



Anesthesia Considerations for Pregnant People With COVID-19 Infection

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Abstract: The purpose of this review is to describe updates following initial recommendations on best anesthesia practices for obstetric patients with coronavirus disease 2019. The first surge in the United States prompted anesthesiologists to adapt workflows and reconsider obstetric anesthesia care, with emphasis on avoidance of general anesthesia, the benefit of early neuraxial labor analgesia, and prevention of emergent cesarean delivery whenever possible. While workflows have changed to allow sustained safety for obstetric patients and health care workers, it is notable that obstetric anesthesia protocols for labor and delivery have not significantly evolved since the first coronavirus disease 2019 wave.

Key words: COVID-19, SARS-CoV-2, pregnancy, neuraxial analgesia, cesarean delivery, anesthesia

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic has significantly changed the practice of

anesthesiology worldwide. In the United States, labor and delivery units maintained obstetric anesthesia services for pregnant and peripartum people while simultaneously managing antepartum patients with coronavirus disease 2019 (COVID-19) and achieving safe isolation practices. While most pregnant people infected with SARS-CoV-2 remain asymptomatic, evidence that pregnancy increases the risk of severe COVID-19 and adverse obstetric and neonatal outcomes is strong. Pregnant and recently pregnant people are more likely to be admitted to intensive care units (ICUs) and receive mechanical ventilation than nonpregnant patients with COVID-19, and preexisting maternal comorbidities represent significant risk factors for both mothers and newborns. These findings have highlighted the crucial importance of vaccination campaigns and widespread access to vaccination for all pregnant people, which is now recommended by the American College of Obstetricians and Gynecologists (ACOG) and the Society for

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Maternal-Fetal Medicine (SMFM),¹ as well as the Centers for Disease Control and Prevention (CDC).²

In this review, we present updates in recommendations on maternal COVID-19, the impact of COVID-19 on pregnancy, and obstetric anesthetic considerations for labor and delivery.

PRESENTATION OF COVID-19 IN PREGNANCY AND UNIVERSAL TESTING

Early observations suggested that many obstetric patients with COVID-19 were asymptomatic, and among those who are symptomatic, symptoms such as shortness of breath, fatigue, congestion, or even fever could be mistaken for those normally seen in pregnancy or labor. After incidents in which large numbers of health care providers were unknowingly exposed to obstetric patients with COVID-19 infection, recommendations emerged to conduct universal SARS-CoV-2 testing on all pregnant people admitted to labor and delivery and antepartum units, especially in areas with a high prevalence of SARS-CoV-2.^{3,4} This approach provided data on the proportions of infected but asymptomatic versus mildly, moderately, or critically ill parturients.⁵

In New York City, where universal screening was instituted early in the pandemic, most obstetric patients found to be positive for COVID-19 were asymptomatic or paucisymptomatic.⁶⁻⁸ These observations were confirmed in a large cohort study reporting from 33 United States medical centers, including 1219 pregnant people with COVID-19 between March and July 2020; 47% of cases were asymptomatic, 27% were mildly symptomatic, 14% were moderate, 8% were severe, and 4% were identified as critical, and 4 maternal deaths were attributed to COVID-19 (0.33% mortality rate).⁹

In a living systematic review and meta-analysis including 192 studies,¹⁰ which was updated in March 2021,¹¹ 10% of pregnant or recently pregnant patients admitted to

the hospital for any reason were diagnosed with COVID-19 infection. It also confirmed that pregnant people continue to be at increased risk of severe COVID-19, particularly those with high body mass index and advancing maternal age, and suggested that nonwhite ethnic origin is a risk factors for severe COVID-19.¹¹ Data from the United Kingdom Obstetric Surveillance System (UKOSS) demonstrates that the severity of pregnant people's presentation of the illness appears to have become worse over time; 24% of cases admitted in the first wave had moderate or severe disease, compared with 36% with the Alpha variant and 45% with the Delta variant.¹²

IMPACT OF PREGNANCY ON SEVERITY OF COVID-19

A key question has been whether pregnant people compared with nonpregnant women have an increased likelihood of experiencing severe COVID-19. A case-control study with 38 pregnant cases with severe COVID-19 matched to nonpregnant controls demonstrated that composite morbidity was worse in the pregnant cohort, despite an increase in preexisting conditions in the nonpregnant cohort.¹³ Data presented in the living systematic review and meta-analysis also reported a higher likelihood for pregnant or recently pregnant people to be admitted to the ICU for mechanical ventilation, although preexisting maternal comorbidity was a significant risk factor for ICU admission and mechanical ventilation.¹⁰ In June 2020, the CDC published data reporting that pregnant people were 5.4 times more likely to be hospitalized, 1.5 times more likely to be admitted to the ICU, and 1.7 times more likely to receive mechanical ventilation than nonpregnant people.¹⁴ An update from November 2020, examining over 400,000 symptomatic cases, compared pregnant people and nonpregnant women aged 15 to 44, concluding that pregnant people are at a 3-fold adjusted relative risk of ICU

admission (10.5 vs. 3.9/1000 cases) and mechanical ventilation (2.9 vs. 1.1/1000 cases).¹⁵ In the multinational cohort study (INTERCOVID) that enrolled 706 pregnant cases with COVID-19 and 1424 pregnant controls without COVID-19 between March and October 2020, COVID-19 in pregnancy was associated with consistent and significant increases in severe maternal morbidity and mortality and neonatal complications when pregnant people with and without COVID-19 were compared.^{16,17} Finally, in the largest cohort study evaluating 18,715 pregnant people delivering with COVID-19 in 499 academic centers in the United States between March 2020 and February 2021, COVID-19 was associated with increased mortality, risk of intubation and ventilation, and ICU admission as well as preterm birth.¹⁸

RACIAL DISCREPANCIES IN COVID-19 MORBIDITY AND MORTALITY

In general, racial minorities, specifically patients, experience a significantly greater burden of morbidity and mortality from COVID-19.^{19,20} Such disparity in health care outcomes is also evidenced by the average 3-fold higher mortality rates, with worse discrepancies varying by region and state, in black pregnant and postpartum people in the United States.²¹ The syndemic of health care disparities among ethnic/racial minorities and COVID-19 further increases the risk of serious maternal morbidity and death.^{22–28} Acknowledging the crucial opportunity to develop resources to support equitable obstetric care during the COVID-19 pandemic, SMFM outlined challenges to overcome, which include telehealth access and confronting bias, among many others.²⁹

SEVERE CRITICAL MATERNAL COVID-19

The management of severe critical maternal COVID-19 and admission of obstetric patients to ICUs is a complex topic.³⁰ Institutions have substantially modified their

obstetric anesthesia services and created tools to allow for new workflows while accounting for potentially inexperienced staff to urgently care for patients in high-risk situations without prior experience.³¹ In the spring of 2020, overfilling of traditional ICUs led us to operationalize an obstetric ICU on our labor and delivery unit, which allowed us to manage the care of mild to critically ill COVID-19 parturients while continuing to be able to provide obstetric care to noninfected obstetric patients.^{32,33}

Oxygen supplementation with nasal oxygen therapy or tracheal intubation were initially proposed as the 2 modalities for COVID-19 management in pregnant people, with other in between modalities initially not employed to reduce the risk of aerosolization, and because it was thought that rapid escalation to invasive mechanical ventilation would be needed. Subsequently and with increased experience, the use of intermediate therapies has gained favor, including noninvasive positive-pressure ventilation with bilevel positive airway pressure, continuous positive airway pressure, and high flow nasal cannula, having now been employed successfully in obstetric patients.³⁴ Prone positioning,^{35–39} high concentration nitric oxide inhalation,⁴⁰ and extracorporeal membrane oxygenation (ECMO) are further successful therapeutic options once mechanical ventilation has been established.^{41–51}

In the Society for Obstetric Anesthesia and Perinatology (SOAP) COVID-19 Registry reporting on 490 cases of SARS-CoV-2 infection during delivery hospitalization between March and June 2020, 8.4% of cases received supplemental oxygenation, 5.7% of cases were admitted to the ICU, 3.9% were diagnosed with acute respiratory distress syndrome, and 3.7% received mechanical ventilation. There were no ECMO cases and no maternal deaths.⁵²

Decision-making about respiratory interventions for pregnant people with COVID-19 may be guided by the use of the respiratory component of the Sequential Organ Failure

Assessment (SOFA) modified score [partial pressure of oxygen/fractional inspired oxygen (mm Hg) ratio], as reported in a French study.⁵³ In that cohort of 126 obstetric patients with COVID-19 during the first wave, ICU admission occurred in 17% of cases, mechanical ventilation occurred in 12% of cases, and there was 1 ECMO case. Postpartum mechanical ventilation was correlated with predelivery oxygen therapy, oxygen saturation, and hemoglobin levels. These criteria could serve as triggers for patient transfer to a hospital with an appropriate level of maternal care.⁵³

As already emphasized, because SARS-CoV-2 infection is associated with worse outcomes in the obstetric population, as indicated by higher ICU admissions rates, higher use of invasive ventilation, higher ECMO use, and higher death rates, including pregnant people among priority populations for COVID-19 vaccination and ensuring racial and ethnic equity in access to vaccination throughout the pandemic has been highly underscored.^{54–58}

Anesthesia Considerations for Labor and Delivery

Remarkably, obstetric anesthesia guidelines have not significantly changed since the early pragmatic clinical recommendations published in spring of 2020,^{59–62} mostly because no breakthrough data in the last 18 months has suggested that management of labor analgesia or cesarean delivery anesthesia should be further modified. SOAP produced a COVID-19 Toolkit with Interim Considerations for Obstetric Anesthesia Care Related to COVID-19 (first drafted in March, with minor updates in May 2020) and several other educational resources, which included simulation and drills material,⁶³ and joint SOAP and SMFM recommendations.⁶⁴

Overall, 2 areas of concern about the safety of neuraxial anesthesia in SARS-CoV-2-infected patients were raised after initial reports from China: maternal hypotension during cesarean delivery,^{65,66}

and thrombocytopenia prohibiting safe neuraxial procedure,⁶⁷ whether an epidural, combined spinal-epidural, or spinal anesthetic.

First, alerts about possible hemodynamic instability following neuraxial anesthesia for cesarean delivery appeared unfounded with the current practice of spinal hypotension prevention with vasopressors (phenylephrine infusions), and any possible concerns were rapidly dissipated.⁶⁸

Second, maternal thrombocytopenia with platelet counts below the established threshold of $70,000 \times 10^6/L$ for neuraxial procedures in obstetric patients, as recommended by SOAP in a recent consensus statement,⁶⁹ were not associated with COVID-19 in the SOAP COVID-19 Registry.⁵² There was 1 case with a nadir count of $40,000 \times 10^6/L$ reported in a French series of 3 thrombocytopenic parturients with mild COVID-19.⁷⁰ Therefore, recommendations based on SARS-CoV-2 status in obstetric patients related to checking the platelet count before neuraxial procedures have not been altered. In healthy pregnant patients with a normal platelet count during pregnancy ruling out gestational or idiopathic thrombocytopenia, there is no need to wait for an additional platelet count on admission before placing neuraxial labor analgesia. With a diagnosis of preeclampsia with or without severe features, it remains indicated to obtain a platelet count before a neuraxial procedure (neuraxial labor analgesia or spinal anesthesia for cesarean delivery), with the acceptable cutoff of $70,000 \times 10^6/L$ in the absence of any coagulopathy.⁶⁹

Last, data related to COVID-19 coagulopathy showed thrombocytopenia occurring on the one hand and a procoagulant state associated with thromboembolic events on the other.⁷¹ Therefore, recommendations for monitoring coagulation status in obstetric cases with COVID-19, taking hypercoagulability of pregnancy into account, have been

proposed.⁷² Pregnant people admitted with COVID-19 have an indication for thromboprophylaxis as standard-of-care for hospitalized patients who are not frequently ambulating (unless active bleeding or with severe thrombocytopenia) and so do critically ill or mechanically ventilated patients if there are no contraindications.

NEURAXIAL LABOR ANALGESIA

Recommendations related to neuraxial labor analgesia were based on early lessons from United States institutions sharing their first experiences as of mid-March 2020.^{3,59,63,73} In general, providing early neuraxial labor analgesia and ensuring that the epidural catheter is well-sited and providing optimal analgesia has been and remains the basis of all recommendations from societies around the world throughout the pandemic.^{63,74}

Recommendations identified early on, and that remain the mainstay are presented in Box 1.

For management of severe postdural puncture headache, an epidural blood

patch should be discussed case by case because not treating severe postdural puncture headache is not recommended due to the risk of severe complications,⁷⁵ and alternative treatments such as sphenopalatine ganglion blocks are not recommended.^{63,76} Safe use of epidural blood patch in obstetric cases with COVID-19 have been reported, one after labor epidural analgesia⁷⁷ and one after cesarean delivery,⁷⁸ although caution has been suggested^{79,80} due to the hypercoagulable state and possible risk of central nervous system inoculation associated with autologous neuraxial blood injection.

ANESTHESIA FOR CESAREAN DELIVERY

Provision of neuraxial anesthesia via an indwelling epidural catheter for an intrapartum cesarean delivery or with a spinal or combined spinal-epidural is unambiguously the preferred method to avoid the aerosolization of viral particles during endotracheal intubation and extubation and other circumstances resulting in airway manipulation (suction). Devices to

BOX 1. Practice Recommendation for Neuraxial Labor Analgesia

- (1) *Place neuraxial labor analgesia early*—this allows procedures to occur in a more controlled manner with appropriate PPE and for all logistics related to protecting anesthesia equipment (epidural carts, supplies, pumps, medication)
- (2) *Do not delay epidural placement until COVID-19 screening test results are obtained*—if a laboring person requests an epidural, adequate PPE should be utilized per institutional guidelines, and the epidural should be placed without delay
- (3) *Reduce unnecessary patient encounters without compromising patient safety or comfort*—strategies include:
 - (a) Combining informed consent with the procedure itself
 - (b) Suggesting an experienced anesthesiologist performs the procedure to ensure it is functioning optimally and will not require additional adjustments or repeated procedures (new epidural or a blood patch in case of accidental dural puncture)
 - (c) Minimizing additional epidural top-ups by maximizing the efficacy of neuraxial analgesia using combined spinal-epidural (CSE), programmed intermittent epidural bolus (PIEB) pumps, and considering the addition of adjuvants (eg, clonidine)
- (4) *Ensure a well-functioning epidural catheter*—be proactive about troubleshooting or replacing epidural catheters that are not working optimally. This will minimize the need for general anesthesia if an intrapartum cesarean delivery becomes indicated, in all patients, whether confirmed to have COVID-19 or with unknown SARS-CoV-2 status

COVID-19 indicates coronavirus disease 2019; PPE, personal protective equipment; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

minimize aerosolization of viral particles during intubation have been suggested in the general population. Recent reviews of their use demonstrate no clear benefit,⁸¹ especially when the seal is not tight,⁸² and they do not obviate the need for adequate personal protective equipment. We recommend against the use of an aerosol retention device in obstetric patients, especially since aerosol retention devices will interfere with normal communication between an awake patient and the anesthesia providers.

GENERAL ANESTHESIA

The COVID-19 pandemic has been recognized as an opportunity to reduce the overall rates of general anesthesia for cesarean delivery, whether in COVID-19 patients or not. As mentioned earlier, strategies to reduce the rate of general anesthesia for emergent cesarean delivery have included increasing communication between obstetrical, nursing, and anesthesia teams and ensuring early neuraxial labor analgesia with a well-functioning epidural catheter. As previously recognized, precesarean delivery huddles before transporting a patient to the operating room and debriefings allow improved team communication.⁸³

Preceding the COVID-19 pandemic, a large epidemiological report demonstrated adverse events and complications associated with avoidable general anesthesia for cesarean delivery, with a higher rate of avoidable general anesthetics among minority pregnant people, particularly black pregnant people,⁸⁴ and the use of general anesthesia for cesarean delivery was reported to be significantly higher among black pregnant people in 2 other studies.^{85,86} Further, maternal mortalities attributable to general anesthesia for cesarean delivery in low- and middle-income countries were reported.⁸⁷ Therefore, regardless of SARS-CoV-2 status, strategies to avoid nonindicated general anesthetics should be prioritized.

In the UK, the COVID-19 pandemic has resulted in an overall reduction in the general anesthesia rates for cesarean delivery,⁸⁸ similar to the increased use of neuraxial anesthesia for planned cesarean deliveries recently reported in Israel.⁸⁹ In a cross-sectional study from April to July 2020 from 6 maternity wards in the north-west of England with over 17,000 deliveries, the anesthesia model of coverage changed (the on-site out-of-hours anesthesia consultant support system), resulting in more experienced and skilled anesthesiologists allowing for better supervision, higher neuraxial anesthesia rates and lower conversion rates to general anesthesia; the general anesthesia rate was more than halved (from 7.7% to 3.7%).⁹⁰ Numerous possible reasons that contribute to neuraxial anesthesia being the preferred anesthetic mode were listed, which of note, are not specific to COVID-19: mitigation of difficult intubation, complications associated with general anesthesia such as aspiration and awareness during general anesthesia, the support person being allowed to be present during the cesarean delivery, earlier skin to skin contact and bonding, superior perioperative analgesia, decreased blood loss and transfusion, decreased thromboembolism risk, reduced hospital stay, and decreased respiratory tract and surgical site infections. In addition, avoidance of contamination for anesthesia staff and other health care workers in the operating room played a significant role in this reduction, which was facilitated by the availability of senior anesthesiologists. The premise that obstetric anesthesiologists and fellowship training in obstetric anesthesia will significantly reduce the odds for general anesthesia during unplanned cesarean delivery has already been demonstrated.^{91,92}

In the SOAP COVID-19 Registry, COVID-19 cases were more likely to receive general anesthesia for cesarean delivery (8.7% vs. 2.6% in noninfected controls),

however, maternal respiratory failure was the indication in 12 of 15 cases, with postpartum hemorrhage the indication in 1 case, and fetal indication in 2 cases.⁵²

Conclusions

Adapting the workflow on labor and delivery units and increasing the communication between teams has been a cornerstone to maintain safe care for all obstetric patients, whether infected or not, and to minimize contamination risks for everyone.

For the asymptomatic and noncritically ill COVID-19 patients receiving anesthesia care during labor and delivery, recommendations have highlighted 2 principles: (1) early neuraxial labor analgesia with a well-functioning epidural catheter throughout labor to reduce the likelihood of general anesthesia being used for unplanned intrapartum cesarean deliveries, and (2) favoring neuraxial over general anesthesia for cesarean delivery whenever possible, for its well-known benefits and to reduce health care exposure during airway manipulation; evidence that general anesthesia rates for cesarean delivery during the pandemic has emerged although this has not yet been apparent in reports from the United States.

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