



Staying Ahead of the Curve: Modified Approach to Emergency Caesarean Section Under General Anaesthesia in COVID-19 Pandemic

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Abstract

The recent outbreak of SARS-CoV-2 has prompted healthcare professionals to re-design and modify the standards of care and operating procedures relevant to dealing with suspected or confirmed cases of COVID-19. The aim of this review is to highlight the key recommendations related to obstetric anaesthesia from scientific bodies in the United Kingdom and United States and to summarize recently developed and implemented clinical pathways for care of obstetric patients – specifically those requiring urgent general anaesthesia for caesarean section within a large maternity unit in London. The need to perform an emergency operative delivery in a timely manner while ensuring clinicians are suitably equipped and protected represents a uniquely challenging scenario, given the higher risk of viral transmission with aerosol generating procedures. In these settings, emphasis needs to be put on meticulous preparation, safety checklists and specific equipment and staffing adjustments. We present a structured framework comprised of four critical steps aimed to facilitate the development of local strategies and protocols.

Keywords: Caesarean section, COVID-19 pandemic, general anaesthesia, obstetric anaesthesia, pregnancy

Introduction

Novel coronavirus (SARS-CoV-2) is a new strain of coronavirus causing COVID-19, first identified in Wuhan City, China. Other human coronavirus (HCoV) infections include HCoV 229E, NL63, OC43 and HKU1, which usually cause mild to moderate upper respiratory tract illnesses like the common cold, and also the more severe variants of Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). Most cases of COVID-19 globally have evidence of human to human transmission. The virus can be readily isolated from respiratory secretions, faeces and fomites.

Pregnant women do not appear more likely to contract the infection than the general population. Pregnancy itself alters the body's immune system and response to viral infections in general, which can occasionally cause more severe manifestations, particularly in the third trimester.

Obstetric Anaesthesia Relative to the COVID-19 Pandemic

COVID-19 is an emerging disease and therefore the optimal management for affected obstetric patients has not yet been established. To provide a guidance in this fast-evolving situation, the Obstetric Anaesthetists' Association, the Faculty of Intensive Care Medicine, the Intensive Care Society, the Association of Anaesthetists and the Royal College of Anaesthetists have released a set of generic recommendations on management of pregnant patients with suspected or confirmed COVID-19 (1).

According to these guidelines:

- Epidural analgesia should be recommended to women with suspected/confirmed COVID-19 to minimise the need for general anaesthesia if urgent delivery is required.
- Avoiding general anaesthesia is necessary in order to reduce the exposure to aerosol generation procedures, such as intubation and extubation.
- Personal Protective Equipment is mandatory and its donning may be time consuming causing delays in emergency delivery of the compromised fetus.
- For intubation videolaryngoscopy is preferable, by the most experienced anaesthetist available. In case of difficult intubation, plan B is to use a second generation supraglottic airway and plan C is to use Front of the Neck Access (FONA).
- Hospitals should prepare local protocols based on national guidance.

In the United States, The Society for Obstetric Anaesthesia and Perinatology (SOAP) has also released an interim guidance with specific considerations related to obstetric anaesthesia which follow the APSF (Anaesthesia Patient Safety Foundation) guidelines for management of women who test positive for COVID-19 (2). The key messages of this guidance are as follows:

- COVID-19 diagnosis itself is not considered a contraindication for neuraxial anaesthesia
- Early epidural analgesia may reduce the need for general anaesthesia for emergent caesarean delivery
- All healthcare workers should implement droplet and contact precautions
- Since the care of COVID-19 patients is time intensive, additional staffing may be needed and back-up strategies may need to be developed.

Main Points:

- The key priorities in the management of obstetric patients undergoing operative delivery are to ensure good clinical outcomes for both mother and baby in a timely manner and to minimise risks of exposure to virus in healthcare professionals.
- All efforts should be aimed to avoid the need of aerosol generating procedures such as intubation/extubation during general anaesthesia. The additional benefit that epidural analgesia provides in reduction of decision to delivery time should be discussed with all patients.
- If general anaesthesia is required, safety checklists and prompt availability of adequate equipment and staff are of paramount value. Working in designated teams and performing necessary tasks pre-operatively (e.g. cannulation, catheterization, name band placement, pre-medication) reduces decision to delivery time while staff don appropriate personal protective equipment.

- If GA is indicated, pre-oxygenation should occur with a circuit extension and HEPA filter at the patient side of the circuit; a closed suction system should be used; intubation should occur via video-laryngoscope to maximize success on first attempt; extubation is of a significant risk and consideration should be given to transporting intubated patients to a negative pressure room.

Within operative specialities, Caesarean Section for acute fetal distress is arguably the single most common, time-critical indication for urgent general anaesthesia worldwide (3). During the current COVID-19 pandemic, there is high risk of viral transmission posed to healthcare professionals owing to the volume of aerosol generating procedures being performed. It follows that those providing maternity care must develop new and robust pathways for managing obstetric emergencies where general anaesthesia is required.

The following represents a summary of work undertaken at a high-risk obstetric unit in London, where the aim was to develop new rapid response pathways to obstetric emergencies. It is understood that maternity units differ in terms of their layout, staffing, equipment and populations served; while, therefore, the recommendations below may not be completely transferable to individual units, it is hoped that this document may provide some additional evidence-based guidance to units developing their own local guidelines.

Layout of the Unit

The formation of separate areas within delivery suites for the management of suspected or confirmed COVID-19 parturients has been recommended by the RCOG (4).

West Middlesex University Hospital (part of Chelsea & Westminster NHS Foundation Trust) runs a 24-hour Consultant-led service, delivering 4,500 babies annually, with an eight-bedded labour ward, two obstetric theatres, and a four-bedded alongside natural birth centre. Within the labour ward set up, there also exists a separate five-bedded triage area, and five additional rooms that are used variously for extended recovery of postnatal patients and/or for women who have suffered a late pregnancy loss. These latter five rooms have been reconfigured to accommodate a specific area for patients with suspected or confirmed COVID-19 infection.

Moreover, in order to continue to provide the aforementioned maternity services, two labour isolation rooms and two postnatal care rooms have been established, along with the fifth, and largest, of the additional rooms transformed into a negative pressure, third obstetric theatre. This theatre has an antechamber which functions as a scrub area. Collectively, these clinical areas are termed the "Isolation area" and exist within a closed off section with its own dedicated entrance

for patients. Each clinical area has separate telephone access, including an additional telephone in the connecting corridor.

Prevention is better than cure

In the absence of bedside testing for COVID-19, all patients who require a general anaesthetic for any procedure in the UK are assumed to be carriers of Sars-CoV-2, in accordance with advice from Public Health England (5). In most instances, in general surgery, time taken to stabilize a patient pre-operatively allows for staff don PPE protection appropriately.

The situation in obstetrics can more frequently be time critical. The correct application of PPE is time consuming and in obstetrics, where an acute situation, such as a placental abruption or cord prolapse occurs, delays to delivery are inevitable while staff don appropriate protection. Recent data from New York, following a policy of universal screening of women presenting in labour, demonstrated that 13.7% of asymptomatic parturients tested positive for Sars-CoV-2 (6). The implications in terms of general anaesthesia as applied to an obstetric setting are stark.

All patients with suspected or confirmed COVID-19 infection are encouraged to accept epidural analgesia in labour and CTG monitoring, given the reported increased risk of fetal distress intrapartum (7). Having a functional epidural in labour reduces the likelihood of requiring a general anaesthetic, should there be the need for urgent operative delivery. Taking the advice from Public Health England into account, this logically mandates that these discussions are held with all parturients, regardless of COVID-19 status, and care individualised according to the wishes of the woman.

To further reduce the need for general anaesthesia in obstetric practice, all non-urgent caesarean sections are undertaken with the use of a combined spinal-epidural (CSE) technique, where no contraindication to this approach exists. Single-shot spinals are being selectively reserved for use in emergency caesareans where there is immediate risk to the fetus. It is understood that evidence pertaining to this practice may be considered controversial, but in the non-urgent delivery setting CSE may provide an added insurance given the ramifications of conversion to GA during the pandemic (8). Anti-emetic administration forms part of our standard practice to reduce the likelihood of vomiting intraoperatively.

Anaesthetic and midwifery staff routinely ensure complete satisfaction with the effectiveness of epidurals used in labour. However, staff need to have very early recourse to re-siting those epidurals which fail to provide optimal pain relief intrapartum, as later conversion to GA intraoperatively now produces new challenges, particularly in positive pressure theatre environments.

Choice of Anaesthesia in an Obstetric Emergency

The indications for Caesarean section are divided into grades, with a Grade 1 delivery designated where there is immediate threat to the life of the woman or the fetus (9). In these instances, delivery must ideally occur within a maximum time-frame of 30 minutes, with attempts made to reduce the decision to delivery time as far as possible.

Where a woman requiring Grade 1 delivery does not have a functional epidural in situ, the choice of anaesthetic method varies. General anaesthesia is the fastest method used to facilitate immediate delivery in cases where vaginal birth is impossible. Conversely, attempts to site a single shot spinal in these cases may be considered in certain instances. The drawback of this latter approach lays in its possible failure, prolonging decision to delivery time and requiring conversion to GA. Similarly, there are a host of contraindications to spinal anaesthesia – not least thrombocytopenia and presumed sepsis, both sequelae of COVID-19 infection. Adapted drills on managing general anaesthesia are also particularly critical given the occasional need to manage unstable patients with rapid sequence induction (i.e. for ongoing major obstetric haemorrhage).

On average, 1.6% of deliveries are classified as urgent, Grade 1 within our unit, with a typical requirement for general anaesthesia in these settings of 51%. There exists, therefore, a need to be prepared to perform general anaesthesia safely in these scenarios in a timely manner for all intrapartum cases, while ensuring staff are suitably equipped to reduce the risk of viral transmission.

Emergency Scenario

For any parturient presenting with significant fetal distress (e.g. sustained fetal bradycardia) in the absence of both a working epidural and the possibility of immediate vaginal delivery, we recommend a framework that is comprised of certain critical steps:

1. The activation of a specific emergency call.
2. Safety checks.
3. Pre-operative optimization of patient.
4. Administration of General Anaesthetic in its COVID-19 modified version.

Step 1: Emergency call

During the COVID-19 crisis, at least two anaesthetists and two Operating Department Practitioners (ODPs) are required to safely perform a rapid sequence induction of an obstetric patient. Three anaesthetic team members remain with the patient, with a second ODP in the scrub area acting as a runner in cases of failed intubation.

Step 2: Safety Checks

Safety checklist is a communication tool aimed to enhance patient's safety whereby a team of operating room professionals

Table 1. Safety checks recommended during Caesarean Section of COVID-19 positive or suspected patient

Safety Check 1	Pre-operative team brief involving core staff members in order to discuss standard obstetric/anaesthetic risks, division into specified teams by role and establish a safe location for neonatal resuscitation outside of the operating theatre.
Safety Check 2	At the moment of patient transfer into theatre, an update occurs between anaesthetic staff and obstetric staff about foeto-maternal status, in order to make a final decision about the mode of anaesthesia required.
Safety Check 3	Once anaesthesia secured, as standard, WHO checklist must be completed to ensure safer surgery prior to skin incision.
Safety Check 4	In the immediate post-operative phase, all staff to remain in theatre until WHO checklist sign-out is complete, a thorough obstetric review is undertaken and patient transferred onto the transfer bed.

discuss important details about each surgical case. Launched by the World Health Organization (WHO) in 2008, it has become mandatory for use in the UK since 2009. In view of the unique and unprecedented characteristics of safety standards related to patients affected by COVID-19, it is vital to incorporate this tool into routine practice of the operating theatre in order to minimise errors and adverse incidents affecting patients and clinicians involved in their care. In our Unit, we have designed and implemented 4 mandatory safety checks to be performed at different stages of the patient's journey (Table 1).

Step 3: Pre-operative preparation

The mandatory donning of PPE, regardless the type of anaesthesia, is time consuming. In order to minimise delays to delivery in obstetric emergencies that require general anaesthesia, the following actions should be taken prior to patient's arrival to operating theatre while anaesthetic/scrub teams don PPE and prepare for intubation:

1. Continue CTG in left lateral position.
2. Stop any existing oxytocin infusion, consider the use of terbutaline.
3. Site an IV cannula and take bloods for VBG, FBC, U&E, LFT, CRP, Coagulation screen and Cross Match at least two units of blood (more if excess blood loss is anticipated).
4. Administer IV Antibiotics and sodium citrate solution (20 mls) orally to the patient.
5. Insert a Foley's catheter using aseptic technique.
6. Commence IV fluids at a rate of 500 mL per hour.
7. Ensure complete familiarisation with the woman's history, allergy status, antenatal scans and course of antenatal care via discussion with woman and notes review.
8. Consent woman for Caesarean Section.
9. Keep contemporaneous documentation.

Step 4: Safe administration of GA

The equipment/ drugs that need to be available include:

- Video laryngoscope.
- COVID intubation tray.
- FONA tray.

- COVID emergency drugs tray (including Sugammadex)
- COVID fridge drugs tray.
- COVID Controlled Drugs tray.
- Plastic covers for limiting aerosol spread during tracheal intubation and extubation.

The Anaesthetic Team present in operating theatre in first instance should include:

- 1) 1st intubator (the most experienced anaesthetist available).
- 2) 2nd intubator/Team Leader.
- 3) Operating Theatre Practitioner (ODP)/Anaesthetic Nurse.

The fourth member of the anaesthetic team (second ODP) should remain in the area to act as runner in case of intubation difficulties. The second ODP remaining in the scrub room acts as a runner in case of anaesthetic emergency but also has a role in maintaining safety. They prevent anyone entering theatre during the intubation and (in the event they are running for equipment) no staff member will enter theatre until instructed to by the Lead Anaesthetist.

When the anaesthetic team is in theatre with the patient present, the role and responsibilities will be as follows:

1. The ODP performs the quick patient check, connects IV fluids and monitor the patient (ECG, BP and SatO₂).
2. In the meantime, the 1st intubator is at the top ensuring that all the trays are inside the theatre and video laryngoscopy brought in. When the ODP is ready, all the other non-anaesthetic team members are asked to leave the theatre. 1st intubator places face mask on the patient and ensures a tight seal (two hand technique, low O₂ flow). The pre-oxygenation period starts now. The 1st intubator establishes the airway management plan (Step A, B and C) and shares it with the rest of the anaesthetic team.
3. The 2nd anaesthetist (Lead Anaesthetist) is ready to administer the drugs, ensures that the woman is fully monitored and that all other team members have left the room.
4. Rapid Sequence Induction is performed after 3 min of pre-oxygenation with cricoid pressure and with Thiopen-

tone/Propofol and Suxamethonium/Rocuronium. No hand-bag ventilation is recommended after patient becomes apnoeic. Use of plastic sheet covering the patient during pre-oxygenation should be considered to limit aerosol spread (10).

5. It is recommended that the Glidescope should be used first, but this depends on the personal experience of the 1st intubator (11). If not familiar with or Glidescope not available direct laryngoscopy should be used instead. If the first two attempts of the laryngoscopy fail, the 2nd anaesthetist (Lead Anaesthetist) should take over airway management and the roles between the 2 anaesthetists should be swapped. If the patient becomes hypoxic between the attempts, the shortest possible time of mask ventilation should be delivered.
6. The 2nd intubator performs max 2 attempts of intubation. If successful, the ODP inflate the ETT cuff before any ventilation attempt is attempted.
7. If not successful, an Igel or other 2nd generation supraglottic device should be inserted. Consider FONA at this point.
8. Before any disconnection of the breathing circuit, the ET tube should be clamped.

Once intubation is confirmed with positive end-tidal CO₂, there will be notification by the Lead Anaesthetist that the Scrub and Delivery teams may enter theatre in their PPE protection. The team may now proceed to clean the abdomen, drape then proceed to urgent delivery, performed by the most experienced surgeon. The operating team should be mindful of the fact that Ergometrine for the management of PPH, having the side effect of vomiting in a significant number of patients, should be used only when absolutely necessary in this setting (12). Therefore Carbetocin or Syntocinon regime should be applied in the first instance, as standard.

Upon delivery of the baby, the attending midwife will remove the baby to minimize COVID-19 exposure to the neonate. The operating team must not leave theatre until a post-operative check has been completed and all staff members present in theatre are satisfied that the woman is stable enough to be moved back to the transfer bed.

The patient, still intubated, will be transferred from operating table to bed after which all team members (bar the remaining anaesthetic team members) will leave the theatre.

Tracheal extubation is a high-risk aerosol generating procedure (13). As such, extubation of the woman may only take place once all theatre staff have left theatre. Only an ODP and anaesthetist will remain in theatre while extubation is taking place and managed the initial recovery period. Again, the use of a plastic cover over the patient's face and upper torso may help limit generated aerosol spread.

Conclusions

With increasing numbers of patients testing positive for SARS-COV-2 worldwide, including obstetric patients at any stage of their gestation, it is essential that hospitals and departments set up local policies and protocols in order not to find themselves unprepared to face the global pandemic. Establishing methodical and strong response to possible emergency scenarios involving COVID-19 patients, such as emergency Caesarean Section and practising them by means of simulation may contribute to reduced morbidity not only the affected mother and her baby but also many healthcare workers involved in their care.

Failure to plan and prepare, especially in such an unprecedented and uncontrolled situation may result in increased confusion, human errors and bad outcomes.

With this in mind, many institutions around the world, including in the UK, have focused on designing and implementing specific and meticulous COVID-19 related pathways.

At the very early stages of the pandemic in our country, a multidisciplinary team of clinicians within our highly performing Maternity Unit has gathered together in order to establish specific guidance and protocols for most complex clinical scenarios including emergency Caesarean Section under General Anaesthetic. With patients' and staff safety considered to be paramount of care, we have successfully implemented the above described protocol into our routine practice in the times of the COVID-19 pandemic. We feel a professional obligation to share our experience with other Units within and outside Europe in order to coordinate and enhance our response to this global threat.

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