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Review

# What We Know About Anesthesia During Caesarean Section in COVID-19 Patients

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## ABSTRACT

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), sometimes referred to as an invisible killer, has changed all of our lives, including the daily practices of medical personnel and the approach to anesthesia. We must wear protective equipment and special suits, aprons, and 2 or 3 pairs of gloves. Our faces are obscured by masks and goggles and shields. We move with difficulty and have limited vision. Communication with patients is limited; they cannot see our facial expressions of smiles or concern. They only hear our voice, which may also be muffled. We look more like robots than someone demonstrating assistance, love, or compassion. We are strangers to our infected patients. When thinking about the type of anesthesia for pregnant patients who have the disease caused by SARS-CoV-2, coronavirus 2019 (COVID-19), 3 factors taken into consideration ranked according to importance are the safest method for healthcare providers, ease of application, and difficulties associated with movement and vision. The patient's wishes are secondary. Have priorities changed?

## INTRODUCTION

We will never forget the end of 2019 and the year 2020. A previously unknown disease began to take thousands of lives around the world. Coronavirus 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The virus has not spared pregnant women, and exposure increases the risks of morbidity and mortality. In reported cases of pregnancies in the last trimester, Caesarean section delivery has usually been considered the best choice. Regional anesthesia with a spinal or epidural block is preferable to general anesthesia during a Caesarean section with COVID-19 patients, not only to protect the mother and child, but the medical staff as well.

### What we know about SARS CoV-2

A new coronavirus was identified as the cause of an outbreak of respiratory illness in Wuhan, China, in December 2019.[1] The infection source of COVID-19 was detected by researchers from the Chinese Center for Disease Control and Prevention after collecting 585 environmental samples from the Huanan Seafood Market in Wuhan. It was discovered that 33 samples contained SARS-CoV-2, which is believed to have spread from wild animals sold in the market.[2] On January 30, 2020, the World Health Organization declared the SARS-CoV-2 outbreak a Public Health Emergency of International Concern.[3] At the time of writing, there are more than 7 million confirmed cases of infection and nearly 500,000 deaths around the world. The fatality rate has been estimated at 2%.[4]

Coronaviruses are enveloped single-strand RNA viruses that are zoonotic in nature. There are several other coronaviruses known to affect humans, including those responsible for earlier epidemics of severe acute respiratory syndrome (SARS),[5] and Middle East respiratory syndrome (MERS).[6]

The novel SARS CoV-2 is a betacoronavirus. The precise mechanism of how this virus moved from animal to human populations is yet to be determined, however, it is widely accepted that SARS-CoV-2 originated in bats. Angiotensin-converting enzyme II (ACE2) is known to be the cell receptor for SARS-CoV-2, which replicates quickly in primary human epithelial cells within the lungs.[7]

SARS-CoV-2 can be easily transmitted from human to human. The main route of transmission is from the respirato-

ry tract via droplets or aerosolization, and indirectly via fomites. It has also been suggested that fecal-oral spread may occur.[8] The reproduction number (R0) is between 2.0 and 2.8. The mean incubation time appears to be between 4.75 and 7 days, ranging from 3 days to an upper limit of 11 to 14 days.[9] Transmission may occur during the incubation period and from asymptomatic or very mild infections.[8] Severe illness and death are more likely to occur in older individuals, and in those with pre-existing disease, such as diabetes, cardiovascular disease, or malignancy.

## COVID-19 in pregnant women and intrauterine vertical transmission

Early in the pandemic outbreak, there was an impression that pregnant women and breastfeeding mothers may be protected from the infection, but the first cases soon appeared.[10] A systemic review published on April 7, 2020 presented 108 pregnant women infected with SARS-CoV-2 (10). The key message was "Pregnant women with COVID-19 often presented with fever and coughing. Lymphocytopenia and elevated C-reactive protein were common. Although the majority of mothers were discharged without any major complications, severe maternal morbidity as a result of COVID-19 could not be ruled out."

Physiological changes during pregnancy, particularly in the respiratory and immune systems, predispose pregnant women to viral infection. Respiratory system changes are marked by a higher tidal volume and increase in respiratory rate, which enhances the exposure to airborne droplets. Alterations in the respiratory tract mucosa facilitate virus attachment. Cephalic displacement of the diaphragm contributes to basilar atelectasis and alveolar collapse, and decreased functional residual capacity can lead to hypoxic respiratory failure. Increased oxygen consumption, increased respiratory and cardiac effort, and ventilation/perfusion mismatch also create a good foundation for bacterial and viral infections.[11]

There are also evident changes in the immune system during pregnancy. For a long time it was thought that the immune system was suppressed, however, the responses to pregnancy serve to protect the mother against the environment and prevent damage to the fetus.[12] This may be the primary reason why the rate of pregnant women with COVID-19 is low and why intrauterine vertical transmission remains minimal.

Inflammation of the placenta may occur when pregnant women are exposed to bacterial and viral infections, but congenital fetal infection is limited. The protective role of the placenta potentially inhibiting the crossing of SARS-CoV-2 has been explained very well in a recent study by Celik et al.[13]

The villous membrane that separates maternal and fetal blood consists of syncytiotrophoblasts forming a syncytio-capillary barrier (SCB), a matrix of the villous core and the fetal endothelial cells of the capillaries. Gas, nutrient, and drug exchanges occur through this membrane, as well as the elimination of fetal waste, but microorganisms are prevented from reaching the fetus.

Syncytiotrophoblast receptors are the binding site of the SARS-CoV-2. Celik et al.[13] suggested 3 main factors which prevent intrauterine vertical transmission: i) The SCB of the placenta presents a physical barrier to viruses (thickness 1 to 2 µm, and the absence of intercellular gap junctions); ii) the lack of caveolin-1, the integral membrane protein, in the SCB prevents virus-mediated cell damage, allowing the barrier to remain intact; and iii) the absence of caveolin-1 in the SCB inhibits inflammatory reactions, which are activated by coronavirus, and prevents vertical transmission.

## Anesthesia approach for Caesarean section in a COVID-19 patient

The best anesthesia management approach to Caesarean section in COVID-19 patient is still unclear. In our view, we must have 3 main factors in mind when choosing to perform general or regional anesthesia for these patients: the safety of the healthcare team, risks and benefits to patient, and emergency scenarios.

Isolation from respiratory droplets or aerosol-generating procedures safeguards the medical personnel. The concentration of the virus in secretions and the total volume of secretions to which a healthcare provider is exposed determine the amount of viral exposure. Even with appropriate personal protective equipment, it is recommended that the time period of close exposure be limited. Tracheal intubation, bag-mask ventilation, manipulation of a bilevel positive airway pressure mask, and tracheotomy or cricothyrotomy procedures have a high potential risk of transmission. There is as yet no evidence about the contamination risk of procedures like placement or removal of supraglottic airway devices, tracheal extubation, chest compressions, or defibrillation.[14]

All healthcare workers in the operating theater must have level 2 personal protective equipment (PPE) (FFP2 or N95 masks, gown, gloves, eye protection, apron). All of those who provide direct care to a pregnant COVID-19 patient, such as a midwife and other staff, must have level 1 PPE (medical mask, gown, gloves, and eye protection).[15]

The risks and benefits for patients of regional or general anesthesia for a Caesarean section procedure have been discussed in many studies.[16,17] Regional anesthesia, spinal or epidural or both, is considered the most suitable method for the mother and the infant. However, for patients with COVID-19, the general condition of the patient is also a critical factor. If cardiovascular, respiratory, or other organ systems have failed, general anesthesia and intensive care unit attention must be considered.

Asymptomatic patients and those with mild or moderate symptoms of disease are managed according to the guidelines of the UK Obstetric Anesthetists' Association, the Faculty of Intensive Care Medicine, the Intensive Care Society, the Association of Anaesthetists, and the Royal

College of Anaesthetists, and the Society for Obstetric Anesthesia and Perinatology.[18,19] All of the guidelines prioritize regional anesthesia and the avoidance of general anesthesia when possible. PPE and safety checklists are mandatory for all types of anesthesia. In cases where general anesthesia is necessary, preoxygenation with a facemask and filter, rapid sequence induction, and intubation with a laryngoscope are widely recommended. Furthermore, the number of healthcare workers in the operating theater should be minimized.

The 4-grade Lucas classification of urgency for a Caesarean section was introduced in 2000, and following a few modifications, is still in use.[20] Grade I is used to characterize an immediate threat of compromise to the mother or the fetus and need for immediate delivery (15–30 min), grade II describes an urgent case of maternal or fetal compromise that is not immediately life-threatening (delivery within 75 min), while grade III indicates a need for early delivery but without compromising conditions, and elective, timed delivery is categorized as grade IV. An emergency Caesarean section requires substantial preoperative preparation, which is only complicated by COVID-19 conditions and precautions.[21,22]

## CONCLUSION

COVID-19 has introduced a new challenge for anesthesiologists and other healthcare professionals. There are still many unknowns with respect to this virus. While the overall risk of COVID-19 to pregnant women and the possibility for intrauterine vertical transmission are thought to be low, the precise reasons remain unclear. The necessary preparation of the patient and the staff, adequate PPE supplies, and appropriate protocol play an important role in the safety of the patients and medical staff. Spinal or epidural anesthesia is currently viewed as preferable for a Caesarean section in COVID-19 patients.

### Peer-review

Internally peer-reviewed.

### Authorship Contributions

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### Conflict of Interest

None declared.

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## COVID-19 Hastalarda Sezaryen Sırasında Anestezi Hakkında Ne Biliyoruz

SARS-CoV-2 veya "görünmez katil" sadece hayatımızı değiştirmedi, aynı zamanda günlük uygulamalarımız ve anesteziye yaklaşımımızı da değiştirdi. Önlükler, tulumlar ve 2–3 çift eldiven dahil olmak üzere koruyucu ekipman ve kıyafetler giymeye başladık. Yüzlerimiz, bulutlanmış farklı tür maskeler ve gözlüklerle kaplı bir şekilde çalışmaya başladık. Sonuç olarak, zorlukla hareket ediyor ve sınırlı görüş kabiliyetine sahip bir şekilde çalışıyoruz. Hastalarla iletişimimiz sınırlanmıştır; yüz ifadelerimizi, gülümsemeleri veya endişelerimizi göremedikleri için sadece seslerimizi duyabiliyorlar. Biz onlara daha çok yakınlık, sevgi ya da kaygı göstermekten çok robot gibiyiz. Enfekte hastalarımıza yabancıyız. Hamile COVID-19 pozitif hastalar için anestezi türü düşünülürken, önemine göre sıraladığımız üç faktör göz önünde bulundurulmaktadır: bizim için en güvenli yöntem olması, kolayca uygulanabilmesi, zor ve sınırlı hareket ve görüş kabiliyetinin ve hastanın da arzularının dikkate alınması. Öncelikler değişti mi?

**Anahtar Sözcükler:** COVID-19; hamilelik; obstetrik anestezi; sezaryen.