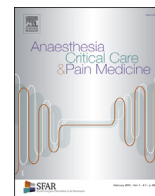




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Review article

Anaesthesia and intensive care in obstetrics during the COVID-19 pandemic



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Everywhere in France, a large number of elective surgical procedures have been minimised, postponed or cancelled to help cope with the COVID-19 disease outbreak, with the obvious exception of labour and delivery units (LDUs) that cannot postpone deliveries. Each month, about 65,000 mothers give birth in France and an even larger number of women receive antenatal care.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is extremely contagious [1], with droplet transmission from coughing, sneezing or even normal breathing and speech or by close or direct contact. Challenges in containing the transmission relate to the incubation period, with asymptomatic carriers being able to transmit the infection [2]. Therefore, community transmission poses a serious threat, along with in-hospital exposure for both healthcare providers (HCP) and patients, resulting in the possible collapse of the healthcare system [3]. Pregnancy is a unique condition; optimal antenatal care includes serial obstetric consultations and pre-anaesthesia assessment to reduce maternal and neonatal morbidity [4].

Nosocomial transmission of COVID-19 infection represents a serious threat to health care systems: In a single-centre case series of 138 hospitalised patients with confirmed COVID-19 pneumonia in Wuhan, China, presumed hospital-related transmission of COVID-19 was suspected in 41% of patients [5]. The clinical environment of LDU (e.g. fast pace, emergencies, high volume) significantly increases the risk for work-related transmission of the various HCP working in LDU (obstetricians, anaesthetists, midwives, nurse anaesthetists, neonatologists. . .).

Hence, the usual approaches to maternal care need to be modified in order to minimise contamination and transmission of COVID-19 among women, their families, the HCP, while ensuring high standards of maternal care [6].

1. Organisation

1.1. Antenatal consultation

In view of the high risk of transmission in the LDU, remote consultations and at home follow-up have been encouraged and rapidly developed. French laws were updated to allow an extensive use of teleconsultations [7,8]. Home visits may be provided by independent midwives networking with the maternity services. Maintaining in person consultations for high-risk pregnant women (e.g. with significant comorbidities or pregnancy-associated complications), can be optimised by scheduling multiple consultations at the same time and promoting a cohesive multidisciplinary approach. Since the beginning of the pandemic, remote pre-anaesthesia consultations have been offered [9] and a dedicated website providing information for expectant mothers has been developed [10].

For women with planned admissions for induction of labour or caesarean delivery, it is recommended to have a phone screening (the interview should also involve the birthing partner) the day before admission.

1.2. Screening on admission

Based on the World Health Organization (WHO) recommendation [11] and national policies [12], a pre-admission triage system to screen pregnant women for COVID-19 symptoms (fever, cough, diarrhoea, possible exposure) is recommended in all LDUs; this can be managed by nurses at the LDU entrance. Women deemed suspicious and patients under investigation are directed to a dedicated area, in anticipation of “segregation” and of a specific care pathway to avoid contamination of hospital areas and HCP exposure.

Concomitantly, standard precautions for all women admitted to the LDU and their partners should include hand and respiratory hygiene measures: use of alcohol-based hand scrub and face mask. Given the high prevalence of asymptomatic carriers and risk of transmission, the goal should be having every patient wear a surgical mask (limited by adequate supplies) [13]. Indeed in a recent study, after implementation of universal testing for all women admitted for delivery in a large academic centre in New York City, the incidence of COVID-19 infection was shown to be 33 of 215 (15.4%) women, with 29 of these 33 women (87.9%) reporting no COVID-19 symptoms on admission [14].

1.3. COVID-19 patient evaluation

Assessment of the severity of COVID-19 symptoms should be done by the senior team member of the LDU to avoid unnecessary exposure.

Severe dyspnoea, respiratory distress, tachypnoea (> 30 breaths/min), or hypoxia (SpO₂ < 93% on room air) are warning signs for disease severity. Breslin et al. reported the results of a series of 49 positively tested COVID-19 pregnant patients presenting to a pair of New York City affiliated hospitals [15]. Over the 43 patients who developed symptoms, there were 6 critical to severe forms of the disease (14%), which is consistent with the Chinese publications related to pregnant women [16–18]. The proportion of severe forms among pregnant women thus seems comparable with the general population. Young women can compensate for deterioration in respiratory function and are able to maintain normal oxygen saturations before they then suddenly decompensate. A rise in the respiratory rate may indicate deterioration in respiratory function. Early multidisciplinary discussion should be early organised to determine the adequate location and level of care for both mother and foetal-neonatal

management. Escalation in therapy may be offered with the same cautiousness and supervision than in the non-pregnant patients (high-flow nasal oxygen or non-invasive ventilation. . .) to reduce the need for mechanical ventilation [19]. In the most severe situations of Acute Respiratory Distress Syndrome (ARDS) from other acute conditions [20], Extracorporeal Life Support has already been used for pre and postpartum patients for other acute conditions [20] with greater than 50% of survival rate [21]. Thus, Extracorporeal Life Support could be also an option for the management of the most severe cases of COVID-19 ARDS in pregnant or postpartum women as well as in the general population.

1.4. Timing of delivery

When a pregnant woman with COVID-19 infection is > 34 weeks of gestation, timing of delivery is quite easy to handle. Indeed, in the severe form of the disease at least, birth should occur rapidly, in order to facilitate mother's care. The difficulty in decision-making arises when termination of pregnancy can lead to extreme premature birth. Decision for delivery cannot simply follow guidelines: it has to be discussed on a case-by-case basis, within a multidisciplinary team, weighting benefits and risks on an individual basis. This team should involve obstetricians, obstetrics anaesthetists, intensivists, neonatologists, the patient and her partner when possible. This decision should be re-evaluated regularly, according to the clinical evolution of the mother and to the gestational age. Indication of foetal extraction must not occur too soon (otherwise producing extreme prematurity whereas there is a chance that maternal condition will remain stable), nor too late (otherwise transport to the theatre and surgery can decompensate a very instable maternal condition). In our opinion, intubation itself and low dose catecholamine is not definitely an indication of foetal extraction by itself, but when it occurs, it should lead to close and continuous communication between all multidisciplinary team members in order to provide delivery in a timely manner if the situation worsen.

1.5. Anaesthesia and analgesia management for delivery

There is no evidence that regional analgesia or anaesthesia is contraindicated in the presence of coronavirus. The management of suspected or confirmed COVID-19 cases should include complete blood count, as some abnormalities have been observed: severe thrombocytopenia ($< 100,000 \times 10^6/L$) has been early described in both pregnant and non-pregnant patients [22]. Recently prolonged APTT and PT have both been described in a few cases in the general population with poor details of bleeding risk [23].

The COVID-19 outbreak does not appear to have changed the rate of epidural labour analgesia [24]. Early epidural analgesia may be indicated to reduce respiratory exhaustion in mild to severe symptomatic women and is recommended to decrease the need for general anaesthesia in case of emergent delivery. Emergency caesarean delivery due to intrauterine foetal distress was a frequent mode of delivery in the Chinese published reports [25]. Non-reassuring foetal heart rate may be consecutive to maternal fever or hypoxaemia or due to other obstetrical causes. Performing an emergency caesarean delivery in a COVID-19 patient poses logistical safety constraints due to the time needed to don personal protection equipment (PPE) and moving through several consecutive wards. Having an indwelling epidural catheter that can be rapidly utilised to initiate epidural anaesthesia is helpful and decreases the chances of exposure for all healthcare workers that might be present if a general anaesthetic was needed.

Given the relatively high rate of foetal compromise, continuous electronic foetal monitoring during regional anaesthesia placement of neuraxial labour analgesia should be encouraged.

Protecting HCP from virus contamination is particularly challenging in the LDU. In this clinical environment, it is not uncommon to have to go in and out of a labour ward multiple times during the course of labour and delivery (for consent, neuraxial placement, top-ups, hourly evaluation of pain relief or management of maternal hypotension). The risk of contamination exists, as prolonged face to face contact occurs while providing information or instructions to the patient before or after epidural placement to reduce the risk of viral transmission. Use of contact/droplet protection is recommended (PPE: FFP2 mask, eye protection, gloves and gown) when entering the ward for any anaesthetic intervention, which should be cautiously removed (doffed) when leaving the ward, associated with appropriate hand hygiene after PPE removal. In addition, it is important to avoid the presence of unnecessary people in the labour ward. In some obstetric units, epidural placement by the physician is facilitated by a nurse anaesthetist providing assistance. During the COVID-19 pandemic, it is recommended to limit the personnel and assistance may be provided by the midwife in charge.

It is also strongly recommended that the pregnant woman wears a medical mask during epidural placement.

1.6. Mode of delivery

In the first publications from China, caesarean delivery was by far the most common mode of delivery for COVID-19 pregnant women [16–18,25–27]. It seems that urgent delivery was decided as soon as the patient required nasal oxygen supplementation even at low-flow rate. Contrastingly, some suggest that whenever possible, vaginal delivery via induction of labour should be favoured to avoid unnecessary surgical complications in an already sick patient [28].

China has already one of the highest caesarean delivery rates in the world, around 40% [29]. This trend may be further pronounced in the context of COVID-19. A recent report from Breslin et al. in New York City reported 10 vaginal deliveries over 18 COVID-19 patients without complication [15].

Caesarean delivery may protect the foetus from viral transfer during vaginal delivery. However, no transfer of the virus from the mother to the foetus during birth was found in 13 neonates delivered vaginally [15,17]. Moreover, vaginal fluids from a series of 10 severely ill non-pregnant COVID-19 patients were tested negative for SARS-CoV-2 [30].

1.7. Anaesthesia for caesarean delivery

Neuraxial anaesthesia appears to be the safer option for caesarean delivery, irrespective of the patient's COVID-19 status. Spinal or epidural anaesthesia does not appear to be associated with haemodynamic instability or respiratory decompensation (on the contrary) in pregnant women with COVID-19 infection. However, in one Chinese series, the authors reported “exaggerated decreases” in blood pressure not responding to their usual vasopressor therapy [25] (although detailed information is lacking in this report [31]).

Regional anaesthesia for caesarean delivery in COVID-19 patients, especially in case of emergency procedure is also at risk of healthcare contamination. A recent study suggested that the highest level of protective equipment appears to reduce the risk of transmission to anaesthetists who are exposed to mildly symptomatic surgical patients under spinal anaesthesia [32].

1.8. General anaesthesia and endotracheal intubation

Although it should be avoided whenever possible, general anaesthesia may become indicated with deterioration of maternal respiratory function, or for or during emergency caesarean delivery. This time period represents the highest risk of exposure involving direct contact with respiratory droplets during airway management, primarily during tracheal intubation and extubation. Enhanced PPE is required for the procedure with FFP2 mask, face shield, gown, and gloves (preferably long gloves). It is important to minimise the number of HCP in the ward, and the procedure must be performed by the most experienced staff. A highly hydrophobic filter is placed between the facemask and the breathing circuit or between the facemask and the bag. Another filter should be placed on the expiratory line. The anaesthetist should ensure that a closed suction system is readily available before intubation, and should consider videolaryngoscopy rather than direct laryngoscopy to minimise close exposure between staff and patient respiratory tract. After a tight seal preoxygenation with oxygen 100% to avoid aerosol generation of viral respiratory droplets, rapid sequence induction is done as per usual practice. Because cough at intubation is a major cause of viral dissemination, it is important to give a full dose of neuromuscular block and to respect onset time before laryngoscopy. Extubation also exposes staff to a significant risk of contamination. At this time, the number of HCP should be minimal, and FFP2 mask and PPE should be worn by healthcare providers. If it is decided to proceed with extubation at the end of the case, this should be done in the operating theatre while keeping PPE on until after extubation. If manual ventilation is required, only small tidal volumes should be applied.

1.9. Recovery ward, Early Warning System and postpartum period

Precipitous transfers of COVID-19 patients between labour wards, operating theatres and recovery wards should be avoided whenever possible to avoid nosocomial spread.

Institutional processes should be implemented in each centre. Postpartum monitoring should include thorough evaluation of COVID-19-associated complications (tachycardia, hypoxaemia, acidemia, etc.) using Modified Early Warning Score (MEWS) [33].

1.10. Thrombosis

Since pregnancy is associated with a hypercoagulable state and emerging evidence suggesting that patients admitted to the ICU for severe COVID-19 infection have increased risk of thromboembolic events (microthrombi, strokes), it is likely that pregnant women with severe COVID-19 infection are at increased risk of maternal venous thromboembolism (VTE) during the peripartum period.

A special focus on “Coagulation changes and thromboembolic risk in COVID-19 pregnant patients” and practical management is available in the related section of this issue by Benhamou et al.

1.11. Use of steroids and NSAID

Early reports have suggested that the use of NSAIDs for management of COVID-19 symptoms may worsen COVID-19 infection [34]. Caution leads to prefer other pain treatments. In case of persistent pain, occasional use is possible [35,36].

Given the potential risks of systemic steroids in the setting of COVID-19 disease, dexamethasone for prevention of vomiting, which is not particularly effective anyway, should be avoided.

1.12. Non-regional analgesia

Nitrous oxide, while requiring removal of the facemask, is not classified as an aerosol generating procedure, but should be used with caution with a single-patient microbiological filter [37]. Epidural analgesia should certainly be preferred in absence of thrombocytopenia.

IV Opioid: parenterally administered opioids may induced respiratory and oxygen desaturation, which may subsequently lead to the need of emergent airway instrumentation and its risk of aerosolisation. Consequently, specific attention should be paid on the respiratory status of parturients receiving IV opioids for labour analgesia.

1.13. Partner in the labour ward

Although this has been a topic of heated debates in the early period of the outbreak, most maternity units and scientific bodies now suggest that the support person be allowed during childbirth, provided that he (she) has no symptoms of COVID-19 disease, wears a surgical mask and complies with hand-washing procedures. No visitor is allowed once the woman is discharged from the delivery ward nor during the stay at the hospital, excepted in some cases defined by the medical team, with the same airborne and contact precautionary measures [38].

1.14. Team communication

Communication in full PPE can be challenging (particularly with N95 respirators, which impair the ability to hear each other, particularly in loud environments). Preparing teams, assigning roles and setting out the management plan improve safety and team effectiveness. Briefing and debriefing are key practices to keep the team involved and secure [39].

1.15. Staff training

In situ simulation and drills are recommended to test institutional policies and practices and help their deployment. As always, it should involve a multidisciplinary team of anaesthetists, obstetricians, midwives, nurses, neonatologists, intensivists and hygienists.

Several scenarios involving an obstetric patient with suspected COVID-19 disease have been proposed and developed [40]:

- patient presenting to the hospital in active labour;
- patient in active labour who progresses to have a spontaneous vaginal delivery;
- patient in active labour who requires caesarean delivery.

The objectives of these in situ simulations are to test the implementation of the procedure in situ, to train the professionals to COVID-19 related procedures (especially the donning and doffing of personal protective equipment), to test the dedicated pathway of a suspected or confirmed COVID-19 patient and the management of the neonate, and to improve the team communication methods.

Additional ways to prepare and support teams, is the drafting and wide diffusion of summary sheets including cognitive aids, in the form of a checklist.

In March 2020, the CARO (Club Anesthésie Réanimation en Obstétrique) Working Group designed an infographic for obstetric care of patients with suspected or confirmed COVID-19 infection. (Appendix 1) This infographic outlines the context (suspected

signs; severe symptoms), proposes patient's preparation, makes recommendations based on the delivery mode (pathway; dedicated ward and team; decision regarding whether or not an accompanying person is present; necessity of PPE, other equipment; anaesthetic techniques; advised or contraindicated agents...). CARO recommends easy access to this visual aid; it should ideally be broadly displayed in the maternity unit (emergency department, delivery wards, operating theatres...)

2. Conclusion

The COVID-19 outbreak has profoundly challenged medical systems and clinicians' practices especially in the field where activity must go on, like in the maternity unit. In the absence of evidence-based guidelines, practical approaches involving close communication with the obstetricians have rapidly emerged to guide clinicians in these challenging times.

Disclosure of interest

The authors declare that they have no competing interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.accpm.2020.05.006>.

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