

First Report of Rhinovirus-Associated Respiratory Distress in an Otherwise Healthy Pregnant Patient

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Abstract

Introduction: The physiologic changes of the respiratory system during pregnancy leave patients increasingly susceptible to viral respiratory disease. There are no documented cases of isolated rhinovirus in pregnancy causing respiratory distress requiring positive pressure ventilation.

Case: A 25-year-old primigravida at 28 weeks gestation reporting upper respiratory symptoms. She became tachycardic, tachypneic and hypoxic despite IV fluids and oxygen by nasal cannula. She was transferred to the ICU and transitioned to positive pressure ventilation via high-flow nasal cannula. Workup was notable only for rhinovirus. She improved following overnight observation in the ICU without need for endotracheal intubation.

Conclusion: We describe the first documented case of rhinovirus causing respiratory distress requiring positive pressure ventilation in a healthy pregnant patient, and the first to demonstrate the safe, effective use of high-flow nasal cannula in the critically-ill pregnant patient.

Keywords: Human rhinovirus; Pregnancy; Respiratory distress

Introduction

The expected physiologic changes of the respiratory system during pregnancy leave pregnant patients increasingly susceptible to the effects of viral respiratory disease [1]. Throughout the course of pregnancy, levels of progesterone rise to 150 ng/mL at term, resulting in a state of functional hyperventilation as progesterone is a known stimulant of respiratory drive [1,2]. Various anatomic changes take place as well, including an elevation of the diaphragm by up to 4 cm and a decrease in functional residual capacity (FRC) [3-5]. Altogether, the alterations of the respiratory system in pregnant women result in a compensated respiratory alkalosis. Additionally, the pregnant state is notable for changes to the upper respiratory system to include glandular hyperactivity, increased amount of acid mucopolysaccharides in the nasal mucosa and increased phagocytic activity [6]. Additionally, changes to the immune system include a decrease in cytotoxic lymphocytic activity [1]. Taken together, these physiologic alterations leave pregnant women at increased risk of the deleterious effects of viral respiratory disease.

Human rhinovirus (HRV) is a common cause of acute respiratory illness among pregnant patients, causing both acute upper respiratory tract infections and acute lower respiratory tract infections. A recent study by Hause et al. analysed nasopharyngeal secretions in pregnant women in their second and third trimester presenting with symptoms of acute respiratory infection and identified HRV as the most commonly detected pathogen, with 27% of cases testing positive [7]. Most often, symptoms are mild to moderate and can be treated in the outpatient setting. In fact, despite its prevalence, there are no documented cases of HRV infection in pregnancy causing severe respiratory distress.

Case Report

A 25-year-old otherwise healthy primigravida at 28 weeks 5 days gestational age presented to the obstetric triage clinic with a four-day history of upper respiratory tract infection symptoms to include cough, as well as muscle soreness, generalized weakness and malaise, chills and diaphoresis. She had no prior history of asthma or reactive airway disease and was a never-smoker. On the day of presentation, the patient described progression of her symptoms to include chest tightness/pressure, dyspnea, palpitations, and pre-syncope symptoms. During

the patient's triage evaluation, she became increasingly tachypneic to 40 breaths per minute, hypoxic with blood oxygen saturation level (SpO₂) of 88% on room, and tachycardic to 150 beats per minute. She was placed on supplemental oxygen by nasal cannula (NC) with improvement in SpO₂ to 97% and received intravenous (IV) fluid resuscitation with subsequent mild improvement in her tachycardia to 130 beats per minute. However, she was becoming increasingly somnolent. Due to concerns for maternal fatigue and impending respiratory failure, she was transferred to the intensive care unit (ICU) where she was transitioned to high-flow nasal cannula (HFNC) positive pressure ventilation for oxygen support. Extensive workup included blood, sputum and urine cultures. Laboratory findings were notable only for positive HRV on viral respiratory panel by nasopharyngeal swab. This respiratory panel ruled out Adenovirus, Influenza A and B, Parainfluenza 1, 2 and 3, as well as Respiratory Syncytial Virus as possible contributors. Continuous external fetal monitoring during this time was reassuring for the gestational age. The patient improved following an overnight stay in the ICU and was tapered off HFNC onto supplemental oxygen by NC, transferring out of the ICU after 24 hours. The remainder of her hospital stay was uncomplicated, and she was discharged home on hospital day number four. The patient went on to have an uncomplicated antenatal course thereafter and was admitted to labour and delivery at 39 weeks 3 days gestation in spontaneous labour. She had an uncomplicated vaginal delivery and was discharged home on postpartum day number two.

Discussion

We describe the first documented case of human rhinovirus (HRV) causing severe respiratory distress in pregnancy. Our patient's lack of underlying lung disease or other risk factors and ultimate need for

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escalation of care for positive pressure ventilation increase the rarity of this case presentation, clinical course and management. This case documents the potential morbidity associated with respiratory viruses in pregnancy. While the effects of some respiratory viruses, for instance influenza, on pregnant patients have been well documented, the clinical implications of other common respiratory pathogens in this vulnerable patient population remains less well known [8]. Recently, a case series demonstrated the effects of another common respiratory virus, respiratory syncytial virus (RSV), on pregnant women. The case series was the first to highlight the morbidity associated with a non-influenza viral respiratory infection in pregnancy. Specifically, three pregnant patients in their third trimester are reported to have had RSV-mediated respiratory complications, two of three had histories of mild, intermittent asthma and were active smokers and ultimately required intubation for mechanical ventilation; the third had no underlying risk factors for complications and was managed as an outpatient only [9].

To identify the frequency of acute respiratory illness in pregnant patients and to further describe the clinical presentation and outcomes, Hause et al. evaluated patients in their second and third trimester presenting with symptoms of acute respiratory illness and compared their respiratory cultures to asymptomatic controls. HRV was the most commonly identified pathogen among both cases and controls, with, as expected, a statistically significant higher incidence among cases. Interestingly, while HRV is most commonly associated with the common cold and upper respiratory infection symptoms, several HRV cases in this study identified symptoms of lower respiratory tract infection, defined as difficulty breathing or shortness of breath, wheezing, or cyanosis [7]. This is consistent with our patient, who presented with dyspnea. In turn, our case reconfirms Hause et al's findings that respiratory viruses in pregnancy can in fact be associated with significant morbidity.

Our case also identifies the effectiveness of high-flow nasal cannula in pregnant patients with respiratory distress as an alternative to the more cumbersome noninvasive mechanical ventilation modalities, such as continuous positive airway pressure (CPAP), and/or intubation. While high-flow nasal canal has been shown to be non-inferior to CPAP in acute hypoxemic respiratory failure in certain patient populations, our case is the first to demonstrate its potential safe and effective use in pregnant patient despite the physiologic changes of the respiratory system [10,11]. The proposed benefits of high-flow nasal cannula include maintenance of a consistent FiO_2 , generation of a positive end-expiratory pressure (PEEP), decrease in the anatomical dead space, improved mucociliary clearance and decreased work of breathing [10]. Additionally, high-flow nasal cannula is user friendly, patient preferred and can be used in low-monitoring, low-resource settings. It has been shown to be effective in patients suffering from acute hypoxemic respiratory failure or respiratory distress syndrome (ARDS) and decreases the subsequent need for intubation or days on ventilator if intubation is required [10]. Our case exemplifies the safe use of high-flow nasal cannula in a pregnant patient. In fact, the PEEP effect as well as the improvement in mucociliary clearance associated with high-flow nasal cannula likely prove even more beneficial in the

pregnant population given the known alterations of the respiratory tract in pregnancy.

Conclusion

The common respiratory pathogen HRV has not been previously reported to be associated with significant morbidity in pregnancy. An absence of underlying lung disease or additional risk factors such as smoking makes our case report increasingly unique. Additionally, we report a single case of safe and successful use of high-flow nasal cannula in pregnancy for positive pressure ventilation as treatment for respiratory distress, allowing for avoidance of the more cumbersome CPAP and/or intubation.

Teaching Points

1. Pregnant patients are more susceptible to and more severely affected by respiratory illnesses due to the normal physiologic changes of pregnancy.
2. Human rhinovirus is a common respiratory pathogen only rarely associated with morbidity in pregnancy in those without underlying lung disease or additional risk factors.
3. Though high-flow nasal cannula has not been studied in pregnant patients with acute respiratory distress syndrome, our case suggests both its safe and effective use with successful avoidance of intubation.

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