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## Case report

## Acute Respiratory Distress Syndrome in a pregnant patient with COVID-19 improved after delivery: A case report and brief review

Josebelo Chong, MD<sup>a,\*</sup>, Siraj Ahmed, MD, FCCP<sup>a</sup>, Kyle Hill, DO<sup>b</sup><sup>a</sup> San Joaquin Critical Care Medical Group, Stockton CA, USA<sup>b</sup> St. Joseph's Medical Center Emergency Medicine Residency, Stockton CA, USA

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## ABSTRACT

Acute Respiratory Distress Syndrome (ARDS) can frequently occur as a complication of Coronavirus Disease 19 (COVID-19). As the number of COVID-19 cases increases around the world, it is inevitable that COVID-19 and ARDS will complicate some pregnancies. Currently, there is scant data to guide decision-making on the timing of delivery for these patients. We present the case of a 41-year-old patient with severe ARDS from COVID-19 who was also 32 weeks pregnant, whose respiratory status improved dramatically after delivery.

## 1. Introduction

The COVID-19 pandemic has caused significant morbidity and mortality around the world. The causative virus, Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) affects a wide spectrum of people, ranging from the healthy to those with multiple comorbidities. Treatment protocols are variable within and between institutions, and change frequently as more data and evidence accumulates.

Pregnant women have not been spared from the effects of the pandemic. A recent review showed that out of 538 pregnancies complicated by COVID-19, maternal ICU admission occurred in 3%, maternal critical disease in 1.4%, with no maternal deaths [1]. While encouraging, this also reflects that there is very little data to guide the timing of delivery in pregnant patients who are critically ill from COVID-19. We report the case of a patient who developed severe ARDS from COVID-19, who was also 32 weeks pregnant.

## 2. Case presentation

A 41-year-old female, G5P4, 32 weeks pregnant, presented to our emergency department complaining of dry cough, shortness of breath, and headache of about 3 days duration. She had been receiving regular prenatal care, and there were no reports of diabetes mellitus, hypertension, bronchial asthma, or other comorbidities. Her BMI was 35.6.

Vital signs on admission reflected normal blood pressure with a heart rate of 99 bpm and respiratory rate of 24 bpm. Initial oxygen saturations were 93–96% on room air. A chest x-ray showed diffuse bilateral alveolar infiltrates (Fig. 1). She was admitted to a general medical floor with a diagnosis of sepsis (fulfilling SIRS criteria for heart rate and respiratory rate, with a suspected infection) from community acquired pneumonia and started on empiric antibiotic therapy with ceftriaxone and azithromycin. A few hours later, the COVID-19 PCR swab that was done on admission returned a positive result.

Unfortunately, while being monitored on a general medical floor, her oxygenation was noted to steadily worsen. Around 15 hours post-admission, saturations dropped below 90%, and she was consequently started on supplemental oxygen at 3 L/min. At around 24 hours post-admission, with ongoing desaturations, oxygen via high flow nasal cannula (HFNC) was started. It was set at a 40 L flow with 100% FiO<sub>2</sub>. An ABG done at that time revealed a PaO<sub>2</sub> of 111 mmHg (PaO<sub>2</sub>:FiO<sub>2</sub> ratio of 111, indicative of moderate ARDS). She was transferred to the intensive care unit. A repeat ABG done 7 hours later (31 hours post-admission) revealed progressively worsening oxygenation, with a PaO<sub>2</sub> of 89 mmHg (PaO<sub>2</sub>:FiO<sub>2</sub> ratio of 89, indicative of severe ARDS). A dose of furosemide 40 mg was given intravenously, with no effect. Intravenous dexamethasone was started. The decision was made to intubate.

The OB service had been actively involved in the care since

\* Corresponding author.

E-mail address: [dr.jb.chong@gmail.com](mailto:dr.jb.chong@gmail.com) (J. Chong).<https://doi.org/10.1016/j.rmcr.2020.101171>

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admission. When the decision was made to intubate, the possibility of delivery was discussed by the critical care and OB services. However, an ultrasound had revealed placenta previa with possible accreta, and it was felt that the patient would be at high risk for complications. The pregnancy was not felt to be contributing to the patient's condition, and the fetus was not exhibiting any signs of distress. There was no vaginal bleeding. Hence it was decided that urgent delivery was not indicated.

Thirty-five hours post-admission, endotracheal intubation was performed in the operating room, with a setup for possible emergency caesarian section. The intubation itself was uneventful. Medications for that included sevoflurane, rocuronium, and succinylcholine. However, immediately post intubation, the patient's respiratory status became unstable, and ventilator settings were rapidly increased to a PEEP of 20 cmH<sub>2</sub>O and an FiO<sub>2</sub> of 100%. The ABG done immediately on those settings revealed a PaO<sub>2</sub> of 59 mmHg (PaO<sub>2</sub>:FiO<sub>2</sub> ratio of 59).

The patient was transferred back to the ICU. Sedation was initiated with fentanyl and midazolam infusions, with intermittent doses for breakthrough pain and agitation. A repeat ABG done 2 hours after intubation revealed improved oxygenation with a PaO<sub>2</sub> of 150 mmHg (PaO<sub>2</sub>:FiO<sub>2</sub> ratio of 150). Ventilator settings were adjusted to ensure that tidal volume was no greater than 6 mL/kg. Plateau pressure was checked and found to be 39 cmH<sub>2</sub>O. PEEP was decreased from 20 cmH<sub>2</sub>O to 15 cmH<sub>2</sub>O.

Thirty-eight hours post-admission, the patient unfortunately developed vaginal bleeding. Emergency cesarean section was performed in the operating room. Medications for that included sevoflurane, rocuronium, midazolam, fentanyl, oxytocin, phenylephrine, and intravenous bicarbonate. The baby was delivered and noted to be limp with no spontaneous breathing, with an Apgar score of 0, 5, and 7, leading to the infant being intubated. In addition, the infant had a drop in heart rate to 60 and brief compressions were performed. From a maternal standpoint, the procedure was otherwise unremarkable, with no intraoperative respiratory complications.

Postoperatively, the patient was transferred back to the ICU. Ventilatory support was maintained at preoperative settings: PEEP of 15 cmH<sub>2</sub>O and FiO<sub>2</sub> of 100%. ABG performed at 41 hours post-admission (6 hours post-intubation and 2 hours post-delivery) revealed PaO<sub>2</sub> of 438 mmHg (PaO<sub>2</sub>:FiO<sub>2</sub> ratio of 438). Plateau pressure had come down

to 25 cmH<sub>2</sub>O. Convalescent plasma was given. Over the next 24 hours, the patient's oxygenation improved, and PEEP and FiO<sub>2</sub> were able to be weaned down to 10 cmH<sub>2</sub>O and 40%, respectively. ABG demonstrated a PaO<sub>2</sub> of 92 mmHg. Over the next several days, oxygenation continued to improve and ventilator settings were gradually weaned. On the seventh hospital day (four days after intubation and delivery), the patient was successfully liberated from mechanical ventilation to 3 LPM via nasal cannula. She was transferred out of the ICU shortly after that. Outside of the ICU, her oxygen requirements continued to improve. After 3 more days, she was transitioned to room air, without any further episodes of hypoxemia. The remainder of her hospital course was largely unremarkable. On the 12th hospital day (nine days after intubation and delivery), she was discharged from the hospital.

As far as the infant, his hospital course was notable for negative COVID PCR at 24 and 48 hours post-delivery. Additionally, he was successfully extubated 48 hours following delivery and remained stable from a respiratory standpoint. No subsequent COVID PCR tests were done after 48 hours. Placental tissue was sent for pathology and showed no significant abnormalities. The placental tissue itself was not tested for COVID RNA.

### 3. Discussion

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening syndrome characterized by bilateral pulmonary opacities not fully explained by effusions, lobar/lung collapse, nodules, or fluid overload, occurring or worsening within a one week time frame, with a PaO<sub>2</sub>:FiO<sub>2</sub> ratio of  $\leq 300$  mmHg [2]. It occurs as a complication of COVID-19 in up to 33% of cases [3].

As the COVID-19 pandemic continues to spread, pregnant patients will continue to be affected as well. Although the incidence of critical illness in pregnancy appears to be low [1], it is not absent, and it is inevitable that more cases will be complicated by ARDS with the passage of time. At this time, there is scant data to guide the timing of delivery in pregnancies complicated by ARDS caused by COVID-19.

A myriad of physiologic changes occur in pregnancy, including elevation of the diaphragm, decrease in total lung capacity, decrease in total lung compliance, and increase in tidal volume. Despite these,

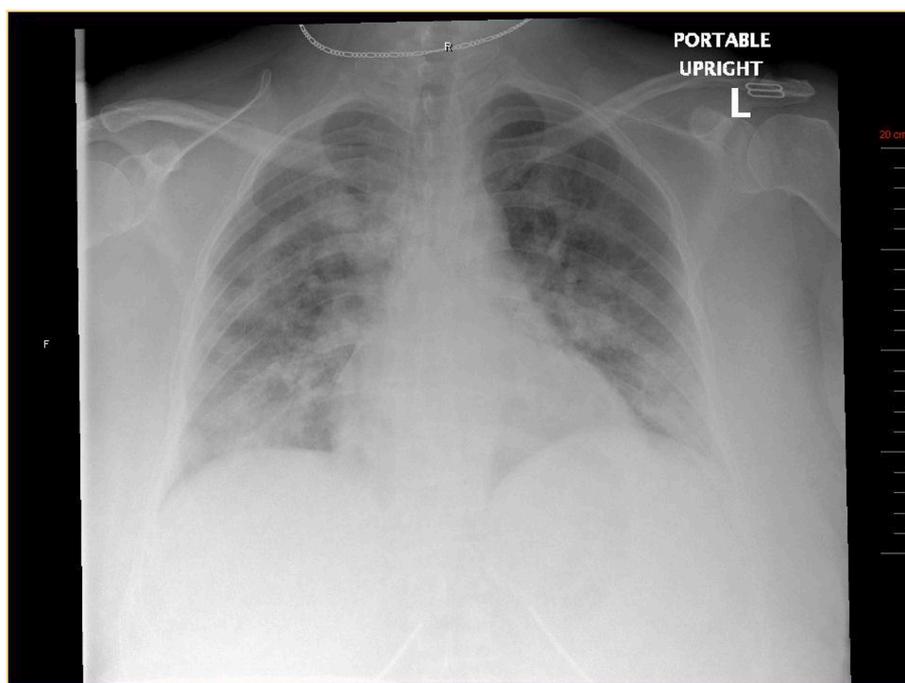


Fig. 1. Chest AP on admission.

management of ARDS in pregnancy does not significantly differ from that of the nonpregnant patient, and still primarily focuses on lung protection through the use of low tidal volume (4–8 mL/kg ideal body weight) and low pressure (plateau pressure <30 cmH<sub>2</sub>O) ventilation [4, 5].

Recent guidelines from the Society for Maternal-Fetal Medicine state that improvement in lung mechanics gained by early delivery is theoretical, and that it is unclear whether delivery provides any substantial improvement. Although mechanical ventilation alone should not be an indication for delivery, it is reasonable to consider delivery in the setting of worsening critical illness [6]. In fact, the Royal College of Obstetricians and Gynaecologists prioritizes the wellbeing of the woman and mentions that urgent birth of the baby may be required to aid in supportive care of a patient with severe or critical COVID-19 [7]. Currently, it is recommended the decision for delivery should be individualized, taking into account gestational age, maternal status, and fetal status. Potential indications for delivery include cardiopulmonary arrest, severe ARDS, or barotrauma [8,9].

Delivery in respiratory-compromised pregnant patients has previously been seen to improve oxygen requirements. However, the effect was neither dramatic nor uniform enough to routinely recommend it [10]. Similarly, in a recent retrospective observational study performed on pregnant women with COVID-19, 4 out of 7 non-intubated patients in respiratory distress had an improvement in oxygenation within hours to days after delivery. Although the possibility of uterine decompression improving respiratory status was mentioned, no specific mechanism was proposed, nor a recommendation given [11].

We have presented the case of a pregnant patient who was critically ill with ARDS from COVID-19, whose oxygenation status rapidly improved after delivery of the baby. Although dexamethasone was administered early in the course and she received neuromuscular blockade for intubation and caesarian section as well, the dramatic improvement in her oxygenation and plateau pressures post-delivery suggests that uterine decompression and improved lung compliance may have been a significant contributing factor. The rapid liberation from the ventilator despite the severity of her illness supports this, as well. We suggest that delivery should be strongly considered as part of the management of critically ill COVID-19 patients who develop rapidly worsening ARDS.

#### Conflicts of interest and funding

The authors certify that they have NO affiliations with or

involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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