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CORRESPONDENCE

General anesthesia for Cesarean delivery in a parturient critically ill with COVID-19: a case report

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To the Editor,

COVID-19 critical illness in pregnant patients is associated with an increased likelihood of Cesarean delivery (CD) (72–84%).[1, 2] We describe the general anesthetic technique for CD and postoperative outcomes of a parturient with COVID-19 acute respiratory distress syndrome (ARDS). Written informed consent for publication was obtained.

A 31-yr-old G3P2 at 26 weeks gestation was intubated in a community hospital for severe COVID-19 ARDS (caused by the Beta and Alpha variant of SARS-CoV-2) associated with fever and hypoxemic respiratory failure (Figure). Upon transfer to Mount Sinai Hospital (Toronto, ON, Canada), the patient received lung protective ventilation in the intensive care unit (ICU) using a pressure control mode. Initial parameters were P_{insp} 16 cm H_2O and positive end-expiratory pressure (PEEP) 10 cm H_2O, targeting a tidal volume of 400 mL. Deterioration in her blood gas and PaO_2/F_iO_2 ratio (pH 7.26; $PaCO_2$ 47 cm H_2O; PaO_2 96 cm H_2O; F_iO_2 1.0) prompted paralysis with rocuronium (20 $\mu g \cdot kg^{-1} \cdot min^{-1}$) and proning. This was discontinued after 48 hr because of sustained improvement in her oxygenation and PaO_2/FiO_2 ratio (PaO_2 118 cm H_2O; F_iO_2 0.4). In the ICU, fetal status was monitored with daily nonstress testing and biophysical profile. Delivery was delayed given her stable results to allow for further fetal maturation. Ten days later, the patient developed septic shock. Increasing ventilatory requirements (P_{insp} 25 cm H_2O; PEEP 5 cm H_2O; F_iO_2 1.0), hypoxia (SpO_2 79%), and new infiltrates on chest *x-ray* prompted a diagnosis of ventilator-associated pneumonia (VAP). Her mean arterial pressure was maintained > 65 mm Hg with norepinephrine (0.02 $\mu g \cdot kg^{-1} \cdot min^{-1}$) and vasopressin (0.04 $IU \cdot min^{-1}$). Piperacillin-tazobactam was started. The patient was repositioned prone, with no change in SpO_2. Inhaled nitric oxide was administered at 40 ppm, which improved the SpO_2 to 93%. The patient's hemoglobin fell from 97 $g \cdot L^{-1}$ to 68 $g \cdot L^{-1}$ without obvious blood loss. She suffered an acute renal injury without requiring renal replacement therapy. On day 20, a multidisciplinary decision was made to perform urgent CD because of preterminal fetal ultrasound.

Cesarean delivery was performed at 28^{+6} weeks gestation. The patient was maintained on ICU sedation: propofol 60 $\mu g \cdot kg^{-1} \cdot min^{-1}$, fentanyl 250 $\mu g \cdot hr^{-1}$, midazolam 10 $mg \cdot hr^{-1}$, and vasopressors. The patient was paralyzed with rocuronium 50 mg and ventilated with pressure-

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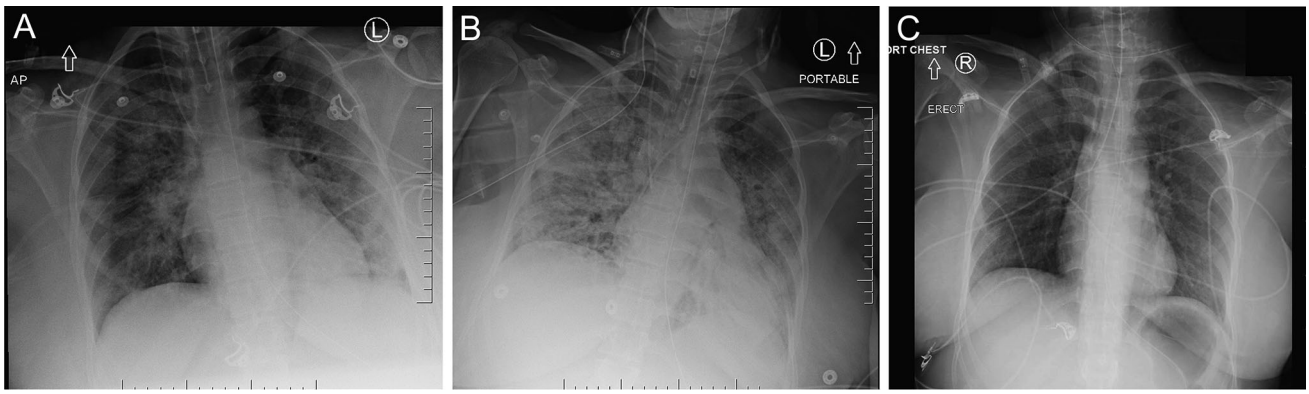

Figure Chest *x-ray*. **A**) Day 1 of admission. Significant bilateral pulmonary opacification, in keeping with COVID-19 pneumonia. Blunting of the left costophrenic angle with no large pleural effusion present. **B**) Day 14 of admission. Pre-Cesarean delivery chest *x-ray*. Increasing bilateral opacities associated with presumptive diagnosis of ventilator-associated pneumonia superimposed on ARDS. **C**) Day 38 of admission. Interval improvement of bilateral chest opacities following decannulation from extracorporeal membrane oxygenation.

control ventilation using a PEEP of 15 cm H_2O. She developed uterine atony and postpartum hemorrhage (PPH) of 1,500 mL requiring four units of packed red blood cells and 1,000 mL of Ringer's lactate. Fluid balance was 500 mL positive. Uterotonic management included oxytocin (5U slow *iv* × 4 and 40 IU/L infusion at 125 $mL{\cdot}min^{-1}$), ergometrine (250 µg slow *iv* × 1 and *im* × 1), and carboprost tromethamine (250 µg intramyometrial). Calcium chloride 1 g and tranexamic acid 1 g twice were also administered. The fetus was delivered flaccid and apneic with APGAR scores of 2, 5, and 8 at one, five, and ten minutes, respectively. The patient's uterine atony had resolved by the end of the surgery.

Postpartum, the patient's respiratory status remained critical, likely from a combination of ARDS, VAP, and PPH-related fluid redistribution. Her ventilatory parameters were precarious (P_{insp} 24 cm H_2O; PEEP 10 cm H_2O; F_iO_2 0.9–1.0); driving pressures above 20 cm H_2O were required. Intermittent proning, paralysis, diuresis and escalation of her antimicrobial therapy was undertaken, with little clinical improvement. The patient was subsequently trialled on high-frequency oscillatory ventilation before being transferred for extracorporeal membrane oxygenation (ECMO) and tracheostomy on postoperative day 16. She was decannulated from ECMO after ten days. Her subsequent recovery was complicated by sporadic bacteremia and slow weaning of respiratory support. The patient was discharged from the ICU on postoperative day 26, and from the hospital after another month.

Parturients with COVID-19 ARDS present a unique challenge, combining considerations for ARDS, multisystem critical illness, and concurrent pregnancy. Severe hypoxemia and precipitous clinical decline served as the basis for mechanical ventilation and managing this case under general anesthesia; however, delivery did not improve her respiratory status.

Lung protective ventilation improves outcomes in patients with ARDS.[3] Plateau pressures < 30 cm H_2O and driving pressures < 15 cm H_2O should be targeted. High PEEP (≥ 15 cm H_2O) was employed for hypoxemia. Alveolar recruitment and improved oxygenation with higher PEEP should be weighed against the hemodynamic consequences of reduced cardiac preload.

We support the use of norepinephrine as the first-line agent in the treatment of hypotension for critically ill obstetric patients. Overzealous fluid and blood product administration can contribute to pulmonary edema in ARDS, which is likely to be exacerbated by auto-transfusion after delivery. This may have contributed to our patient's worsening respiratory status post-CD. A restrictive fluid strategy and blood transfusion target of > 70 $g{\cdot}L^{-1}$ may be optimal, with vasopressors as required.[4] Uterotonic agents should be used judiciously because of their hemodynamic and respiratory effects. Hemabate and ergometrine increase pulmonary vascular resistance and may cause pulmonary edema. Hemabate can also cause bronchospasm impairing ventilation and oxygenation.[5]

An intraoperative and postoperative decline in respiratory status should be anticipated in COVID-19 parturients with ARDS. Extracorporeal membrane oxygenation should be considered when oxygenation is inadequate despite mechanical ventilation, optimized F_iO_2, and prone positioning.

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References

1. *Di Mascio D, Khalil A, Saccone G, et al.*. Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: a systematic review and meta-analysis. Am J Obstet Gynecol MFM 2020; 2: 100107. https://doi.org/10.1016/j.ajogmf.2020.100107
2. *Villar J, Ariff S, Gunier RB, et al*. Maternal and neonatal morbidity and mortality among pregnant women with and without COVID-19 infection: the INTERCOVID multinational cohort study. JAMA Pediatr 2021; 175: 817–26. https://doi.org/10.1001/jamapediatrics.2021.1050
3. *Battaglini D, Robba C, Macêdo Rocco PR, De Abreu MG, Pelosi P, Ball L*. Perioperative anaesthetic management of patients with or at risk of acute distress respiratory syndrome undergoing emergency surgery. BMC Anesthesiol 2019; 19: 153. https://doi.org/10.1186/s12871-019-0804-9
4. *Serpa Neto A, Juffermans NP, Hemmes SN, et al*. Interaction between peri-operative blood transfusion, tidal volume, airway pressure and postoperative ARDS: an individual patient data meta-analysis. Ann Transl Med 2018; 6: 23. https://doi.org/10.21037/atm.2018.01.16
5. *Landau R, Bernstein K, Mhyre J*. Lessons learned from first COVID-19 cases in the United States. Anesth Analg 2020; 131: e25–6. https://doi.org/10.1213/ane.0000000000004840