The Role of Locoregional Anesthesia in the COVID-19 Pandemic

O Papel da Anestesia Loco-Regional na Pandemia da COVID-19

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ABSTRACT

Coronavirus disease 2019 (COVID-19) refers to the respiratory tract infection caused by the newly emergent coronavirus SARS-CoV-2. The present pandemic, declared on the 11th of March 2020, was first recognized in Wuhan city, and rapidly spread throughout China and other countries, including Portugal. Regional anesthesia should be considered whenever surgery is planned for a patient with suspected or confirmed COVID-19, as it minimizes not only airway management, the intervention with the highest risk of aerosolization, but also potential personnel contamination and patient recovery time, while maximizing operation room efficiency. Anesthesia techniques should be aimed at preventing airway manipulation such as endotracheal intubation, which is associated with a higher risk of pulmonary complications in infected patients. These recommendations are structured in pre-, intra-, and post-operative management in suspected or confirmed infected patients with SARS-CoV-2, based in local hospital infection committee recommendations and the most recent literature available regarding regional anaesthesia. They are aimed at anesthesiology personnel, with the main goals being both team and patient safety. The SARS-CoV-2 virus will be not the last novel virus to trigger global pandemics, so having a well-structured regional anesthesia plan to manage this kind of cases will ensure the best outcome possible to both patients and the perioperative team.

Keywords: Anesthesia, Conduction; Anesthesia, Local; Coronavirus; COVID-19; Pandemics

RESUMO

Coronavirus disease 2019 (COVID-19) refere-se a uma infeção do trato respiratório causada pelo recém-emergente coronavírus SARS-CoV-2. A presente pandemia, declarada em 11 de março de 2020, foi reconhecida pela primeira vez na cidade de Wuhan e rapidamente se disseminou pela China e por outros países, incluindo Portugal. A anestesia loco-regional deve ser sempre considerada em doentes propostos para cirurgia com infeção suspeita ou confirmada por COVID-19, uma vez que minimiza intervenções de alto risco, a contaminação potencial para os profissionais e o tempo de recobro necessário, maximizando a eficiência da sala operatória. As técnicas anestésicas devem ter como objetivo impedir a intubação endotraqueal associada a um maior risco de complicações pulmonares em doentes infetados. Estas recomendações estão organizadas em abordagem pré, intra e pós-operatória em doentes com infeção suspeita ou confirmada por SARS-CoV-2, com base nas recomendações da comissão local de infeção hospitalar e na literatura mais recente disponível sobre anestesia loco-regional. Estas recomendações são direcionadas às equipas de anestesiologia, sendo considerado como principal objetivo a segurança dos profissionais e dos doentes. O vírus SARS-CoV-2 não será o último novo vírus a atingir epidemias em todo o mundo e, desta forma, ter um plano de anestesia loco-regional bem estruturado para abordar este tipo de casos garantirá o melhor *outcome* possível para os doentes e para a equipa do peri-operatório.

Palavras-chave: Anestesia Local; Anestesia por Condução; Coronavírus; COVID-19; Pandemia

INTRODUCTION

Coronavirus disease 2019 (COVID-19) refers to the respiratory tract infection caused by the newly emergent coronavirus SARS-CoV-2.[1] The present pandemic, declared on the 11th of March 2020, was first recognized in Wuhan city and rapidly spread throughout China and other countries, including Portugal since the 1st of March 2020, with the United States, Spain, Italy, Germany and France being the most affected countries at the time of writing.[1,2]

Exponential transmission dynamics are due to its attack rate, estimated between 2.5 and 2.9, posing a high nosocomial infection risk and easily affecting health care professionals.[1] The median incubation period currently estimated is of 4 days but ranges from 1 up to 14 days. While most people (80%) only develop mild symptoms with an uncomplicated clinical course, 10% - 15% require hospitalization and 5% intensive care admission due to acute respiratory distress syndrome (ARDS), sepsis and multiorgan failure, with a mortality rate of 2% - 4%.[1]

Currently, COVID-19 is an emerging, rapidly evolving situation. Since anesthesiologists are in the front line of the management of surgical patients, it can be expected that they encounter cases with confirmed or suspected COVID-19 infection. Most procedures carried out by anesthesiologists during general anesthesia involve aerosol generation thus presenting high risk to staff, regardless of the clinical severity of the disease.[3] These procedures include bag mask ventilation, open airway suctioning and endotracheal intubation.[3-4] Some recommendations during airway management of confirmed or suspected cases have been elaborated to reduce the risk of nosocomial viral transmission.[3-4]

Regional anesthesia may play a prominent role in confirmed or suspected cases, even if asymptomatic, as it minimizes high-risk interventions, potential personnel

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contamination and patient recovery time while maximizing operation room efficiency.[3-5] Anesthesia techniques for COVID-19 patients should be aimed at preventing airway manipulation such as endotracheal intubation, which is associated with a higher risk of pulmonary complications due to mechanical ventilation.[6] Regional anesthesia has a lower impact on respiratory function and dynamics compared with general anaesthesia,[7] which theoretically minimizes the incidence of postoperative pulmonary complications in these patients.[6-9] On the other hand, regional anesthesia also has the benefit of reducing pain and opioid consumption, postoperative nausea and vomiting, intensive care unit admissions and length of hospital stay.[5,9]

These recommendations are structured in pre-, intra- and post-operative management in suspected or confirmed infected patients with SARS-CoV-2, based in local hospital infection committee recommendations and on the most recent literature available regarding regional anesthesia. They are aimed at anesthesiology staff, with the team and patient safety being the main goals considered.

CASE DEFINITION

Definitions of suspect, probable or confirmed case can be found in the guideline 002A/2020 published on the 25th January 2020 and continuously updated by the Directorate-General of Health (DGS), based on the European Centre for Disease Prevention and Control guidance.[10] It should be considered that once local or community transmission is reported, all patients presenting with acute respiratory infection symptoms in primary care or the emergency department (first contact points of patients with the healthcare system) should be considered suspected cases.[10]

PRE-OPERATIVE MANAGEMENT

- Non-urgent procedures should be cancelled or postponed until the patient is no longer infected or infectious.[4]
- COVID-19 infected patients should be strictly approached in a dedicated operating theatre.[4] Room availability and suitability for the procedure should be confirmed before initiation of patient transfer.
- The dedicated operating theatre should be equipped with air renovation systems for patient protection against peri-operative infectious (e.g. surgical wound infection) while simultaneously ensuring the safety of personnel and other patients. Air filtering/renovation with portable self-contained high efficiency particulate air (HEPA) filtration systems (Hospi-Gard® or IQAir®) and air conditioning systems with frequent air renewal as automated vacuum collection (AVAC) are some available options. This should follow local and national guidelines. Considering COVID-19 confirmed patients, aerosol-producing procedures would ideally take place in airborne infection isolation anterooms, which are negative pressure rooms with a separate entrance between operating or procedure room.[11] The current literature also states that, when this recommendation is not feasible, both the positive pressure system and the air conditioning could be switched off.[4]
- Team briefing. Develop and present the anesthetic plan, emphasizing patient course in the operating theatre and each staff member's role.
- The dedicated operating room (OR) should be labelled as "COVID-19" and only personnel required for direct care should be allowed inside, in order to minimize staff exposure.[4]
- According to our hospital's infection control committee and current available guidelines, only essential medication and equipment for the anesthetic procedure should be available inside the OR, so as to make it easier to sanitize the room and reduce waste. All preparations of airway, technique-required provisions and drugs that can take place outside the room should do so.
- In every clinical situation, necessary precautions and material for general anesthesia with airway approach in a COVID-19 known or suspected patient should be assured:
  - HEPA filtration system placed in the expiratory limb, at the interface of the circuit and anesthesia machine;
  - Breathing circuit filter and humidifier installed between the proximal end of the endotracheal tube and Y interface of the circuit;
  - Videolaryngoscope with disposable blades and orotracheal tubes available in various sizes, if possible;
  - Disposable plastic screen case, sleeve and bag for laryngoscope blade after usage;
  - Single-use plastic cover for intubation and/or extubation placed on top of the patient's head.[3,4]
- Additional equipment required that was initially unanticipated can be obtained by an additional professional designated to be outside of the OR (dedicated anesthetic trained nurse, if possible).[4]
- Frequent hand hygiene and proper placement and removal of personal protective equipment (PPE) are crucial to prevent transmission of COVID-19 to health care workers. Confirm availability and gather all adequate PPE, arranged in placement sequence, in order to minimize errors. Compulsory PPE includes, according to the American Society of Anesthesiologists (ASA) and Centers for Disease Control and Prevention recommendations, the Perioperative Considerations for the 2019 Novel Coronavirus (COVID-19) and the guideline 002/2020, dated 25/01/2020 and updated on 10/02/2020 by DGS:
  - Protective footwear;
  - Disposable coverall or fluid resistant full-length gown;
  - Fit-tested disposable N95 respirator mask, ideally covered with a face shield, or a powered air-purifying respirator (PAPR) placed over the

head;
    - Eye protection device (Goggles/Face shield);
    - Disposable hair cover;
    - Beard cover, if indicated;
    - Two pairs of disposable gloves.[12-15]
- PPE should be placed before arrival of the patient to the operating theatre. The sequence varies between hospitals and full head protection/surgical hood should be added to the standard kit for endotracheal intubation and high-risk procedures.[15] Contact precautions must also be applied and require time for installation. Algorithms and cognitive aids are helpful in preventing misuse. There should be supervision by a second member whenever possible. Table 1 represents the author's institutional sequence for PPE placement.
- Informed consent should be obtained regarding the anesthetic plan. If possible, informed consent should be delivered in a digital format, signed on mobile devices covered with a single-use plastic cover.
- Patient transfer to the operating theater with a well-fitted surgical mask in place.
- All contact surfaces along the patient course should be disinfected.

INTRA-OPERATIVE MANAGEMENT AND ANAESTHETIC TECHNIQUE

- The patient should be transferred directly to the OR, bypassing the induction room.
- Only anesthesiology personnel involved in direct care should be present in the OR, fully equipped with PPE. Exclude non-essential staff, including residents.[4]
- Ensure an emergency contact readily available outside the OR.
- Ensure ASA monitoring standards.

Table 1 – Authors' institutional sequence for PPE placement

1 - Removal of all personal objects and accessories
2 - Foot universal protection
Surgical hand scrub
3 - Disposable coverall or fluid resistant full-length gown
4 - Disposable FFP2 mask
Surgical hand scrub
5 - Eye protection device (Goggles/Face shield)
6 - Disposable hair cover
7- Two pairs of raised disposable gloves
OR ENTRY

Sedation

- Administration of sedative medication should be minimized throughout the procedure to avoid occurrence of respiratory depression and airway rescue approaches. Consider other anxiolysis techniques, as psychological support using gentle reassuring words, audiovisual (e.g. background music) and tactile techniques (e.g. stress balls) during all the perioperative period.[16]
- Supplemental Oxygen:
    - SpO_2 94% - 98% acceptable for most patients, if type II respiratory insufficiency aim at 88% - 92%.[17]
    - If needed, supplemental oxygen is appropriate with a low flow system via nasal cannula under a well-fitted surgical or N95 protective mask (e.g. up to 6 L/minutes).[18] Higher flows of oxygen may be administered by a simple face mask over a well-fitted surgical or N95 protective mask.[4,18,19] However, it was demonstrated that dispersal distances of exhaled air increased with higher oxygen flow rates, raising the contamination of the surrounding environment and staff.[20] Oxygen delivery should be kept with minimum allowed outflow in order to ensure satisfactory SpO2 levels.[4]
- Avoid aerosol-generating procedures including high-flow nasal oxygen, non-invasive ventilation and nebulizations.[1]

Regional technique

Focus on safety, promptness and reliability and aim to succeed at first attempt. Techniques should be executed by the best skilled loco-regional manager.

Neuraxial blocks

- Viral structure, infection pathway and neurotropism are shared characteristics of coronaviruses, so neuroinvasive potential is probably applicable to the novel SARS-CoV-2.[21] Increasing evidence supports that coronaviruses may invade peripheral nerve terminals and use trans-synaptic instead of hematogenous or lymphatic routes.[21]
- Neurologic manifestations have been reported in a retrospective study from Wuhan, China, including 214 patients, 78 (36.4%) of which presented depressed consciousness, muscular lesions and acute cerebrovascular disease.[22] Symptoms were commoner in patients with severe respiratory disease (45%).[22] Neurologic complications may reflect either direct lesion or systemic infection impact.[22] A brief neurological examination should be performed and registered on the patient's anesthetic file before and after the regional technique.
- In patients with preexisting infection or immunosuppression, a low incidence of neurologic infections following regional anesthetic techniques has been reported.[23] Viral meningitis after neuraxial techniques

usually has a benign course and is the least frequent etiology, with only one report of coxsackie B virus described.[24] Seventeen pregnant women that tested positive for COVID-19 underwent elective cesarean in Wuhan, China.[6] Epidural continuous anesthesia was used in 14 women and general anesthesia in three.[6] No adverse maternal and neonatal outcomes were reported, supporting the safety of the neuraxial approach.[6]

- Currently, the diagnosis of COVID-19 is not considered a contraindication to neuraxial techniques.[4,6,25] Most authors favour loco-regional techniques whenever possible, since the main targeted infection site is the lung, thus avoiding pulmonary complications, which are associated with endotracheal intubation and mechanical ventilatory support.[6] It also provides a safer environment for OR staff.
- According to recent available literature, the majority of COVID-19 patients show thrombocytopenia, with platelet count rarely below 100 000.[26,27] However, coagulation disorders seem to be common in this group of patients.[26,27] Pre- and post-operative platelet count and coagulation assays should be considered for all patients that are subjected to insertion and removal of epidural or intrathecal catheters.
- Asepsis recommendations remain unchanged, according to the recommendations of the American Society of Anesthesiologists.[28] Sterile gloves and gown may be placed over PPE or replace them. Supervision during this procedure is advised.
- Short/intermediate acting local anesthetics should be preferred (e.g. Prilocaine), promoting a fast recovery and reducing exposure time of the anesthesiology team.[5]

Peripheral nerve blocks

- Among regional techniques, peripheral nerve blocks should be preferred if possible and include short/intermediate acting local anesthetics (e.g. lidocaine). This allows post-anesthesia care unit bypass and reduction of exposure to SARS-CoV2.
- Blockade duration should be adequate to the surgical procedure. If predictably over two hours, short/intermediate and long acting local anesthetic mixtures (e.g. lidocaine and ropivacaine) or placement of a perineural catheter should be considered.
- Due to the risk of thrombocytopenia and coagulation disorders mentioned above,[26,27] pre- and post-operative platelet count and coagulation assays should be considered for all patients subjected to neuraxial-like and profound blocks (interscalene, supra and infraclavicular brachial plexus approaches, lumbar plexus, transgluteal, anterior and parasacral sciatic nerve approaches). The same applies to placement of perineural catheters in the previously mentioned anatomic locations.
- Usual asepsis recommendations apply, including sterile gel and sleeve for ultrasound probe.[29] Additionally, ultrasound screen and neurostimulator may be enveloped in plastic disposable cases. Additional ultrasound probes that are not required for the procedure should be kept outside of the OR. As aforementioned, sterile gloves (and gown for continuous peripheral blocks) may be used over or replace standard PPE. Supervision during this procedure is advised.
- Pneumothorax and phrenic nerve block could be potential complications associated to brachial plexus blocks that may cause further respiratory compromise in COVID-19 patients.[29]
- In order to prevent a pneumothorax in supraclavicular and infraclavicular approaches, an ultrasound guided peripheral nerve block should be performed, in which the needle tip should always be visualized.[29]
- Instead of interscalene and supraclavicular approaches, sparing phrenic nerve blocks should be the choice whenever possible, like suprascapular and axillary nerve blocks, superior trunk block or infraclavicular brachial plexus block.[30,31]
- Various strategies can be adopted to minimize the occurrence of phrenic nerve palsy in interscalene approach, namely:
  - Reducing the local anesthetic dose via volume and concentration;
  - Slower, lower pressure, titrated injection of low volume of local anesthetic;
  - Modifying injection site: ultrasound guided extrafascial injection or intrafascial injection below C6 level.[30]

Table 2 – Authors' institutional sequence for PPE removal

Raised gloves
Surgical hand scrub
Disposable coverall or fluid resistant full-length gown
Disposable hair cover
Surgical hand scrub
Eye protection device (Goggles/Face shield)
Foot universal protection
Surgical hand scrub
OR EXIT
Surgical hand scrub
Disposable FFP2 mask
Surgical hand scrub

After performing regional techniques

- The remaining OR team may enter the room after anesthesiology team approval, considering the time needed for block set-up.
- Surgical incision and surgery should be started only when the block is tested and proved successful and complete (e.g. ice cube test), in order to minimize the risk of conversion to general anesthesia during the procedure.
- Full PPE must be used throughout the procedure.
- Entering and exiting from the infected OR should be minimized.
- Nonsteroidal anti-inflammatory drugs administration in COVID-19 patients is controversial,[25] but diclofenac seems to be the most appropriate whenever indicated.[32]
- Dexamethasone should be carefully considered as post-operative nausea and vomiting prophylaxis in this specific population, since corticosteroid use is discouraged during the disease treatment.[25]

POST-OPERATIVE MANAGEMENT

- Post-operative recovery time should be assessed, since regional techniques may allow for short post-anesthetic care.[5]
- Patients should not be admitted in post-anesthetic care units, in order to limit space contamination.[4] If needed, recovery should occur in the OR with anesthesia personnel only.[4]
- Well-fitted surgical masks should be applied in every patient prior to ward admission.[4] Supplemental oxygen supplementation may be delivered as mentioned above.
- PPE should be carefully removed after the patient leaves the OR and under supervision.[4] Algorithms and cognitive aids are useful. Table 2 represents the authors' institutional sequence for PPE removal.
- According to our hospital's infection control committee, HEPA filtration systems should be kept functioning for at least two hours after patient transfer and OR sanitization scheduled after this period. Entries in the OR during this time frame should be made under respiratory protection.
- Every equipment, surface and work areas should be sanitized and disinfected.[4]

CONCLUSION

Regional anesthesia preserves respiratory function and avoids aerosolization and viral transmission. Therefore, it should be considered whenever a patient with suspected or confirmed COVID-19 undergoes a surgical procedure. Although these recommendations lack the support of well-designed and executed, they could still be a useful clinical care guideline for the anesthesiologist who would like to perform regional anesthesia in a suspected or confirmed COVID-19 infected patient. Furthermore, clinical care protocols are institution specific, so these recommendations may not apply to all healthcare facilities. The SARS-CoV-2 virus will be not the last novel virus to trigger pandemics, so having a well-structured regional anesthesia plan to manage this kind of patients will ensure the best outcome possible to both patients and the anesthesiology team.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

COMPETING INTERESTS

The authors have declared that no competing interests exist.

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