

OBSTETRIC ANESTHESIA CARE AND COVID-19

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Abstract

Since December 2019, new cases of pneumonia of unknown etiology were detected in Wuhan City, Hubei Province of China, later found to be caused by a corona virus that was named “severe acute respiratory syndrome coronavirus 2” or SARS-CoV-2. The novel infection threatened the general population including pregnant women as well as health care workers caring for them. As the virus spread took an upward trajectory, it became clear that protection of healthcare workers as well as provision of high-quality standardized care for pregnant patients infected with COVID-19 are both of equal importance. In this manuscript, we present the latest recommendations and clinical guidance pertinent to the anesthetic care of the obstetric population including symptomatology and clinical presentation, fetal and neonatal outcomes, labor analgesia, anesthesia for cesarean delivery, and delivery under general anesthesia. The evidence in this manuscript is based on information from the Society for Obstetric Anesthesia and Perinatology (SOAP) Interim Consideration for Obstetric Care related to COVID-19, including recommendations from World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) and on expert opinion in the field of obstetric anesthesia.

keywords: Coronavirus, Anesthesia, Obstetrical, Clinical Protocols.

Introduction

Since December 2019, new cases of pneumonia of unknown etiology were detected in *Wuhan* City, Hubei Province of China.¹ The emerging disease was later found to be caused by a corona virus and was named by the International Committee on Taxonomy of Viruses as “severe acute respiratory syndrome coronavirus 2” or SARS-CoV-2.² Viruses of the family Coronaviridae possess a single-strand, positive-sense RNA genome. Interestingly, genomic studies have revealed SARS-CoV-2 to be related to two bat-derived SARS-like coronaviruses (88% genomic similarity) collected in China in 2018, more distantly related to SARS-CoV (79%) and Middle East Respiratory Syndrome (MERS)-CoV (50%).³ The spread of the novel virus took an unprecedented course and was declared by World Health Organization (WHO) as a pandemic on March 11, 2020.

Person to person transmission of the virus occurs through respiratory route during close exposure to a person infected with COVID-19 primarily via droplets. Droplets are expelled when an infected person speaks, coughs, or sneezes.⁴ Droplets tend to settle quickly to the ground usually within one meter of generation.⁵ Transmission also occurs through contact with contaminated surfaces followed by self-delivery to eyes, nose or mouth and according to the centers for disease control (CDC), the contribution of aerosols or droplet nuclei to close proximity transmission is

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currently uncertain.⁴ Thus, it appears reasonable to consider the possibility of aerosol transmission in a closed environment when exposed to high concentrations of aerosol for a long period of time.

It became clear that the protection of health care workers is of paramount importance as the virus spread took an upward trajectory. Anesthesiologists worldwide took a leading role in caring for patients infected with COVID-19 as airway experts and acute and critical care professionals. Airway instrumentation, including intubation and extubation both considered as aerosol-generating procedures (AGP), puts the anesthesiologist at a higher risk of infection.⁶

SARS-CoV-2 threatened the general population including pregnant women and in contrast to other patient populations, the care for pregnant women is time-sensitive and remains a clinical priority. Thus, it became a necessity to standardize obstetric care of pregnant women during the COVID-19 pandemic.

In this manuscript, we present the latest recommendations and clinical guidance pertinent to the anesthetic care of the obstetric population with the aim to provide both a standardized high-quality care for patients, and protection of healthcare workers.

Clinical features of covid-19 in pregnancy

The clinical presentation of COVID-19 infection in pregnancy can range from asymptomatic and mild flu-like symptoms including fever, cough, sore throat, myalgia, and malaise to signs of severe respiratory illness such as pneumonia with or without acute respiratory distress syndrome, renal failure and multiorgan dysfunction requiring immediate critical care support.⁷ Gastro-intestinal symptoms (diarrhea, vomiting, abdominal pain) could be the chief complaints upon presentation, even occurring in the absence of respiratory symptoms.⁸ A sudden reduction or loss of the sense of smell or taste has been recommended as a part of screening for COVID-19 infection by the American academy of Otolaryngology-Head and Neck Surgery.

In a review conducted by ElShafeey et al. including 33 studies reporting 385 pregnant women with COVID-19 infection, most women were

symptomatic at presentation (92.5%) with the most frequent symptoms reported being fever (67%), cough (65.7%), dyspnea (7.3%), diarrhea (7.3%), sore throat (7%), fatigue (7%), myalgia (6.2%), and chills (5.5%). The course of the disease was mild in 95.6%, severe in 3.6% and critical in 0.8% of pregnant patients.⁹

In a WHO-China joint report describing 147 cases in pregnant women, 8% suffered severe respiratory disease (defined as tachypnea > 30 breaths per min or oxygen saturation of < 93% or PaO₂/FiO₂ < 300 mmHg). Similar to Elshafeey's review, 1% had critical disease, defined as requiring mechanical ventilation.⁸

In contrast to previous data for MERS outbreak suggesting worse outcomes in pregnant women compared to non-pregnant women, and despite the cardiorespiratory physiologic changes of pregnancy (such as basal atelectasis from gravid uterus, lower lung reserves, and increased oxygen consumption) that may predispose pregnant women to more severe disease course, emerging COVID-19 data suggests mild infection in the majority of cases.

Pregnancy represents a unique immune condition that is modulated rather than suppressed. The modulated immune response characterized by an inhibited Th1 pro-inflammatory pathway and decreased tumor necrosis factor- α mediated by the human chorionic gonadotropin and progesterone might protect the pregnant patient.⁹

The non-specific nature of the presenting signs and symptoms of COVID-19 in pregnant women resembles many pregnancy-related complaint. For example, Diarrhea and myalgia can be presenting signs of latent labor, chorioamnionitis causes tachycardia and fever, headache is characteristic of preeclampsia, and shortness of breath is commonly perceived toward the third trimester of pregnancy.¹⁰ Thus, it is crucial to keep a high index of suspicion when admitting pregnant women with such non-specific symptoms to the delivery suite.

Patients requiring hospital admission who have clinical or radiological evidence of pneumonia or signs of acute respiratory distress syndrome (ARDS) or a fever >37.8°C, in combination with a persistent cough, hoarseness, nasal discharge/congestion, shortness of breath, sore throat, wheezing or sneezing, require testing. These patients are considered patients under

investigation (PUI) and should be managed as positive until the results are out.

Fetal and neonatal outcomes

In a study evaluating the clinical characteristics of COVID-19 in pregnancy, Chen et al. examined the evidence of intrauterine vertical transmission testing for the presence of SARS-CoV-2 in amniotic fluid, cord blood, and neonatal swab samples in 9 pregnancies with laboratory-confirmed COVID-19 infection. All samples tested negative for the virus. The study concluded that there is currently no evidence for intrauterine infection caused by vertical transmission in women who develop COVID-19 pneumonia in late pregnancy.¹¹ This conclusion is supported in the review done by Elshafeey et al.⁹ in which data extracted from four neonates who had RT-PCR confirmed infections had negative cord blood and amniotic fluid samples.

In contrast, a case report from China by Dang et al. showed evidence of vertical intrauterine transmission in neonate born to a mother with COVID-19. The neonate had elevated Ig M antibody levels and abnormal cytokine test results two hours after birth with laboratory evidence of inflammation and liver injury.¹² However, no PCR testing of amniotic fluid of cord blood was performed. Overall, current evidence suggests that intrauterine vertical transmission is rare based on the available evidence.¹³

Practice recommendations

The following section contains practice recommendations based on information from the Society for Obstetric Anesthesia and Perinatology (SOAP) Interim Consideration for Obstetric Care related to COVID-19, including recommendations from WHO and CDC and on expert opinion presented by Bampoe et al.¹⁴ and Bauer et al.¹⁵

Pre-hospital screening for COVID-19 infection usually includes the following: fever, cough or shortness of breath, diarrhea, and any possible exposure to COVID-19.¹⁵ Phone or video screening for symptoms consistent with COVID-19 should be performed on pregnant patients and their support

person or persons. It is reasonable to apply universal RT-PCR testing in regions of high prevalence since it improves case detection.

Testing for COVID-19 in pregnant women admitted for labor and delivery helps to protect both the neonate by ensuring separation from mother after birth and protection of health care workers by ensuring the use of appropriate personal protective equipment (PPE).

Pregnant patients can be classified according to their COVID-19 status into the following: (1) COVID-19 negative, (2) asymptomatic, (3) symptomatic PUI and (4) COVID-19 positive. The status of the patient should be made accessible at all times and updated as soon as RT-PCR or CT-scan results are out. This classification system makes the disposition of the patient clearer and makes it easier for the health care workers to use the appropriate PPEs.

Patients who are COVID-19 positive or high risk PIU should be placed in isolation rooms. If an AGP is to be performed, these patients should be ideally placed in negative pressure isolation rooms. The care for obstetric COVID-19 positive and high risk PIU is multidisciplinary and necessitates collaboration among anesthesiologists, obstetricians, labor and delivery nurses, neonatologists, and critical care experts.

PPE

PPE are specialized clothing or equipment used by healthcare workers for their protection and to limit the spread of infectious organisms between patients. They include facemasks, gloves, gowns, face shields or goggles. Wearing PPE does not ensure total protection and should be used in combination with other strategies such as hand hygiene, avoidance of touching the face or the mucus membranes with contaminated hands, in addition to meticulous donning and doffing of PPE under direct observation.

Pregnant patients who are COVID-19 positive or high risk PUI should wear a surgical face mask at all times. Health care workers caring for these patients should use droplet and contact precautions during clinical care of <2 m from patient with the use of the following: gown, gloves, surgical mask, goggles or

face shield. Airborne precautions using fluid-resistant long sleeved gown, gloves, eye protection and N95 or FFP3 respirator is preferred in high risk obstetric scenarios (second stage of labor with deep respiratory effort and hyperventilation, cesarean deliveries, twin vaginal deliveries) and is mandatory during AGPs such as intubation and extubation, and positive pressure hand-bag ventilation.

Donning and doffing takes time and might delay patient care in case of emergencies. This scenario could be mitigated by proper training and preparation of health care workers.

Labor analgesia

Early neuraxial labor analgesia remains the mainstay for pregnant patients with COVID-19 to avoid the exacerbation of an already compromised respiratory status with labor pain due hyperventilation and tachycardia, and to reduce the chances of general anesthesia if intrapartum cesarean delivery becomes necessary. There is no current evidence that epidural analgesia or spinal anesthesia are contraindicated in pregnant patients with COVID-19. Currently, there is no data on hemorrhagic complications of neuraxial anesthesia in pregnant patients with COVID-19. However, it is prudent to keep in mind that the incidence of mild thrombocytopenia (a platelet count < 150 000) is not uncommon in patients infected with COVID-19, with more severe reductions in platelet counts observed in patients with severe illness. Disseminated intravascular coagulation occurs in critical cases and is associated with a poor prognosis.¹⁶ Thus, it is recommended that the platelet count is checked before spinal or epidural catheter placement or removal. It is generally safe to perform neuraxial blockade with a platelet count as low as 70 000. However, given the low risk of spinal/epidural hematoma versus the higher risk of disease exacerbation and risk of infection spread with general anesthesia, it has been suggested to perform neuraxial anesthesia even at a lower platelet count.¹⁴ The risk of encephalitis or meningitis caused by viremic blood seeding remains theoretical. No such neurologic complication has been so far reported in the literature.

The utilization of video-consultation for pre-

anesthesia assessment and for obtaining consents is recommended. The neuraxial procedure should be performed by the most experienced anesthesiologist to decrease the risk of inadvertent dural puncture that may require an epidural blood patch.

The epidural cart or tray should not be brought into the patient's room to decrease the chance of contamination, and all needed medications should be assembled in a bag before entering to the patient's room. Ideally COVID-19 kits should be assembled and will include all equipment and medications for labor analgesia, cesarean delivery, and general anesthesia. Rescue medications should remain in the patient's room.

It is also important to limit the number of personnel present in the room during the procedure to the anesthesiologist performing the procedure and his/her assistant. Hourly round on patients is done through video/phone calls for assessment of general status and effects of neuraxial analgesia. Increasing the concentration of the epidural local anesthetic solution or increasing the programmed intermittent bolus volume is a reasonable strategy to decrease breakthrough pain and the need for top-up boluses.

The use of opioid IV PCA (remifentanyl or fentanyl) for labor analgesia is also not recommended to avoid the possibility of sedation and respiratory depression requiring airway instrumentation and aerosolizing procedures and to avoid opioid-induced nausea and vomiting.

Anesthesia for cesarean delivery

Patients with suspected or confirmed COVID-19 infection who are scheduled for elective cesarean delivery should be assessed for respiratory symptoms for risk stratification. The care of the patient with respiratory distress or hypoxemia should be discussed with the intensive care team before initiating anesthesia for surgery for possible intensive care unit (ICU) admission in case of intrapartum or postpartum deterioration.

An operating room and an anesthesia machine should be prepared beforehand and used only for suspected or confirmed COVID-19 cases for the

duration of the pandemic. Efforts should be made to minimize contamination by encouraging the use of disposable equipment, checking equipment readiness and access to supplies, covering the anesthesia workstation and machine with plastic cover sheaths, and keeping only necessary equipment in the room. Attention should be paid for transfer arrangements for a woman who needs cesarean delivery i.e. the route to and from the isolation ward or ICU should be cleared by security personnel.

Prior to entering the operating room, and regardless of the type of anesthesia, anesthesia providers and necessary assistants should implement droplet and contact precautions with eye protection (gown, gloves, mask, and face shield). The use of donning and doffing checklists and trained observers or the use of mirrors in the anteroom can facilitate correct donning.

Neuraxial Anesthesia is the mainstay in the obstetric population. Pregnant patients with confirmed or suspected COVID-19 are of no exception. It is recommended to avoid general anesthesia unless necessary for standard indications and to consider plans for the management of failed neuraxial blockade. It is also essential to avoid emergent cesarean deliveries as much as possible through proactive communication with obstetrical and nursing teams, minimizing response time and possible worsened patient outcome or contamination in cases of emergency. To reduce the risk of complications associated with neuraxial anesthesia, it is recommended that the anesthetic procedure be performed by the most experienced anesthesiologist available.

In a case series by Chen et.al describing the safety and efficacy of different anesthetic regimens for 17 parturients with COVID-19 undergoing cesarean delivery, the incidence of excessive hypotension was reported in 12 out of 14 patients receiving an epidural top-up or combined spinal-epidural for cesarean delivery compared to the 3 patients who underwent general anesthesia.¹⁷ However, no comparison was made to patients without COVID-19; the blood pressure trends, and the use of vasopressors were also not reported. At our institution, the use of prophylactic intravenous phenylephrine infusion is recommended to prevent hypotension associated with neuraxial anesthesia for cesarean delivery and this could be

translated to patients with COVID-19 to maintain cardiovascular stability and improve fetal outcomes.¹⁸

General anesthesia

The risks associated with general anesthesia in patients with COVID-19 are two-fold. On one side, transmission to healthcare workers during intubation and extubation (both considered AGPs) is significant. On the other side, the impact of tracheal intubation and mechanical ventilation on a patient with a compromised respiratory function is concerning.

Multiple checklists pertaining to general anesthesia in patients with COVID-19 have been developed. These checklists are readily transferrable to obstetric care, with few points to be highlighted. First, all personnel in the OR at the time of intubation should wear an airborne PPE. Only essential personnel shall be present in the room during intubation to the best judgement of the anesthesiologist, while making sure assistance is readily available. Second, pre-oxygenation should occur with a circuit extension and HEPA (high efficiency particulate air) filter at the patient side of the circuit. For the pre-oxygenation, a tight-fitting facemask using the two-hand technique should be utilized. Disconnection of the circuit should be avoided and if necessary should be done between the HEPA filter and the circuit. Third, intubation should occur in a way to maximize success on first attempt and minimize any need to provide bag mask ventilation and thus the risk of aerosolization. Given that there is an increased risk of difficult and failed airway in the obstetric population, in addition to a possibly compromised respiratory status in COVID-19 positive parturients, the most experienced anesthesiologist available in the delivery suite should make the first intubation attempt. If desaturation occurs, gentle low volume manual ventilation can be done using a tight seal on the face mask. Finally, extubation is equally, if not more of a significant risk for aerosolization. Multiple strategies should be implemented to perform a safe extubation in a COVID-19 positive patient. The number of personnel present in the room at the time of extubation should be reduced to minimum. Avoidance of emergence coughing is also essential, and pharmacologic means of cough suppression can

be implemented with dexmedetomidine being the most effective compared to a variety of pharmacologic interventions including (remifentanyl, fentanyl, intra-cuff or intravenous lidocaine and lidocaine via tracheal or topical application) as recently shown by Tung et al.¹⁹

Other recommendations

It is recommended by both SOAP and the American College of Obstetricians and Gynecologists (ACOG) to consider suspending the use of nitrous oxide for labor analgesia since there is currently insufficient information about the cleaning, filtering, and potential aerosolization of nitrous oxide in labor analgesia systems in the setting of COVID-19.

According to SOAP, nonsteroidal anti-inflammatory drugs (NSAID)s for asymptomatic and mildly symptomatic COVID-19 patients requiring post-partum analgesia beyond acetaminophen can continue to be used since the evidence behind NSAID-induced COVID-19 infection exacerbation is not robust. However, for patients with severe infections it is recommended to avoid NSAIDs.

Finally, the use of carboprost (hemabate) for treatment of uterine atony should also be avoided to mitigate the risks associated with bronchospasm and the possible need for airway instrumentation.

Conclusion

The emerging data suggests that pregnant women are not at a greater risk for COVID-19 complications than the general population. The asymptomatic or mild disease at presentation and the similarity of the presenting complaints with other pregnancy-associated symptoms requires vigilance from the side of health care workers to ensure correct patient disposition and safety of health care workers.

Neuraxial anesthesia remains a mainstay in COVID-19 parturients as in regular pregnancies. Preparedness, communication and inter-disciplinary efforts among anesthesiologists, obstetricians, nursing team, neonatologists and intensivists are essential to provide a safe hospital course for pregnancies complicated by COVID-19 infection. Efforts should be made to avoid general anesthesia and airway instrumentation and prevent complications associated with neuraxial anesthesia. Ensuring the adequacy of PPE for the intended procedure is crucial to protect health care workers as is the technique for donning and doffing. As we are still navigating the uncharted territory of COVID-19 infection, it is of paramount importance to benefit from the shared experience through research and dissemination of knowledge in the face of the international challenge posed by the novel SARS-Cov-2.

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