CHAPTER 11

ANESTHESIA MANAGEMENT IN OBSTETRIC PATIENTS WITH COVID-19

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INTRODUCTION

Through the ends of year 2019 the world has met a new infection first reported from Wuhan, China which was caused by a new type of Corona Virus named as “severe acute respiratory syndrome corona virus 2 or SARS-CoV-2”, which would be named as COVID-19 by world health organization on 11 February 2020. Within a month, on 11 March 2020, WHO declared the new infection outbreak as a pandemic. We all had some knowledge about SARS outbreak happened at 2003 but the new pandemic caused by SARS CoV-2 spreads faster and affects many people worldwide with an unpredictable course.

SARS-CoV and Middle East Respiratory Syndrome (MERS-CoV) were both reported to have more severe course when the patient was pregnant however it is not the case with COVID-19 infected parturients according to the literature that we obtained up to date regarding the clinical outcomes of
COVID-19 infected pregnant women. According to present data on COVID-19 infected patients, men has higher fatality rate than women although there is no clinical explanation for this documentation. The reason may be related to gender, underlying comorbidities or other reasons.

In the context of COVID-19 global pandemic, management of pregnant patients have become more challenging. The parturients are anxious about their health status, their babies’ health status, and the risks related to bonding and ability of breast feeding in case of separation of their baby is indicated or recommended by the care givers.

The most common symptoms of COVID-19 are fever (>37 degrees Celsius), cough (generally dry but may be productive), flue-like symptoms, diarrhea, vomiting, myalgia, tachypnea, shortness of breath, and loss of taste sensation. These symptoms however can be seen during the routine course of pregnancy and therefore can confuse the diagnosis. With the increasing rate of reverse transcriptase polymerase chain reaction (PCR) test accessibility, universal testing of pregnant women admitted to hospital is advised. Pregnant women with one or more of these symptoms should be accepted as patients under investigation for COVID-19 infection on admission to hospital and should be hospitalized at a designated service of the hospital for COVID-19 patients under investigation (PUI). Universal testing of pregnant women is essential thus most of the COVID-19 positive patients are asymptomatic on admission to hospital.

Management of pregnant patients in the context of COVID-19 global pandemic has emerged several challenges for the care givers. Early and strict communication of the obstetrician with the anesthesiologist, labor and delivery nurses, midwives, neonatologist, intensive care specialist, infectious disease and infection control experts, employee health services is essential in the context of COVID-19.

**LABOR ROOM AND OPERATION ROOM PREPARATION**

Every hospital must generate their own protocols to provide optimal healthcare for the pregnant mother who is a confirmed case for COVID-19 or suspected to be COVID-19 and under investigation, meanwhile strategies for the prevention of the dissemination of the disease, as well as protecting the health care workers by providing personal protective equipment (PPE) is crucial.

A designated labor and delivery room should be addressed preferably apart from the main labour service to prevent the transmission of the disease
to the pregnant women tested negative for COVID-19. Patients that are confirmed cases or under investigation for COVID-19 should wear a surgical mask on admission to hospital. PPE should be present in the designated labour unit, an area to don and doff the PPE should be assigned for the health care workers, and the health care workers should be trained for the proper donning and doffing of PPE. There must be proper signages on the doors of the labor and delivery rooms regarding the presence of an infected case. Minimum number of personnel should be present in the labor room while maintaining the optimal care for the laboring patient to decrease the risk of infecting the health care workers.

The designated labor and delivery unit should preferably be isolated for single patient and should have negative pressure that has at least ten fresh air changes per hour. If negative pressure system is not the choice, air conditioning must be turned off and a natural aeration must be used.

The standard equipment used during the labor and delivery process must be kept in closed sterile trays aiming to prevent contamination. An invigilator personnel should be readily present close to the dedicated labor and delivery room, but outside the room, to provide any extraordinary medical equipment if needed during the labor and delivery. Since communication under PPE is often difficult and may lead to misunderstandings under PPE, all stuff taking part in the labor process should be trained for different possible scenarios. The role of all medical stuff must be well defined, their names should be clearly written on the coveralls.

**TESTING ON ADMISSION**

COVID-19 is a highly contagious infection that can be transmitted via droplets, aerosols, and with close contact with confirmed cases. Current data suggests that even an asymptomatic patient can transmit the disease to their close proximity before any symptoms of the disease is present. Although most of the early common symptoms of COVID-19 (fever, myalgia, shortness of breath, fever, headache) overlap with the symptoms of pregnancy, during the COVID-19 pandemic health care personnel should be awake and should keep in mind the possibility of taking care for an infected case. Apart from the previous severe acute respiratory syndrome (SARS) outbreak in 2002, the clinical course of COVID-19 in pregnant patients is mild and most of the pregnant patients admitting to hospital for delivery are asymptomatic. Therefore; patients with the symptoms of fever (>37°C), caough (dry or pro-
ductive), shortness of breath, diarrhea, or pregnant patients that had a close contact with a confirmed COVID-19 patient should be tested for COVID-19.

The specificity of reverse transcriptase polymerase chain reaction testing for viral ribonucleic acid is unclear and may report false negative results if the viral load is small and/or if the specimen was not sampled in an appropriate manner. But especially in high prevalence communities it is advocated to perform PCR testing to the pregnant women on admission to hospital for labor and delivery thus most of the pregnant patients are asymptotically infected or may be asymptomatic at the time of admission. The importance of testing the parturient on admission to the hospital has two arms. One is that if the parturient is tested positive, she will be isolated in a dedicated labor and delivery unit and the second arm is the transfer of the patient will be through the predetermined route to the dedicated labor and delivery room that will assure to limit the contamination of the hospital, and transmission of the disease to the health care providers.

PREANESTHETIC CONSULTATION

To assure the optimal anesthetic care for a confirmed COVID-19 or highly suspicious pregnant women admitted to hospital for delivery, a team of anesthesiologists, obstetricians, neonatologists, midwives, critical care experts, infectious disease and infection control experts must be in close communication.

Pregnant patients must be evaluated for vital signs and physical examination excluding lung auscultation with a stethoscope to prevent transmission. Ultrasonographic evaluation of pulmonary system is recommended to assess the presence of consolidation or atelectasis of the lungs. Laboratory test should include complete blood count. Although thrombocytopenia is a common occasion during pregnancy, a platelet count of less than 100000 x 106/L is rare. In the very early phase of the pandemic, a clinical report from China reported that pregnant patients with COVID-19 disease had lower platelet counts but the recent studies could not confirm this finding.

An arterial gas sampling is indicated for patients whose SpO2 level is below 93% at room air, tachypneic and or needing oxygen support. Hypoxia (SpO2<93% at room air), severe dyspnea, tachypnea (>30 breaths/min), respiratory distress are the signs for the severity of the disease indicating the progression of the respiratory function deterioration.
LABOR ANALGESIA

There is no clinical evidence for avoiding neuraxial labor analgesia for pregnant women that is a confirmed COVID-19 case or suspected to be positive and under investigation. The obstetricians must inform the obstetric anesthesiologists early on admission of the parturient to the hospital and keep close communication to inform the clinical progression of labor. Furthermore an early implemented epidural catheter is essential in the context of COVID-19 to avoid deterioration of respiratory status of the patient due to labor pain and to reduce the possibility of the need for general anesthesia induction if intrapartum cesarean section is needed.

Epidural analgesia is not accepted as an aerosol generating procedure therefore an impervious gown, a surgical mask, eye protection and sterile surgical glows are the adequate PPE that must be donned by the anesthesiologist during the epidural analgesia placement process. The PPE should be donned outside the labor and delivery room preferably at a predefined and dedicated area for donning and doffing of the PPE in the labor and delivery unit. The patient must wear a surgical mask at all times starting from the admission to the hospital for delivery to minimize contamination with droplets. To minimize the risk of transmission and to keep the minimum number of healthcare providers within the room of a COVID-19 infected patient, a midwife dealing with the pregnant patient may assist the anesthesiologist while placing the epidural catheter. All routine medical equipment necessary for the placement of an epidural catheter must be in dedicated trays and preferably disposable materials must be used whenever possible to prevent the contamination with droplets.

The laboratory tests of a pregnant women receiving epidural analgesia who is a confirmed COVID-19 positive case or symptomatic and under investigation for COVID-19 must include a complete blood count before epidural analgesia placement. A platelet count of $>70000 \times 10^6/L$ or above is accepted to be safe to provide a neuraxial analgesia in pregnant patients to avoid general anesthesia and its probable inadvertent side effects as respiratory compromise and aerosol generating procedures during intubation and extubation that will increase the risk of transmission of the disease to the medical stuff taking care of the patient within the labor and delivery unit. Clinical reports from China in the very beginning of the pandemic reported a platelet count of less than $150000 \times 10^6/L$ in 36.2% of the pregnant patients with COVID-19 infection and this was supported by another meta-analysis reporting that the severity of thrombocytopenia increases with the increasing severity of COVID-19.
infection. Although epidural hematoma is a big threat with platelet counts less than 70000 \times 10^6/L, up to date there is no reported case of epidural hematoma formation following epidural catheter placement for labor analgesia in a COVID-19 infected pregnant women.

To avoid any possible complications as inadvertent dural puncture, to increase the success rate of epidural analgesia, and to decrease the time spent within the same room while placing an epidural catheter to a parturient tested positive for COVID-19, preferably the most experienced anesthesiologist must carry out the epidural procedure. Minimum number of personnel must be present in the labor and delivery room during epidural placement while assuring the optimal assistance to the stuff anesthesiologist.

Epidural analgesia results in an increase in body temperature and this may worsen the clinical course of a parturient tested positive or symptomatic and under investigation for COVID-19 infection. A common feature of COVID-19 tautologous is pyrexia and the increased maternal body temperature may also lead to fetal compromise. Recommending fetal monitoring during the placement of an epidural catheter for labor analgesia is therefore logically a necessity.

Treatment of inadvertent dural puncture with epidural blood patch is another challenging concern in parturients tested positive or symptomatic and suspected for COVID-19 infection. When conservative follow up, hydration and paracetamol are ineffective for the management of post-dural puncture headache, epidural blood patch is used to stop the leakage of cerebrospinal fluid from the punctured dura however in COVID-19 parturients injecting the viremic blood may result into meningitis or encephalitis. We recommend staying on the safe side of the treatment of post-dural puncture headache and postponing epidural blood patch although there is no reported encephalitis or meningitis case following epidural blood patch during the COVID-19 tautologous.

There is no clinical data about the aerosolization of nitrous oxide used for labor analgesia but it is recommended to suspend the use of nitrous oxide for labor analgesia in the context of COVID-19.

Using remifentanil patient controlled analgesia also is not recommended for a pregnant patient tested positive or symptomatic and under investigation for COVID-19. The threat in the use of remifentanil for labor analgesia is the risk of respiratory depression which may be life threatening for a pregnant patient with COVID-19 infection that has a respiratory compromise.
ANESTHESIA MANAGEMENT IN OBSTETRIC PATIENTS WITH COVID-19

ANESTHESIA FOR CESAREAN SECTION:

As formerly mentioned, the route of the pregnant patient who tested positive or symptomatic and under investigation for COVID-19 infection must be well defined and protocolized starting from the hospital admission to the labor and delivery unit. Moreover, the transport of the parturient to the operation room, to the postoperative service or intensive care unit must be well documented to minimize the risk of hospital contamination and transmission. The patient must be the last in the order of operation list to minimize the risk of transmission and contamination of the operating theatre.

Neuraxial anesthesia is recommended for parturients with confirmed or suspected cases of COVID-19 to avoid the transmission with aerosol generating procedures as intubation and extubation during general anesthesia. The usual contraindications as coagulation disorders, thrombocytopenia, and fever also apply to the COVID-19 infected parturients. The neuraxial anesthesia may be provided by either extending the epidural analgesia or de novo spinal or combined spinal epidural anesthesia.

The cesarean rates increased during the COVID-19 tautological either due to medical reasons (fetal compromise due to maternal fever) or due to the willing of the parturients to undergo cesarean section rather than vaginal delivery since they are anxious about vertical transmission to their babies. For scheduled cesarean sections, epidural, spinal or combined spinal epidural anesthesia can be the choice of neuraxial anesthesia. Neuraxial anesthesia is accepted as non aerosol generating procedure therefore the PPE needed for anesthesiologists includes a waterproof apron, sterile gloves, eye protection, and water resistant surgical mask. The patient must wear a surgical mask at all times. The risk of conversion to general anesthesia from neuraxial anesthesia for a scheduled cesarean section is less and generally be anticipated. Neuraxial anesthesia must be performed by the most experienced anesthesiologist available to increase the success rate of neuraxial anesthesia, and to reduce the risk of complications as failed block or inadvertent dural puncture.

Emergent intrapartum cesarean section may be needed during the course of parturition therefore close communication between the anesthesiologist, midwife and the obstetrician is crucial for assuring the best anesthetic care for the parturient. The midwife can inform the anesthesiologist about the performance of an epidural catheter inserted for labor analgesia. For the successful extension of epidural analgesia to neuraxial anesthesia for cesarean section, the obstetrician must inform the anesthesiologist about the timing of cesarean
section to provide the necessary time for local anesthetic spread. If the epidural catheter inserted for labor analgesia is not functioning well, the anesthesiologist should consider de novo spinal or combined spinal anesthesia induction which is not more time consuming than induction of general anesthesia when applied by the most experienced anesthesiologist available.

The conversion risk to general anesthesia from neuraxial anesthesia in emergency cesarean section cases is higher than scheduled cases and the emergency cesarean section cases often do not have a PCR test for COVID-19 within the last 48 hours, therefore the anesthesiologist must don a FFP3 or N95 mask, eye protection, long sleeved waterproof gown, and gloves. All medical stuff must don their appropriate PPE outside the operation theatre before the patient has arrived. Minimal number of care givers must be present in the operation room during the neuraxial procedure. Conventionally necessary equipment and medications for neuraxial anesthesia must be readily available in sterile trays to prevent contamination. A runner outside the operation room must be standing to assure any extra need during the process of neuraxial anesthesia and cesarean section. A dedicated operation room must be used for all confirmed or suspected cases for COVID-19.

A research article reported that the incidence of hypotension following neuraxial anesthesia was increased in pregnant patients with COVID-19, however this study had limitations. The information about the use of a vasoressor agent or intravenous crystalloid infusion following induction of neuraxial anesthesia and the blood pressure trends were lacking and the sample size was only 19 patients. According to our clinical experiences with neuraxial anesthesia in COVID-19 positive parturients, neuraxial anesthesia is well tolerated if management of hypotension is managed properly with intravenous crystalloid infusion and vasoressor administration.

Another common complication of neuraxial anesthesia is nausea and vomiting that should be properly managed. The use of dexamethasone for the management of nausea and vomiting for a confirmed or suspected COVID-19 infected parturient is not recommended since high dose steroid may worsen the clinical course of the disease. Alternative antiemetic medications should be mentioned.

Uterotonic medication should be used with caution. Avoid using carboprost tromethamine as the first line uterotonic medication since it may cause bronchoconstriction and pulmonary vasoconstriction that will increase the aerosol production. Oxytocin and methylergonovine should be considered as alternative uterotonic medications.
GENERAL ANESTHESIA

General anesthesia is an aerosol generating procedure during intubation and extubation of the patient. The threat of general anesthesia induction for cesarean section in a confirmed or suspected COVID-19 infected pregnant patient is the respiratory compromise due to endotracheal intubation. The threat on the medical care givers side is transmission of the disease via aerosols during the intubation and extubation processes.

Preoxygenation is mandatory as is usual for induction of general anesthesia in obstetric population without COVID-19 infection. However, high-flow nasal oxygenation or face mask oxygenation should be avoided since they are accepted as aerosol generating procedures. Patient must be preoxygenated with a tight fitting mask applied by two hand technique with usual oxygen flow rates to minimize the risk of aerosolization. Rapid sequence induction and intubation is recommended for parturients that are confirmed cases or suspected to be COVID-19 infected.

All medical stuff should don proper PPE for aerosol generating procedures before the patient is transferred to operating theatre. The anesthesiologist should don a FFP3 or N95 mask, long-sleeved waterproof gown, eye protection, and at least two pairs of gloves. Difficult airway is an anticipated condition in obstetric population and the additional respiratory compromise with COVID-19 infection increases the difficulty of airway management of parturients that are tested positive for or suspected to be COVID-19. The most skilful and experienced anesthesiologist must handle the intubation process to increase the first pass success rate. Fiberoptic laryngoscopes should be used whenever possible to decrease the risk of cross-contamination. A cross clamp on the intubation tube is recommended until the cuff is inflated and the patient is connected to the anesthesia circuit to minimize the risk of contamination with aerosols and transmission of the disease to the medical stuff in the operation room. Before starting induction of anesthesia, caregivers other than the anesthesiologists must leave the operation room whenever possible to decrease the transmission risk. Intraoperative anesthesia management is carried out as usual. Small tidal volumes (8-10ml/kg) with a frequency of not more than ten are recommended. Positive end expiratory pressure may be used to maintain the desired oxygen saturation levels in arterial blood gas analysis samples.

The extubation is an aerosol generating procedure which poses the risk of high aerosol production during the cough on extubation. Several measures have been tested for to prevent or at least reduce the cough produced following
extubation. Dexmedetomidine, lidocaine, remifentanil, and fentanyl were used for this purpose and dexmedetomidine was found to be most effective amongst these drugs in decreasing the frequency of post extubation cough. Anesthesiologist must always keep in mind that dexmedetomidine and opioids may result in respiratory depression in a pregnant patient whose lung capacity is decreased and respiratory system is compromised with COVID-19 infection.

**POSTPARTUM ANALGESIA**

For the asymptomatic and mild symptomatic patients usual postoperative analgesia modalities can be used. The epidural catheter can be used to initiate an epidural patient controlled analgesia (PCA). The PCA provides the opportunity of efficacious control of pain but the anesthesiologists should be alert for the possibility of respiratory depression due to the opioids. In the early periods of the pandemic, avoiding non steroidal anti-inflammatory drugs were recommended without any clinical robust data. The logic was the non steroidal anti-inflammatory drugs increase the ACE-II receptor which was defined as a binding site for COVID-19.

An alternative postoperative pain control modality is adding a transversus abdominis plane block or a low thoracic/high lumbar erector spinae plane block as the part of a multimodal analgesia.

**CONCLUSION**

COVID-19 is a global emergency health threat challenging all health care management strategies. Management of confirmed or suspected COVID-19 parturients in the labor and delivery units increased the importance of communication and team work to assure the best care for the pregnant woman while protecting the health care providers from transmission of COVID-19.

Based on the data on the management of COVID-19 infected parturients up to date, most of the pregnant patients are asymptomatic on admission therefore care givers must don the appropriate PPE while providing best health care to the parturient unless the patient tested negative for COVID-19.

Providing early neuraxial labor analgesia is very important in the context of COVID-19 that can be extended to surgical anesthesia if intrapartum cesarean section is needed. De novo spinal or combined spinal epidural anesthesia
should be applied in case of a failed labor epidural analgesia. If general anesthesia is unavoidable, the patient must be consulted with the intensive care unit expert and the health care providers should don the appropriate PPE for aerosol generating procedures.

All effort must be on the prevention of transmission to the health care workers while assuring the optimal care for the parturient who tested positive for or suspected to be COVID-19 positive.

REFERENCES


