Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

International Journal of Obstetric Anesthesia (2020) 43, 1–8
0959-289X/$ - see front matter
https://doi.org/10.1016/j.ijoa.2020.04.006

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REVIEW ARTICLE

Novel coronavirus SARS-CoV-2 and COVID-19. Practice recommendations for obstetric anaesthesia: what we have learned thus far

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ABSTRACT
SARS-CoV-2 is a novel coronavirus causing a global pandemic of a severe respiratory illness known as COVID-19. To date, globally, over 30,000 people have died from this emerging disease. As clinicians and healthcare systems around the world are rapidly adapting to manage patients with COVID-19, limited data are emerging from different patient populations to support best-practice and improve outcomes. In this review, we present a summary of emerging data in the obstetric population and offer obstetric and anaesthetic clinicians around the world a set of evidence-driven, practice-based recommendations for the anaesthetic management of pregnant women with suspected or confirmed COVID-19.

Keywords: Coronavirus; COVID-19; Anaesthesia; Obstetrics; Recommendations

Introduction

In late 2019 a pneumonia of unknown cause, subsequently identified as caused by a coronavirus, was first detected in Wuhan, China. The International Committee on Taxonomy of Viruses named it the 'severe acute respiratory syndrome coronavirus 2', or SARS-CoV-2, as it is related to the virus that caused the 'Severe Acute Respiratory Syndrome' (SARS) outbreak in 2003.[1] On 11 February 2020, the World Health Organization (WHO) announced that the official name of the disease it caused would be 'COVID-19', a shortened version of 'coronavirus disease 2019'.[2]

The trajectory of international infection has been unprecedented and on 11 March 2020, the WHO termed the outbreak a pandemic. Although this term has no universally agreed definition, it is widely accepted to mean an epidemic that has spread over several countries or continents, affecting a large number of people.

Coronaviruses were first identified as a cause of infection in animals in the 1930s and human infection in the 1960s. They are named after the ring of spiked glycoproteins forming a halo structure on the outer surface of the virus. There are three groups and four types (alpha, beta, gamma and delta) of coronavirus; human infection arises from viruses in Groups I and II.[3]. The SARS-CoV-2 virus is a novel beta coronavirus that causes a syndrome of principally respiratory disease. Much like the coronaviruses that caused SARS and the 2012–2014 Middle East Respiratory Syndrome (MERS), which are also beta coronaviruses, COVID-19 is thought to have originated in a non-human species. The closest match to the human coronavirus has been found in a bat in China's Yunnan province; 96% of the genetic material of bat coronavirus is shared with SARS-CoV-2.[4]

Genetic analysis of 103 SARS-CoV-2 genomes has identified two major strains designated as L-type and S-type.[5] S-type SARS-CoV-2 is the ancestral and less aggressive strain of the virus, with approximately 30% prevalence. L-type SARS-Cov-2 is thought to have evolved from the S-type virus and is both more aggressive and more prevalent (70%).[5]

Transmission of the virus occurs through respiratory spread via droplets or aerosols (airborne transmission); the virus replicates in the respiratory epithelium. Droplets are expelled particles that have a propensity to settle quickly to the ground, usually within 1 m of the site of generation.[6] Aerosols, expelled particles that

Accepted April 2020
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are comparatively smaller in size than droplets, can remain suspended in the air for prolonged periods. This can lead to exposure of a greater number of individuals to possible infection at a greater distance from the source.[7] Additionally, viral transmission can occur from infected surfaces, and there are reports of viral spread from asymptomatic individuals.[8]

There may be sex differences in vulnerability and mortality to COVID-19 tautologous. Emerging evidence suggests that more men than women are dying.[9] The reasons for this are unclear, but factors may include sex-based immunological or gendered differences[10] or underlying cardiovascular or respiratory morbidity.

COVID-19 is an international public health emergency. In contrast to many other areas of healthcare which can be deferred to prioritise dealing with patients affected by COVID-19 tautologous, care for obstetric patients remains a clinical priority.[11] This article summarises current knowledge about COVID-19 tautologous in pregnancy with particular reference to obstetric anaesthesia care. As new evidence appears on an almost daily basis, official guidance will continue to evolve. In this article, we present a series of practical recommendations for the anaesthetic management of pregnant women, based on currently available evidence and practical experience. Case series data remain sparse in the obstetric population, so the recommendations presented here may also change rapidly.

Clinical features in pregnancy and outcomes

The clinical features of COVID-19 include fever, cough and general flu-like symptoms, although gastrointestinal symptoms (diarrhoea, vomiting, abdominal pain) may be the presenting features, even occurring in the absence of respiratory symptoms. A WHO-China joint report on COVID-19 described a series of 147 cases in pregnant women (62 confirmed, 82 suspected and one asymptomatic) and noted that 8% suffered severe respiratory disease (defined as tachypnea >30 breaths per min or oxygen saturation of <93% or PaO_2/FiO_2 <300 mmHg). One per cent had critical disease, defined as requiring mechanical ventilation.[12]

Polymerase chain reaction testing for acute SARS-Cov-2 infection requires nasopharyngeal swabs. Inpatients or patients requiring admission to hospital who have clinical or radiological evidence of pneumonia or 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. Patients who meet these criteria should be isolated and managed as 'positive' until test results are available.[13]

There are relatively limited data from the previous SARS and MERS epidemics on the impact on pregnancy outcomes.[14] The clinical outcomes of pregnant women during the SARS epidemic were worse than those of non-pregnant women, with higher rates of tracheal intubation, renal failure and disseminated intravascular coagulation.[15] Data for pregnant women from the MERS outbreak are also suggestive of worse outcomes.[16,17] As well as the viral inflammatory process, pregnant women were vulnerable to secondary bacterial infection pneumonia. The cardiorespiratory physiological changes of pregnancy may predispose women with pneumonia to respiratory failure.[18] Fetal outcomes in pregnant women with pneumonia are significantly worsened; the fetus is vulnerable to intra-uterine growth restriction and in utero demise.[19]

In contrast to these epidemics, early data emerging from the COVID-19 experience suggests that most pregnant women with COVID-19 will experience mild disease.

As the global number of cases continues to increase, more series of the clinical course of COVID in pregnancy are emerging. Wang et al. published one of the first cases of a pregnant woman at 30 weeks' gestation who presented with fever following travel to Wuhan.[20] Computed tomography (CT) chest imaging revealed features of severe atypical pneumonia with ground-glass opacities. The patient was admitted to an intensive care unit (ICU) for respiratory support, but following a decrease in fetal movements and a loss of fetal heart rate variability, she underwent emergency caesarean delivery under combined spinal-epidural (CSE) anaesthesia. The preterm infant tested negative for SARS-CoV-2. Subsequent serial CT scans showed resolution of pneumonic changes and both mother and baby experienced an uncomplicated postnatal course.

A 13-case series by Liu et al. describing pregnant women with confirmed SARS-CoV-2 represents the typical clinical course noted in many subsequent series.[21] The authors described women aged between 22 and 36 years, the majority of whom were in the third trimester. The presenting complaint was fever in 10 patients, with only three presenting with respiratory symptoms. Three patients recovered and were discharged without further complications, but 10 patients suffered complications of pregnancy. Six went into preterm labour, and all 10 ultimately underwent emergency caesarean delivery indicated because of fetal distress or intrauterine fetal demise.[21] One patient required mechanical ventilation and extracorporeal membrane oxygenation (ECMO). Data from existing case series are summarised in Table 1 (e-Supplement).

Effects on the fetus

Current evidence suggests that vertical, transplacental transmission of SARS-CoV-2 is rare,[22] with several case studies all reporting negative testing of infants

and amniotic fluid from COVID-19 tautologous mothers.[23–25] In the 13-case series, all infants had Apgar scores of 10 at 1 min, except for one stillbirth.[21] Limited cases suggest an increased risk of fetal distress in labour, but evidence is lacking that clearly links this to COVID-19 tautologous.[13,26]

Practice recommendations

Personal protective equipment

Personal protective equipment (PPE) is specialised clothing or equipment worn by healthcare workers for their protection and to help prevent the spread of infection between patients. It includes gloves, gowns, aprons, goggles or visors and facemasks. Wearing PPE does not guarantee total protection and must be used in combination with precautionary measures such as meticulous 'doffing' (protocolised removal of PPE to minimise the risk of self-contamination) and rigorous hand hygiene.[27] Fluid-resistant surgical facemasks are used to block large particles such as droplets or splashes that may contain micro-organisms such as viruses and bacteria from reaching the nose and mouth. They can also be equipped with a visor to protect the eyes.[28] These masks generally do not form a tight seal against the face and so are not recommended as protection from airborne infectious diseases (aerosols).

A respirator is PPE that prevents the wearer from inhaling hazardous substances, including droplets and airborne particles (aerosols) of infectious agents. They are designed to protect the wearer (when worn properly), up to the safety rating of the mask.[28]

Europe has two different standards for these devices. The 'filtering face piece' score (FFP) comes from EN standard 149:2001. The EN 143 standard covers P1/P2/P3 ratings. The US National Institute for Occupational Safety and Health classifies particulate filtering facepiece respirators into nine categories (N95, N99, N100, P95, P99, P100, R95, R99, and R100). A comparison of filter capacity of the different masks (percentage of all particles 0.3 microns in diameter or larger that are removed) is shown in Table 2 (e-Supplement). Respirators categorised as N95 and FFP3 are preferred for healthcare workers undertaking aerosol-generating procedures (AGP),[29] although as FFP3 respirators provide the highest level of protection, they are the only class acceptable to the UK Health and Safety Executive for protection against infectious aerosols in healthcare settings.

The terms 'standard', 'full' and 'enhanced' have been used to describe the approach to wearing PPE in a variety of settings. However, these are not standardised terms, and this has led to anxiety and confusion over the choice of PPE in different clinical settings. Greater clarity about appropriate PPE is gained if the clinical settings are matched to the route of transmission.[30] A suggested approach is shown in Table 3.

Labour analgesia

Published data to support practice recommendations for labour analgesia are limited. The following recommendations are based on data on viral transmission risks of SARS-CoV-2 and other similar viruses, combined with emerging, shared experience from maternity units caring for patients with COVID-19. These recommendations apply to women with confirmed or suspected COVID-19 tautologous.

Neuraxial analgesia, administered in established labour, is recommended for patients with suspected or confirmed COVID-19. This practice may reduce the need for general anaesthesia if urgent delivery is required. There is no evidence that epidural or spinal analgesia or anaesthesia is contraindicated in the presence of coronaviruses. Currently, there are minimal data on haematological function or complications related to neuraxial anaesthesia in COVID-19 parturients. However, mild thrombocytopenia appears to be common in non-pregnant patients admitted to hospital with COVID-19 (36% of patients in a Chinese study of 1099 non-pregnant COVID-19 patients had a platelet count of $<150 \times 10^9$/L).[31] Those with more severe illness are more likely to have a further moderate reduction in platelet count (by approximately 20%,[31] but platelet counts of $<100 \times 109$/L were rare). Disseminated intravascular coagulation may occur in severely unwell patients and is correlated with a poor prognosis.[32] Since uncomplicated pregnancy is associated with an increase in platelet aggregation and decrease in circulating platelets,[33] thrombocytopenia should be anticipated in term pregnant patients with COVID-19, irrespective of infection severity. Case data for 61 obstetric COVID-19 patients had platelet counts available for only 19 women, among whom the median (IQR [range]) platelet count was 270 (188–293 [81–366]) $\times 10^9$/L. Therefore, we recommend that the platelet count be checked before initiation of epidural or spinal analgesia/anaesthesia, and potentially before the epidural catheter is removed, depending upon timing and infection severity. All standard contraindications to neuraxial block apply, with the caveat that there is no information about platelet function in COVID-19 parturients.

Labour neuraxial analgesia should be reviewed regularly, by communication with the midwife and assessment of its quality, to maximise the chance of successful conversion to anaesthesia should caesarean section be required (therefore avoiding general anaesthesia).[34]

Labour ventilation is not aerosol-generating, therefore only droplet transmission PPE precautions are indicated in patients with suspected or confirmed COVID-19. As such, for neuraxial placement, a hat, eye protection, a surgical mask, sterile fluid-resistant long-sleeved

Table 3 Personal protective equipment according to route of transmission for suspected or confirmed COVID-19 positive patient

Contex	Personal protective equipment
No physical contact and >2 m away from patient	Non-contact precautions Fluid-resistant surgical mask, eye protection
During clinical care <2 m from patient	Droplet precautions (amber alert) Waterproof apron*, gloves**, fluid-resistant surgical mask, eye protection
During AGP e.g. intubation and extubation	Airborne precautions (AGP PPE, red alert) Fluid resistant long-sleeved gown, gloves, eye protection and FFP3 or N95 mask

* Use surgical gown if sterile procedure. ** Use sterile gloves if required by the procedure. AGP: Aerosol-generating procedures.; Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/879107/T1_poster_Recommended_PPE_for_health-care_workers_by_secondary_care_clinical_context.pdf Accessed April 14, 2020.

gown and sterile gloves should be worn.[35] All PPE should be donned outside the labour room.

Epidural analgesia in labour is associated with the development of maternal fever which is associated with adverse outcomes in the neonate.[36] Pyrexia is a feature of COVID-19 tautologous. A woman with COVID-19 infection who receives epidural analgesia should have temperature monitoring during labour and appropriate management if fever develops.

Nitrous oxide and remifentanil analgesia

Use of an Entonox® breathing system does not constitute an AGP.[13] Therefore, PPE for AGP should not be required for staff caring for women with suspected or confirmed COVID-19 who wish to use nitrous oxide analgesia during labour. There is, however, a risk of viral contamination of the breathing system and the equipment circuit must contain an anti-viral filter.[13] Many commonly available heat and moisture exchangers (HME) used in anaesthetic practice meet this standard and many Entonox® delivery systems come with a suitable filter as standard.

There are no data currently about the use of remifentanil PCA in obstetric patients with COVID-19 infection. It should be used with caution in labour due to the risk of respiratory depression, especially in women with respiratory symptoms. Remifentanil should be avoided in women with oxygen saturations <95% due to the risk of further desaturation.

Pre-operative preparation for caesarean section

Pre-operative assessment of women with suspected or confirmed COVID-19 and scheduled for caesarean section should include a history and assessment of respiratory symptoms. Auscultation with a stethoscope should be avoided to reduce the risk of cross-infection. The role of bedside lung ultrasound, that enables simultaneous clinical examination and lung imaging in these patients, has been highlighted.[37] Pre-operative vital signs should be measured and documented. If women are reporting respiratory distress or are hypoxaemic, their care should be discussed with the intensive care team, before commencing anaesthesia for surgery, to ensure capacity for postoperative critical care support.

The operating theatre should be prepared before undertaking surgery in a confirmed or suspected COVID-19 patient. The same operating theatre and anaesthetic machine should be used for COVID-19 cases for the duration of the pandemic and restricted to these cases. Only essential equipment should be kept in the theatre to minimise contamination. Where available, the use of disposable equipment should be considered.

Intra-operative care for caesarean section

The key aspects of providing intra-operative care for women with confirmed or suspected COVID-19 infection are:

- Transfer arrangements to and from the operating theatre.
- Minimising the number of clinical staff in theatre while adhering to a safe level of staffing, e.g. the provision of anaesthetic assistance.
- Having a locally practicable strategy (timing and location) for donning and doffing PPE in both elective and emergency caesarean delivery.
- Determining how emergency drugs or equipment are supplied intra-operatively, usually with a runner outside the theatre
- Ensuring an intra-operative record of care if paper-based notes are used and the local strategy is to keep the medical records 'clean.'
- Provision of safe postoperative care, including transfer to an ICU if required.

Locally developed standard operating procedures are recommended to support delivery of these principles.

Scheduled caesarean section

Women with suspected or confirmed COVD-19 should be placed last on elective operating lists to facilitate deep cleaning of theatres. Neuraxial anaesthesia is recommended as is standard in obstetric anaesthesia and particularly in women with COVID-19 to minimise the risk

of infection from aerosolisation associated with general anaesthesia. For elective cases, the risk of conversion to general anaesthesia is lower than emergency cases,[38] and conversion can often be anticipated. It may therefore be reasonable for staff to wear PPE for non-aerosolising procedures for these elective cases. To reduce the risk of complications associated with neuraxial anaesthesia, the block should be performed by the most appropriate anaesthetist available.

Emergency caesarean section

Neuraxial anaesthesia (epidural extension of labour analgesia, spinal or CSE anaesthesia) is preferred for emergency caesarean section to avoid the risks of aerosolisation associated with tracheal intubation and extubation. The most controversial topic is the choice of PPE. Conversion to general anaesthesia is a risk during all caesarean sections with planned neuraxial anaesthesia and increases with the urgency of delivery.[38] Donning PPE for AGP should be considered for emergency cases because of the elevated risk of failed or inadequate neuraxial block and the consequent need for mid-procedural conversion to general anaesthesia.[13] Although it is theoretically possible to change masks from a standard surgical mask to a FFP3 (or similar) in the event of conversion to general anaesthesia, this could cause delay and also risk contamination of the individual clinician. Strategies to avoid the need for intra-operative conversion to general anaesthesia must be considered, including de novo initiation of spinal anaesthesia rather than extending poorly functioning labour epidural analgesia, or the use of CSE anaesthesia. If it has been decided that PPE for AGP is indicated, the entire theatre team should be present in theatre, in appropriate PPE, donned before the patient is transferred to theatre. Maintaining the "last in, first out" principle (for the patient) may minimise the risk of exposure for the theatre team as they will remain in PPE at all times in the presence of the patient. It is essential to recognise that donning of PPE takes time and will inevitably impact on the decision-to-delivery time.[13] The potential consequences of such delays should be explained to all women presenting in labour,[13] and ideally local units should produce information sheets to be given to patients containing this information. Theatre teams should organise skills and drills training to practise donning of PPE in Category 1 emergency scenarios and thus to minimise delays. Guidance for the use of PPE in different caesarean section scenarios is shown in Table 4. In a case series of 17 COVID-19 parturients, refractory hypotension was observed to be more common in patients having an epidural top-up or CSE for the caesarean section when compared with those receiving general anaesthesia. However, no comparison was made with patients without COVID-19.[39] The use of a prophylactic intravenous infusion of a vasopressor is recommended to prevent hypotension associated with neuraxial anaesthesia during caesarean section outside of COVID-19 infection;[40] the anaesthetist should be aware of the possibility of excessive hypotension in a patient with COVID-19 and an increased requirement for treatment with vasopressors. Uterotonics can be associated with cardiovascular disturbance and should be administered by slow bolus or infusion.

General anaesthesia

The clinical recommendations for general anaesthesia are for patients with suspected or confirmed COVID-19. However, guidance is rapidly evolving, and a number of centres are adopting the following precautions for all patients, including those who are asymptomatic, based on the local context and epidemiology.

The major concern about general anaesthesia for caesarean section is the risk of healthcare worker infection and the impact of tracheal intubation on a patient with acute respiratory compromise. Intubation and extubation are AGP and the risk of viral transmission to staff is greater than with non-AGP. Strategies to minimise this must be employed. Checklists, cognitive aids and standardised airway trolleys can improve team perfor-

Table 4 Suggested personal protective equipment (PPE) for different caesarean section scenarios[30]

Caesarean section neuraxial anaesthesia[1] (low risk of GA, e.g. category 4 caesarean section for breech)	Droplet precautions	Apron, sterile[2] FRDG, sterile gloves, FRSM, eye protection
Caesarean section neuraxial anaesthesia (higher risk of GA,[3] e.g. category 1 caesarean section)	Droplet precautions maybe acceptable but risk assess for possibility of general anaesthesia being required	Apron, sterile FRDG, sterile gloves, FRSM or FFP3, eye protection
Caesarean section general anaesthesia	Airborne precautions	Apron, FRDG, gloves, FFP3, eye protection

1. Neuraxial anaesthesia refers to epidural, spinal or combined spinal-epidural anaesthesia.2. Sterile PPE only indicated for de-novo procedure as part of aseptic technique.3. Risk assessment for likelihood of general anaesthesia being required based on functioning of existing epidural, breakthrough pain (consider removing and performing spinal), anticipated difficult or prolonged surgery or haemorrhage, previous abdominal surgery, adhesions, classical incision, placenta praevia, multiple procedures, uterine structural abnormalities.; FRDG: Fluid-resistant disposable gown; FRSM: Fluid-resistant surgical mask; FFP3: Filtering face-piece type 3.

mance.[41] Multiple checklists have been produced for intubation and general anaesthesia of COVID-19 infected patients; these checklists are readily transferrable to obstetric practice.[42] Antacid prophylaxis and positioning adjuncts should be added as is routine in obstetric practice. There is an increased risk of difficult and failed airway management in obstetric practice compared with non-obstetric surgery.[43,44] The most skilled anaesthetist should make the first intubation attempt, using a videolaryngoscope, to maximise the likelihood of first-pass success while minimising aerosolisation.

The PPE worn during general anaesthesia for caesarean section should include protection against aerosol exposure (e.g. an FFP respirator). As always, closed-loop communication is recommended, especially because the use of PPE for AGP can impair verbal communication. An HME exchanger with viral filtration should be present within the circuit at all times. Disconnection of the circuit should be avoided but, if necessary, should be between the HME and the circuit. Cardiovascular collapse following induction of anaesthesia has been reported in the non-obstetric population with severe COVID-19 and vasopressors should be immediately available for managing hypotension. Impairment of respiratory function with COVID-19 lower respiratory tract infection, coupled with pregnancy-related reduction in lung capacity, means that rapid desaturation should be anticipated following induction. Preoxygenation is mandatory but high-flow nasal or face mask oxygen is not recommended because of the increased risk of aerosolisation. A tight-fitting facemask applied using a two-hand technique (to ensure a good seal), with standard flow-rate oxygen, is advised. Gentle, low-pressure manual ventilation using a tight seal on the face mask or via a supraglottic airway device may be necessary if desaturation occurs. The intubating clinician should ensure that at least two pairs of gloves are worn. In some centres, three pairs are worn with the external pair being removed immediately after intubation. It would be prudent to decontaminate the work surfaces around the patient's head and the anaesthetic machine after intubation to reduce risk of viral transmission from fomite spread.

Tracheal extubation is also a high-risk procedure for aerosol generation. Avoid coughing by the patient and where possible minimise the number of staff in the room during extubation. A recent analysis has evaluated pharmacological methods to minimise emergence coughing after general anaesthesia with tracheal intubation.[45] A variety of agents (dexmedetomidine, remifentanil, fentanyl, intra-cuff or intravenous lidocaine and lidocaine via tracheal or topical application) were evaluated and found to be better than placebo or no medication in reducing moderate to severe emergence cough; dexmedetomidine was ranked the most effective. However, whether these findings could be useful in a population at high-risk of emergence coughing is unknown. The use of agents such as remifentanil and dexmedetomidine has to be carefully balanced against their sedative, respiratory and haemodynamic effects on the mother. A further consideration is that using small amounts of these drugs in this context is usually associated with significant waste. This may become relevant as the COVID-19 pandemic evolves, with the possible development of drug shortages due to increased demand and disruption in the supply chain.[46,47]

Postoperative care

Ideally before general anaesthesia caesarean section, case management should be discussed with the intensive care team to determine the most appropriate postoperative location for the mother. This may include transfer of an intubated patient. Awake patients with suspected or confirmed COVID-19 should wear a surgical facemask for transfer to the recovery location.

Despite initial concerns that the use of nonsteroidal anti-inflammatory drugs (NSAIDs) worsened outcomes in patients with COVID-19 tautologous, there is no clinical evidence to confirm this.[48] Current advice is that NSAIDs can continue to be used.[49]

Precautionary separation of the mother and neonate may minimise transmission, but insufficient evidence to guide management is reflected in divergent strategies adopted by different countries.[13,23,50] The current UK approach is to perform individualised risk assessment, coupled with neonatal follow-up and routine surveillance, and not to mandate isolation of the neonate.

While in six Chinese women breast milk tested negative for COVID-19,[23] sharing of infective airborne droplets is still likely during close contact during breastfeeding. If done, breastfeeding must involve strict adherence to hand hygiene and droplet precautions to limit viral spread.

There is emerging evidence suggesting that individuals admitted to hospital with COVID-19 infection are hypercoagulable. This, coupled with the hypercoagulability of pregnancy, would suggest that pregnant women with COVID-19 are more vulnerable to thromboembolism. The risk may be compounded by self-isolation at home or hospital admission. A UK recommendation is that all pregnant women admitted with COVID-19 infection (or suspected COVID-19 infection) should receive prophylactic low molecular weight heparin unless birth is expected within 12 h (e.g. for a woman with increasing oxygen requirements).[13]

Delivery of obstetric anaesthesia services

COVID-19 is an unprecedented international public health emergency and health care services have shifted dramatically to focus on the management of patients with respiratory failure. During the Ebola outbreak in

Sierra Leone in 2016, a decrease in the number of women attending antenatal and postnatal care, and presenting for birth at a healthcare facility, was observed following the outbreak of the epidemic. This corresponded to a 34% increase in the facility-based maternal mortality ratio and a 24% increase in the stillbirth rate.[51] While there are obvious disparities between income and the provision of healthcare in Sierra Leone and the high-income world, this highlights that the battle against COVID-19 should not come at the expense of falling standards in other sectors of healthcare. Within obstetric anaesthesia, dealing with COVID-19 must not undermine the quality of care provided to all obstetric patients. Hospitals should mitigate the impact of fewer in-person antenatal, postnatal and high-risk clinic visits with the use of strategies that include telephone or video appointments. The impact of COVID-19 on the delivery of clinical services may need to be considered and evaluated on each hospital's risk register. In the UK, the NHS 'Clinical guide for anaesthesia service reorganisation during the coronavirus pandemic' has highlighted obstetrics as an area that cannot decrease clinical activity and where services must receive ongoing support by anaesthetists.[11]

Psychological support

Both staff and patients alike may require additional support during this period of severe working conditions caused by COVID-19. Pregnant and postnatal women already have an increased risk of anxiety and depression. A diagnosis or label of suspected COVID-19, which is not conducive to maternal or fetal well-being, may potentially worsen mental health symptoms.[52]. Women and staff alike should receive timely evaluation of anxiety, depression and sleep. Mental health teams should be consulted for psychological intervention.

Conclusions

Although pregnant women do not appear to exhibit greater susceptibility to COVID-19 than the general population, the direct and indirect risks of managing infected maternity patients mandate a change in approach to team-working, anaesthesia practice, information dissemination and decision-making on the labour ward. We are still navigating uncertain territory regarding management in relation to maternity pandemic viral infection, with the rapid dissemination of research and shared-learning experiences valuable in meeting the changing healthcare needs of the world's pregnant women.

Funding

Dr Bampoe is supported by an award from the NIHR UCLH Biomedical Research Centre.

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Further reading

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijoa.2020.04.006.