral pneumonia, and congestive heart failure. Owing to suspicion of congestive heart failure, magnesium sulfate was discontinued and furosemide was administered intravenously. Cardiology was consulted to perform an

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echocardiogram, which showed a moderately reduced left ventricular ejection fraction (LVEF) of 40% with global hypokinesis, and she was diagnosed with acute heart failure with reduced EF. Given the clinical picture of fever, tachypnea, and chest radiograph findings amidst the background of a pandemic, a GeneXpert COVID-19 RNA polymerase chain reaction test was performed that returned positive. Further laboratory investigation found a normal troponin of 0.046 ng/mL, a brain natriuretic peptide (BNP) of 114 pg/mL (normal <100 pg/mL), and a procalcitonin of 0.13 ng/mL (normal <0.10 ng/mL). On POD 4, chest radiograph demonstrated worsening bilateral lung infiltrates, and despite oxygen therapy, SpO_2 could not be maintained above 90%. An electrocardiogram (ECG) was performed with nonspecific T-wave abnormalities on an otherwise normal ECG, with a QT/QTc of 354/465 ms (both normal). Serum potassium was 3.7 mEq/L (normal). As the patient's condition failed to improve, she was started on 60-mg methylprednisolone IV every 3 hours and 400-mg hydroxychloroquine orally every 12 hours for 24 hours, followed by 400 mg orally daily. That evening, after the initial doses were administered, she began desaturating to 86% on 6 L of nasal cannula. An ABG revealed a pH of 7.07, pCO_2 of 75 mm Hg, pO_2 of 85 mm Hg, HCO_3 of 21.7 mEq/L, and a BE of −2 mmol/L. She was placed on a nonrebreather at 15 L, which initially improved SpO_2 to 90%, and on POD 4, 100-mg methylprednisolone IV daily was started. On POD 5, the patient again desaturated to 80%. As our institutional COVID-19 protocol calls to avoid noninvasive mechanical ventilation that could aerosolize viral particles, the patient was intubated by anesthesia, but without improvement. HR decreased to the 30s, and the patient developed pulseless electrical activity. Cardiopulmonary resuscitation (CPR) was initiated, and return of spontaneous circulation was obtained after 5 minutes of CPR. After arrest, her troponin level peaked at 0.930 ng/mL (normal <0.4 ng/mL), with a BNP of 323 pg/mL. After CPR, the patient was started on a norepinephrine drip, initially at 8 mcg/min and titrated up to a maximum of 20 mcg/min. The patient was administered 1 dose of 800-mg tocilizumab IV, an interleukin-6 (IL-6) receptor antagonist. As of the writing of this article (April 2, 2020), the patient is currently at POD 7 and remains intubated and ventilated in the intensive care unit and is arousable and moving all 4 extremities, with SpO_2 of 96%, continuance of norepinephrine drip at 20 mcg/min, 100-mg methylprednisolone IV daily, and 400-mg hydroxychloroquine orally daily. Her significant laboratory values are troponin 0.046 ng/mL and a markedly elevated procalcitonin of 48.21 ng/mL.

Case 2

A 26-year-old, gravida 3, para 1, Latin American woman at 33 weeks and 6 days of gestation presented with shortness of breath, dyspnea, and decreased fetal movement on March 27, 2020. The patient has a history of 1 full-term vaginal delivery, and the patient's husband was diagnosed as having COVID-19 infection. Her BMI was 37 kg/m^2. Her medical history was significant also for polycystic ovary syndrome, and her only medication was a daily prenatal vitamin. The patient's initial vital signs were HR of 130s beats/min, BP of 110s/70s mm Hg, RR in the mid-20 breaths/min, SpO_2 of 95%, and initial temperature of 99.3°F. SpO_2 improved to 97% on 2-L nasal cannula. About 8 hours after presentation, her RR increased to 40 breaths/min, with HR of 130 breaths/min, and SpO_2 of 95%. An ABG showed a pH of 7.32, pCO_2 of 18 mm Hg, pO_2 of 107 mm Hg, HCO_3 of 14 mEq/L, and BE of −14 mmol/L. Chest radiograph demonstrated bilateral infiltrates. Workup for metabolic acidosis with respiratory alkalosis was significant for an anion gap of 19, which when investigated only found an elevated beta-hydroxybutyrate of 3.61 mmol/L (normal 0.02−0.27 mmol/L). Lactic acid was 0.6 mmol/L (normal 0.4−2.0 mmol/L), and the other differential diagnoses for anion gap acidosis were ruled out. Because there was suspicion for COVID-19 infection, a general respiratory panel was sent and was negative, C-reactive protein (noncardiac) was 7.68 mg/dL (normal <3.0 mg/L), ferritin was 86 ng/mL, BNP was <10 pg/mL, procalcitonin of was 0.17 ng/mL, troponin-I was <0.015, AST was 47 IU/L, and ALT was 52 IU/L. Becton Dickinson COVID-19 testing, which was sent on March 28, 2020, returned positive. The patient was managed with fluid restriction, supplemental oxygen via nasal cannula, ceftriaxone IV, and azithromycin IV. Given our contemporary experience with the patient presented in case 1, out of precaution an echocardiogram was performed that found a moderately reduced LVEF of 40%−45% with global hypokinesis. Her SpO_2 was 96% on room air. Despite her reduced EF, cardiology did not feel she was clinically in acute heart failure; 12.5-mg metoprolol twice daily was initiated, and the patient was placed on a telemetry monitoring. HR was in the 100s beats/min, BP of 110s/70s mm Hg, and RR of 20s breaths/min, with ABG showing a pH of 7.42, pCO_2 of 28.7 mm Hg, pO_2 of 101 mm Hg, HCO_3 of 18.8 mEq/L, and BE of −6 mmol/L. Given the unknown course of COVID-19 in pregnancy, as a precaution, and in an effort to deliver the patient before she became critically ill, the patient underwent a primary cesarean delivery on April 1, 2020, and recovered with continuous telemetry monitoring. As of the writing of this article (April 2, 2020), the patient is currently stable on day 7 of hospital admission and POD 1 from cesarean delivery. She is meeting her POD 1 surgical goals, with an improved respiratory status and SpO_2 of 96% on room air. However, the patient developed supraventricular tachycardia (SVT) overnight; therefore, cardiology increased her metoprolol from 12.5 mg orally every 12 hours to 25 mg every 12 hours. Of note, during her entire hospitalization, fever >100.4°F never developed in the patient. As per the Centers for Disease Control and Prevention, both the mother and neonate are being isolated from the general postpartum population in negative pressure rooms with droplet isolation.

Discussion

A review of literature demonstrates that cardiomyopathy is a frequent finding in

up to 33% of critically ill nonpregnant patients with COVID-19.[3,4] It is unknown if the rate of developing COVID-19 cardiomyopathy is exacerbated in the pregnant population or similar to the rate in nonpregnant patients. In addition, it is unclear whether the high rate of cardiomyopathy reported in the case series of nonpregnant patients is secondary to multisystem organ dysfunction or a direct COVID-19 complication. It must be highlighted that our cohort of COVID-19–positive pregnant women is currently limited and that we are only testing symptomatic pregnant patients; the association between cardiomyopathy and COVID-19 infection in pregnancy is possibly less strong than what we found. Our 2 patients had some risk factors for cardiac disease, including race/ethnic group, obesity, and in 1 case, advanced maternal age.

Pregnancy is an immunocompromised state in which the cardiovascular demands are increased. It is a state of compensated respiratory alkalosis with metabolic acidosis that is vulnerable to respiratory diseases such as COVID-19. Of the respiratory parameters, RR remains unchanged in healthy pregnancy, and the finding of tachypnea is a significant finding and should prompt practitioners to further examine the patient. Although tachypnea and shortness of breath are not unique findings to COVID-19 infection or cardiomyopathy, in the critically ill pregnant COVID-19 woman, or even in the pregnant woman with COVID-19 pneumonia necessitating oxygen, given also the evidence from the nonpregnant literature, performing an echocardiogram should be considered to evaluate for cardiomyopathy. Furthermore, to minimize exposure to echocardiographers and to avoid contamination of the traditional echocardiogram machines that could serve as a fomite and infect the next patient, a policy is suggested whereby board-certified echocardiography cardiologists perform the study with, for example, a point-of-care handheld General Electric Vscan echocardiography device. This small device is easy to decontaminate and of good technical quality, and images are stored, downloaded into the patient's electronic medical record, and interpreted into a formal report. The management, evaluation, and ability to anticipate complications in pregnant patients are critical in this COVID-19 pandemic; more experience is needed. ■

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