Review Article

COVID-19: Considerations for Obstetric Anesthesia and Analgesia

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Abstract

Peripartum services are indispensable notwithstanding the COVID-19 pandemic. Providing safe and quality obstetric anesthesia is quite demanding as most signs and symptoms of COVID-19 are non-specific and overlap with the constitutional signs of pregnancy. Overloaded viral testing facilities, urgency of caesarean delivery, limited resources, capricious evidence-base, and potential exposure risk to healthcare providers further add to the challenge imposed by COVID-19. In this discourse we attempt to provide a summary of the current evidence and recommendations concerning the practice of obstetric anesthesia and analgesia.

Keywords: *Analgesia, COVID-19, obstetric anesthesia, SARS-Co-V2*

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Introduction

Since late 2019, an unknown cause of severe acute respiratory infection (SARI), subsequently identified to be caused by a novel beta coronavirus, now designated SARS-CoV2, has caused unprecedented disruption in the provision of medical and surgical services globally. At the time of this writing, this pandemic "coronavirus disease 2019" (abbreviated COVID-19) has involved over 200 countries, over 6 million cases and has caused the death of over 3.5 lakh people world over.[1] Transmission of the virus occurs via aerosol and droplets. The smaller of the two, that is, aerosols, tend to remain suspended in the air for prolonged periods exposing greater number of individuals, even at a greater distance from the source. Droplets have a tendency to settle on surfaces and the virus has been found to survive on fomites promoting contact transmission. Asymptomatic individuals, including children, can also spread the virus.[2-5] Peripartum services, in contrast to many other healthcare services, cannot be deferred or postponed with the view of redirecting resources towards the overload imposed by COVID-19.[6] Several recommendations and practice guidelines were rapidly made based on the similarities of SARS-CoV2 infection with those of the outbreaks caused by MERS-CoV, SARS and influenza viruses. The new evidence on COVID-19, of which several may be of questionable quality yet nonetheless useful, appears every day and so recommendations may change with time. In this article we try to summarize the available evidence, expert opinions, and recommendations related to the provision of obstetric anesthesia services.

The "High Infection Risk" Parturient

Prompt identification of patients at high risk of infection is important to limit the spread of infection to other parturients and healthcare workers. The clinical features so far identified in association with COVID 19 include fever, fatigue, cough, myalgia, shortness of breath, sore throat, diarrhea, nausea, headache, and vomiting.[7] Sudden anosmia or hyposmia has also been reported.[8]

It seems apparent from the above description that many of these can be attributed to the constitutional symptoms of pregnancy. This limits the usefulness of using temperature monitoring as the sole clinical tool for screening. Screening for travel and contact history also has limited reliability as nearly every country is infected, asymptomatic spread occurs and because of the local community transmission. Hence all parturients with a history or symptoms suggestive of upper respiratory tract infection (URI) and travel history should be considered as high

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infection risk or PUI (Patient Under Investigation) and isolated till tested negative.[9] This isolation should ideally be done in an Airborne Infection Isolation Room (AIIR), a negative pressure room with at least 6 air exchanges per hour.

Clinical Outcome of COVID-19 in Pregnancy

The clinical outcomes of parturients were poor during the SARS and MERS outbreaks with high rates of intubation, organ failure, and consumption coagulopathy.[10-12] The physiological changes in pregnancy predispose these patients to pneumonia and fetal outcomes of women with pneumonia, in terms of growth restriction and in-utero fetal demise, were also worse during the influenza outbreak.[13,14]

However, in contrast to the SARS, MERS, and influenza outbreaks the clinical course of COVID-19 appears to be mild in most pregnant patients.[15] This could be because of sex-related immunological differences[16] between men and women which might also explain the higher mortality in infected men.[17] In a joint report of 147 cases in pregnancy, WHO-China have recorded 8% as suffering from severe respiratory disease with SpO_2 of <93% and a PaO_2/FiO_2 <300 mmHg. Only 1% of these patients required mechanical ventilation.[18] Liu *et al*., in a small case series of 13 patients, however, noted higher rates of preterm labor and emergency caesarean sections in view of fetal distress. One of these mothers needed mechanical ventilation and ECMO.[19] Few reports suggest increased chances of preterm births and fetal distress.[20,21] Preterm births seem to be the most common complication associated with COVID-19.[20] A national cohort study in the United Kingdom reports 27% patients as having had preterm births, of whom 47% required iatrogenic delivery for maternal indications and 15% had fetal distress.[22,23] But this remains merely an association and no causal link to COVID 19 has been established so far. Vertical transmission has also been reported.[22,24,25]

Reorganizing Obstetric Anesthesia Services

A team approach takes precedence in managing the obstetric patient for emergency caesarean section. This team should include contributions from anesthesiology, obstetrics, labor and delivery nurses, neonatology, critical care, infectious disease and infection control, employee health services and telemedicine. They should create established protocols with suitable cognitive aids to streamline the management of COVID-19 patients.

There should be well established lines of communication between the obstetrician and the anesthesia team. A COVID-19 dedicated quick response team (of obstetricians, anesthesiologists and paramedical staff) would enable provision of rapid services. Early information about the possibility of a COVID-19 positive or suspect emergency caesarean section will enable operating room (OR) preparedness and minimize donning time and errors. If the case is a suspect while tests are awaited it is to be managed as a positive case.[23] The increased minute ventilation of pregnancy may increase the chance of droplet spread and hence all suspect cases should be given a surgical mask. Dedicated OR and isolation rooms with separate doffing and donning areas should be identified and modified according to regulatory guidelines to prevent spread of airborne infection to non-COVID areas.[26]

Digital record keeping with remote access and telephonic or videoconferencing should be encouraged in patient evaluation, monitoring, hand-overs, and follow-up to minimize healthcare worker exposure as well as conserve PPE (Personal Protective Equipment).

Anesthetic Choice and PPE

- The choice of anesthesia should be dictated by the urgency of the caesarean section rather than the serostatus of the patient. The level of PPE required during a caesarean birth should be determined based on the risk of requiring general anesthesia.
- Regional anesthesia (RA) should be considered as first line[23,26-30] since it is not an aerosol generating procedure (AGP)[28] as against general anesthesia (GA) which requires airway manipulation.
- The patient should be wearing a surgical mask at all possible times.
- When regional anesthesia is being instituted all non-essential personnel should be outside the procedure room. Only necessary equipment and medication should be inside. A runner with additional equipment may stay outside the procedure room. Those inside should wear a fluid resistant disposable gown (FRDG), gloves, a fluid resistant surgical mask (FRSM) and eye protection.[28] These protect against droplet but not airborne infection.
- In cases where GA is highly likely as in emergency caesarean sections, difficult regional anesthesia (e.g., obesity, scoliosis, poorly functioning labor epidural), full airborne precautions would be ideal.[28-31] This replaces the FRSM with a N95 or FFP3/FFP2 mask in addition to droplet precautions as above.
- Deciding on anesthetic technique for non-obstetric conditions mandating surgery during pregnancy should follow the same principles.

Neuraxial Techniques and COVID-19

Although intrathecal seeding of the virus, and meningitis, is theoretically possible, this has not been causatively demonstrated in SARS-CoV2 or even in influenza infection.[32] Similar questions were raised in the past on providing neuraxial anesthesia in viremic patients with HIV, Varicella Zoster Virus (VZV), Herpes simplex viruses (HSV), Ebola, and SARS. A literature search revealed no randomized clinical trials demonstrating meningitis from neuraxial anesthesia in these patients. Reports and observational

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studies relating to HIV deem neuraxial anesthesia as safe in immunosuppressed obstetric patients.[33-35] Evidence supporting the uneventful use of neuraxial anesthesia for caesarean deliveries in parturients with viremic VZV, MERS, and SARS are limited to case reports and weak practice recommendations.[36-39] Similar testimonies also support neuraxial techniques in HSV-2 infection.[40,41] Concerning Ebola, the problem was more in relation to the hemorrhagic nature[42,43] of the disease precluding the use of neuraxial techniques. However, no publication has listed these infections, with the exception of injection site VZV, as absolute contraindications for neuraxial procedures. COVID-19 can present with lymphopenia and leukopenia as well. As long as strict aseptic precautions are adhered to, the infection risk to the patient should remain the same as in patients with other causes of immunosuppression (e.g., chemotherapy).

There are few case reports of SARS-CoV2-related spontaneous meningoencephalitis and even fewer such cases where the virus has been isolated from the CSF.[44-47] But no reports exist to support viral seeding during a lumbar puncture. Case series, totalling 77 patients in the present literature, have reported uneventful neuraxial procedures inclusive of spinal, epidural and combined spinal-epidural (CSE) anesthetics, with an unremarkable postoperative course.[3,48-51] One of these patients was on maximal non-invasive ventilation at the time of caesarean delivery.[49] From the available evidence we may infer that neuraxial techniques are reasonably safe and should be preferred in this group of patients.

A word of caution however is the association between neuraxial techniques and exaggerated hypotension in COVID-19 patients.[51] This will logically be more common in febrile patients. Prophylactic vasopressor infusion can potentially minimize this; however, one should be aware of a possible higher dose requirement in SARS-CoV2 infected patients.

Coagulation and COVID-19

Thrombocytopenia is another known complication of COVID-19. This is most often mild (100×10^9/L to 150×10^9/L), and counts less than 100×10^9/L were rare (<5%) according to a cohort of 1099 non-pregnant patients.[52,53] Available evidence, however, suggests the presence of a hypercoagulable state manifesting as low grade disseminated intravascular coagulation (DIC) and thrombotic microangiopathy[54] in non-pregnant patients. This combined with the hypercoagulable state of pregnancy and potential decreased mobility of the mother near term may predispose them to venous thromboembolism (VTE). Hence, these patients may be on prophylactic, in some cases therapeutic, anticoagulation, and timely perioperative titration will be required. A high index of suspicion for VTE should be maintained as patients with COVID-19 may require higher dose of prophylactic anticoagulants which is being evaluated by several trials (IMPROVE, COVID-HEP, X-COVID-19).[54-58] Perioperative point of care ultrasound (POCUS) would be a good choice to rule out VTE when feasible. Other point of care tests such as thromboelastography may be of great benefit.[58] In short, all of these patients should have, at minimum, a recent platelet count before proceeding for surgery or neuraxial procedures.

Labor Analgesia

Early epidural analgesia is recommended by several organizations because of the simple fact that this can also be extended for intraoperative use. However, after placement one should regularly follow-up the quality of analgesia to assess the functioning of the epidural. Remote assessment using numerical rating scales for pain should be adequate. Droplet precautions are considered adequate for epidural placement. Dosing of epidural opioids should be done with caution and long acting opioids avoided, especially in patients with respiratory symptoms and low oxygen saturation (<95%) as it may cause respiratory depression.

Entonox may be used as it is not considered an AGP,[23] however droplet precautions must be in place and the equipment circuit should have a viral filter. IV PCA using fentanyl and remifentanil should ideally be avoided as they may cause respiratory depression, nausea, and vomiting.[30] Ketorolac, ibuprofen and NSAIDs have been poorly associated with aggravating the infection trajectory of COVID-19 and should be avoided in sick patients.[29,30] Paracetamol might be safer alternative.

Preoperative Evaluation

All patients should be thoroughly evaluated (with minimal contact) including vital signs, modified physical examination (such as POCUS lung ultrasound instead of auscultation), laboratory tests (blood counts, metabolic panel, blood gases if needed) as this will enable planning appropriate care and monitoring. Continuous pulse oximetry and strict titration of fluid balance are a must. Early detection and treatment of hypoxia is important as undetected it can cause fetal hypoxia and distress becoming an indication for an emergent caesarean section. Oxygen can be supplemented via face mask or nasal prongs with a FRSM over the device which can limit the droplet spread. Increasing oxygen requirements will serve as a marker for disease progression and decision to institute assisted ventilation, be it invasive or non-invasive, should be taken early so that it may be done in a controlled manner with adequate precautions. Adequate precautions should be taken while transferring patients to and from dedicated OR/perioperative room.

Intraoperative Management

Standard monitoring should be in place with a dedicated OR (ideally an AIIR), protected anesthesia workstation[59]

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and only essential equipment and personnel inside the OR. In a category 4 caesarean, the surgical team may wait outside while neuraxial block is confirmed and then scrub into PPE for droplet precautions. However, in urgent, emergent scenarios where GA is likely, minimum personnel donned in full airborne PPE should be at the ready before anesthesia is instituted. Paperless intraoperative recordkeeping will be best. Avoid excessive intraoperative fluids.

Spinal anesthesia, CSE or extension of labor epidural can be used depending on the operator preference. Prophylactic vasopressor should be used instead of overzealous preloading/co-loading. A single shot technique with a thin spinal needle (26-25G) might be preferable as this is less traumatic and may decrease the amount of viremic blood seeding the neuraxis. Single shot hyperbaric bupivacaine, 15 to 25 μg fentanyl with morphine (not more than 100 μg) can be used. However, prophylactic antiemetic administration is a must. Some recommend against the use of dexamethasone,[30] but nevertheless at least ondansetron should be used, but potential QT-prolongation should be considered. The addition of morphine is suggested to cover the postoperative pain, but the decision should be individualized to the patient, that is, avoid in respiratory compromise as well as high-risk PONV cases. In these cases, analgesia may be provided using local infiltration, transversus abdominis plane block, epidural analgesia, or paracetamol.

If GA is required, only essential personnel with barrier intubation devices[60] should be present in the OR. Follow local standard operating procedures for induction.[26] Preoxygenation, with low flows in a closed circuit, can be performed after achieving a good 2-handed mask seal. Avoid positive pressure ventilation or when unavoidable, assist with low volume breaths. Perform rapid sequence induction and intubation (RSII) using video-laryngoscopy as the first line. Single use supraglottic devices to be used as back-up only for a "cannot ventilate" situation. The rest of the team may enter in airborne PPE after successful intubation. Pregnant patients tend to have a physiologic decrease in $PaCO_2$ and hence, if possible, ventilation should be titrated to maintain this in the range of 28–31 mmHg to augment off-loading of oxygen to the fetus. Else, a lung protective strategy should be followed such as the ARDS net ventilator protocol and the first priority should always be maintaining oxygenation. All GA patients should be allowed to recover in the same OR if they can be extubated. Else transfer to a dedicated ICU. Carboprost should be avoided for prophylaxis against postpartum hemorrhage as this can cause bronchospasm.[48,61] Oxytocin and methylergonovine may be used appropriately.

Postoperative Management

Standard postoperative care should be instituted with emphasis on continuous pulse oximetry, appropriate isolation of mother and child, judicious fluid, and pain management. Controlling postoperative pain is important as this may worsen hypoxia as tachypnoea increases the work of breathing. Postdural puncture headache (PDPH) should be managed conservatively with supine bed rest, judicious fluids, paracetamol, and caffeine. Epidural saline maybe considered in place of an autologous blood patch in intractable cases. A case-by-case approach is recommended. In sick patients it is advisable to postpone the blood patch.[61]

Psychological Welfare

It can be appreciated than a label of "COVID-19 positive" can significantly increase the stress of both patients and the attending healthcare team alike and this would not be favorable for maternal or fetal well-being.[62,63] Hospital support groups and mental health professionals may help in this regard through telemedicine.

Conclusions

Most pregnant women with COVID-19 are either asymptomatic or present with mild disease.[15,61] It is, therefore, important to maintain a high index of suspicion and treat all suspect as COVID-19 positive unless proven otherwise. This involves establishing a system of rapid communication, dedicated management areas and workflow, avoiding AGPs, minimizing personnel exposure and appropriate yet adequate PPE. Early epidural analgesia and intraoperative neuraxial anesthesia are preferred.

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Conflicts of interest

There are no conflicts of interest.

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