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Update on biological risk for anesthesiologists taking care of patients affected by SARS-CoV2, COVID19

Actualización de los riesgos biológicos para anestesiólogos en la atención de pacientes afectados por SARS-CoV-2, COVID-19

Keywords: Airway, COVID-19, Coronavirus, Prevention, Protection, Anesthesiologist

Palabras clave: Vía aérea, COVID-19, Coronavirus, Prevención, Protección, Anestesiólogos

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Abstract

Biological risks are currently of great interest and concern due to the coronavirus disease 19 (COVID-19) pandemic. In this setting, the exposure of anesthesiologists and healthcare personnel to patients infected with severe acute respiratory syndrome-CoV-2 causing COVID-19 in their professional practice makes an update in the knowledge of the subject essential. The aim is prevention and protection during procedures entailing a higher risk, as is the case of the so-called aerosol generators (by inhalation of droplets). Therefore, we recommend extreme standard precautions focused on hand washing and barrier protection through the use of personal protective equipment in accordance with comprehensive prevention and protection protocols for anesthesiologists, patients, and operating rooms.

Resumen

En la actualidad, los riesgos biológicos han tomado un gran interés y preocupación debido a la pandemia por COVID-19. En ese escenario, la exposición en su ejercicio profesional de los anestesiólogos y personal sanitario a pacientes infectados con

SARS-CoV-2 causante de la COVID-19 hace imprescindible una actualización en el conocimiento del tema apuntando a la prevención y protecciones durante procedimientos que revisten mayor riesgo, como los denominados *generadores de aerosoles* (por inhalación de gotas). Por lo tanto, se recomienda extremar las precauciones estándar enfocadas al lavado de manos y protecciones de barrera equipo de protección personal (EPP) siguiendo protocolos de prevención y protección integral del anestesiólogo, del paciente y del quirófano. Dados los rápidos cambios en la evidencia disponible en esta patología emergente, muchas de las recomendaciones aquí presentadas serán sujeto de modificaciones o ajustes futuros.

Introduction

In daily practice, anesthesiologists are exposed to a wide range of occupational risks that may, in some cases, bring about serious consequences for health and repercussions for personal, family, work, and social life. These are considered "high professional risks" for healthcare workers.¹⁻³

Biologic risk is caused by living organisms, usually microscopic, including viruses, bacteria, or fungi.

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Traditionally, the focus on biologic risk for anesthetists and other healthcare staff was the occupational risk of acquiring transmissible infections through blood or other fluids, as was the case with HIV, hepatitis B, and hepatitis C.^{4,5} However, epidemics and pandemics caused by airborne viral infections have emerged in recent years, as was the case of the avian flu in Singapore in 2005 known as SARS (severe acute respiratory syndrome)⁶ and the A/H1N1-A flu pandemic arising in Mexico in 2009.⁷

As a result of these epidemics and pandemics, anesthetists have been faced with more frequent exposure at work. Hence, the development of specific prevention and protection recommendations for the care of patients who are carriers of these respiratory infections.⁶ At present, the new SARS-CoV-2 has gained significant relevance among respiratory transmission viruses as the causal agent of COVID-19 (coronavirus disease 19).⁸ Since its outbreak in Wuhan, China, in December 2019,⁹ it has spread throughout the world with very efficient transmission and a higher fatality rate than that of seasonal flu. On January 30, 2020, the World Health Organization declared the situation as a Public Health Emergency of International Concern, and then as a pandemic on the 11th of March.¹⁰

In this article, we introduce, discuss, and comment an updated summary to help anesthetists embrace prevention and protection in their daily practice, particularly during procedures that entail a higher risk, as is the case with those that require airway management.

Risk factor

Occupational exposure of anesthetists and healthcare personnel to SARS-CoV-2 as a cause of COVID-19, it is produced during medical procedures in infected symptomatic or asymptomatic patients,¹¹ due to droplets that may be airborne or transmitted by contact with oral, nasal, and ocular mucosas.¹²

Occupational risk

Aerosol generating procedures (due to droplet inhalation),¹² as well as procedures that entail contact transmission (contact with oral, nasal, and ocular mucosas) from a carrier or from surfaces contaminated with the virus,¹² are the ones associated with the highest risk.

Aerosol generating procedures include^{13,14}:

- Manual face-mask ventilation before orotracheal intubation
- Tracheal intubation
- Non-invasive mechanical ventilation
- Tracheostomy
- Fiberoptic bronchoscopy
- Airway suction
- Extubation
- Respiratory therapy

- High-frequency oscillation ventilation
- Prone ventilation
- Nebulization treatment
- Cardiopulmonary resuscitation
- Digestive endoscopy
- Nebulizations
- High-flow nasal cannula

Sources

The virus causing COVID-19 is SARS-CoV-2. This virus is related to SARS-CoV—hence its name and nomenclature—with which it shares 70% of the genetic material. These findings have led to the assumption that it originated in bats. Studies show evidence of a number of mutations that point to a common ancestor from which it is believed it spread to humans in November 2019.⁸

For most individuals, the incubation period is between 4 and 7 days, but may vary between 1 and 14 days.^{12,15} Human-to-human transmission has been clearly established, with an estimated rate of 2 to 3 people for every confirmed case. The transmission mechanism is droplet inhalation and contact with oral, nasal, and ocular mucosas from a symptomatic person or from surfaces contaminated with the virus.¹²

Effects

Biologic risks are associated with a wide range of health effects, with specific profiles according to the type of patient and the clinical course. The most frequent symptoms of COVID-19 are respiratory, the most important being fever, cough, dyspnea (difficulty breathing). Less frequent are gastrointestinal symptoms such as abdominal pain, diarrhea, and nausea.^{8,16}

The clinical presentation is mild in 80% of cases, severe in 15%, and critical in 5%. The global reported fatality rate is 3.4%.¹⁰

Other coronavirus species, such as SARS-CoV and Middle East Respiratory Syndrome (MERS)-CoV have been associated with higher mortality rates of 9.5% and 34.5%, respectively. Risk factors for a bad course of the disease include old age, chronic cardiovascular and respiratory diseases, diabetes, and immunosuppression. Most of the patients affected by a severe form of the disease go through 2 stages: progressive decline after 8 days with the development of respiratory failure and radiological images consistent with atypical pneumonia (bilateral interstitial/alveolar infiltrates), that may evolve to acute respiratory distress syndrome, shock, and multiple organ dysfunction.^{8,16}

Prevention and protection

Prevention and protection of anesthetists and healthcare workers requires a comprehensive strategy containing

recommendations and precautionary measures focused on medical and healthcare staff, patients, and facilities and, in this case, focused on the operating room and adjacent areas.¹⁷⁻²⁰

Prevention and protection for anesthetists

Conceptually, the prevention and protection tools available against biologic risk are the standard precautions (previously called *universal*)^{3,4,21} and, among them, intensifying the use of hand washing, as well as the appropriate use of different barrier devices for COVID-19.^{11,17-23}

Hand washing

The 5 moments for hand hygiene are to be highlighted:

- (1) Before touching a patient,
- (2) Before clean/aseptic procedures,
- (3) After body fluid exposure/risk,
- (4) After touching a patient, and
- (5) After touching patient surroundings.

Appropriate use of protective barriers

Personal protective equipment (PPE)^{11,17-24} is required for the various procedures.

Basic PPE for low-risk procedures, regional anesthesia with minimal sedation, and other procedures

It consists of the following:

- Surgical face mask for the patient.
- N95 mask for anesthetists.
- Hair tied back (the use of a cap is recommended if contact with the patient extends over a long period of time in the intensive care unit, during resuscitation, and in the staff assigned to the isolated area).
- Eye protection devices: Goggles (with lateral protection).
- Disposable long-sleeve gown (with adequate elastic cuffs or thumb hole) that reaches down to the calf, or coveralls up to the neck, impervious to fluids, and blood-borne pathogens.
- Anti-slip non-sterile gloves.

PPE for aerosol generating procedures

For these cases, PPE consists of^{11,17-22,24}:

- Cap, with hair tucked in
- N95 or FFP-3 mask (for use in more than 1 aerosol generating procedure performed by the same operator, although the outer side must be protected with a surgical mask which must be disposed of after each procedure)
- Devices for eye and face protection
- Long-sleeve gown (with adequate elastic cuffs or thumb hole) that reaches down to the calf, or coveralls up to the neck, with shoe covers, impervious to fluids, and blood-borne pathogens.
- Anti-slip non-sterile gloves. The use of double gloves is recommended, as it is easier to remove them.

Use of PPE when treating intubated or ventilated patients

All of the above, plus the following^{11,17-22,24}:

- Placement of a high-efficiency filter at the expiration valve of the self-inflating bag (Ambu bag or similar).
- A high-efficiency anti-microbial filter must be placed in the inspiration and expiration arms of the mechanical ventilation machines.
- N95 or other similar masks can be used more than once, by the same individual, as long as extreme care is taken not to have an accidental exchange and they are kept in good condition.
- Continuous use of these masks is not recommended for more than 4 hours because of the risk of pressure injuries. Reusable PPE material may be reused only after adequate reprocessing with the usual hospital laundry cycles.

Environmental hygiene and medical equipment

The following recommendations must be borne in mind^{17-20,23}:

- Environmental cleaning with water and soap, and disinfection with the usual agents (hypochlorite or organic chlorine at a concentration of 1000ppm or 70% alcohol) is suggested.
- Increasing the frequency of routine hospital cleaning is recommended, in particular of surfaces in close proximity with the patient, and high contact surfaces. It is also recommended to follow institutional protocols.
- High contact surfaces in portable imaging devices, imaging suites, and other diagnostic rooms must be disinfected routinely between patients. One way of doing it is with sponges soaked in cleaning-disinfectant or using disposable wipes with the addition of a cleaning-disinfection agent.

Prevention and protection for patients

The following procedure is recommended when transferring a patient with suspected or confirmed COVID-19 to the operating room and back to the isolation room^{15,18-20,23}:

- Transfer of a patient with COVID-19 entails the risk of viral transmission; therefore, protection and control measures must be maintained to avoid spreading the infection and to minimize staff exposure.
- Every medical center must develop a transfer protocol suitable to its facilities and make it known to all the people involved in transfer and assistance (medical and nursing staff, aides, elevator operators, housekeeping staff, administrative staff, and users). Moreover, supply of the material required by the protocol must be secured.
- The use of informative posters is suggested.
- Before transfer to the operating room and before putting the protective face mask on, the patient needs to wash hands and nose.

- The patient must use chlorhexidine wipes before the procedure, 2 doses of nasal povidone iodine 1 hour before the scheduled time for the surgery, and chlorhexidine mouth wash.
- The patient must wear a surgical face mask during transfer to the operating room.
- All people involved in transfer and reception in the operating theater must wear their PPE, including a surgical-type mask.
- Hand washing with water and chlorhexidine soap is mandatory before and after touching the patient.
- The number of people involved in the care of the patient must be the minimum necessary and, ideally, team members must not leave the operating room or be replaced during the entire procedure.
- Whenever possible, the patient should be scheduled for the last procedure of the day.

Operating room precautions

Ideally, in terms of operating theater management, no positive pressure room should be used.^{18–20,23} The following are the proposed actions:

- Put a sign on the operating room door indicating that the patient is in isolation and that access is restricted.
- All the healthcare staff coming into contact with the patient must wear full protective equipment.
- The least possible number of people should be involved, and replacements and people coming in and out of the room must be restricted as much as possible.
- The procedure must be finished with the same people who started it.
- All supplies and anesthetic drugs must be ready in the room before the patient is brought in.
- Hand washing at the required times.
- Double glove technique should be used when approaching the airway and taking specimens.
- Operating room temperature must be comfortable for the team and staff given that they are covered by layers of clothing, and heat and sweating may become a problem.
- Dispose of all drugs and supplies used with the patient.
- Recovery must take place in the operating room and from there the patient must be taken to the designated hospitalization area.
- Transfer to the inpatient area must be carried out in accordance with the same guidelines applied during transfer to the operating room.
- Cleaning and decontamination of the operating room must be done as usual. The virus is sensitive to standard disinfection agents. Although hydrogen peroxide is more effective, costs are higher.

- The operating room must also be sprayed using, for example, quaternary ammonium.
- The operating room must remain closed for at least 4 hours following the disinfection process.

Anesthetic procedures associated with exposure to COVID-19

Orotracheal/Nasotracheal intubation

The objective is to minimize interventions that favor the release of aerosolized particles. It is essential to identify patients with predictors of higher complexity and plan an airway management strategy to ensure that the best attempt is the best.^{11,19,23,24}

General considerations

The following considerations apply^{11,19,23–29}:

- All procedures involving airway management are potentially aerosol generators. The protection of all the team members is a priority.
- If needed, intubation must always be performed by an expert practitioner, taking all the precautions to avoid airborne spread of the virus.
- Only 2 people are needed for intubation (the operator and 1 assistant). The number of participants attending these procedures must be limited.
- Pre-assembled PPE kits with all the needed materials for these procedures are recommended.
- A checklist should be prepared before the procedure, preferably by a 3rd party, of all the materials that will be used for the maneuver and for putting on and taking off PPE items.
- PPE items must be ready to put on in the right order: (1) cap; (2) N95 or FFP-3 mask; (3) face protection (for the operator)/goggles with seal (for the assistant); (4) gown that covers down to the calf and up to the neck, and shoe covers. Practice drills for putting on and removing PPE are recommended.
- It is essential to ensure that the anesthetist, apart from using the face mask, has carried out hand and nose hygiene for his/her own protection and that of the other team members.
- Environmental cleaning is required: improved organization and increased cleaning frequency and quality; after anesthesia induction, disinfection of all equipment and surfaces with wipes soaked in a compound containing quaternary ammonium and alcohol; careful organization of used and waste materials.

Recommendations for airway management

The following recommendations must be taken into consideration^{11,19,23–29}:

- Plan airway management and the anesthesia approach beforehand.

- Check availability and operability of the necessary equipment.
- Before the start of the procedure, check monitoring, venous access, instruments, drugs, ventilator, and aspiration system.
- Use heat and moisture exchanger filter for the anesthesia machine circuit, ideally between the orotracheal tube and the Y-piece.
- Assign the case to the more experienced anesthetist.
- Pre-oxygenation for 5 minutes with 100% O₂.
- Use rapid sequence induction to avoid manual ventilation.
- Avoid positive pressure ventilation while intubating the patient, or use low volumes if needed.
- Always prefer tracheal intubation over supraglottic devices.
- Videolaryngoscopy may be used depending on the situation, difficult airway, and skills; it has the advantage of eliminating the need of coming into contact with the patient's airway.
- Anticipate the use of an intubation guidewire and a tactile stylet or *bougie*.
- Use the double glove technique to cover the laryngoscopy blade at the end of the procedure.
- Avoid awake intubation or the use of a fiberoptic bronchoscope.
- When intubating, the orotracheal tube must be clamped until it is connected to the ventilator.
- No positive pressure ventilation must be used in the intubated patient before inflating the cuff.
- When using low tidal volume ventilation, low airway pressure must be maintained, compensating with higher respiratory rate.
- Check the circuit constantly for any disconnects to avoid leakage of droplets from the patient into the operating room air.
- For extubation, the tube must be clamped before disconnecting the anesthesia circuit.
- All airway devices in contact with the patient must be discarded: aspiration tubing, laryngoscope blades (ideally plastic), anesthetic circuit, and circuit filter. Vacuum suction should be used.
- In case of visible contamination of the anesthesia circuit (blood, fluids), the canister and the CO₂ absorber must also be discarded.
- When taking off personal protection elements, care must be taken not to touch the face or hair before hand washing.
- Decontamination of the operating room must follow the standard procedure. The virus is sensitive to usual disinfectants.
- The operating room must also be sprayed using, for example, quaternary ammonium.
- The operating room must remain closed for at least 4 hours following the disinfection process.

Recommendations for regional anesthesia

Recommendations are as follows³⁰⁻³³:

- Ensure equipment protection and isolation (ultrasound machines, peripheral nerve stimulators, etc.).
- In the patient is on spontaneous ventilation, make sure that the surgical mask or the high efficiency face mask is on top of the oxygen delivery equipment.
- Whenever possible, avoid the use of face mask/Continuous Positive Airway Pressure (CPAP)/Bilevel Positive Airway Pressure (BIPAP)/high flow; the use of nasal prongs or cannula is recommended.
- If oxygen therapy is required, nasal cannula for 2 to 3L/min should be preferred over the face mask to reduce droplet risk.
- Check platelet count before inserting the epidural or spinal catheter, and preferably before removing the epidural catheter (a drop of platelet count to less than 150,000 has been documented in 1/3 of infected patients).³³

Obstetric patients with COVID-19

The same isolation measures used in non-pregnant women must be adopted in case of SARS-CoV-2 in a pregnant patient.

Recommendations for obstetric patients with COVID-19

Surgical procedures in obstetric patients must be planned and coordinated as part of a multi-disciplinary team effort with as much time in advance as possible.³¹⁻³³

- If there are no contraindications, the recommended technique for cesarean section is neuroaxial anesthesia (spinal, epidural, or combined).
- If regional anesthesia techniques are used, the same protective measures used for general anesthesia apply.
- In case of cesarean section using neuroaxial anesthesia in women infected with SARS-CoV-2, the patient must wear an N95 face mask at all times.
- After any surgical or diagnostic procedure, transfer of these patients to postanesthetic care units must be avoided to prevent contamination of other patients or of the clinical staff.
- The use of inhaled anesthesia techniques are not recommended due to the high risk of airborne spread of the virus.
- Being a high-risk procedure, general anesthesia is not recommended for cesarean section.
- In case of general anesthesia, general and airway management recommendations must be followed.
- There is yet no current evidence regarding neonatal safety.
- Communication with the pediatric team is essential to plan the care of the newborn from the moment of birth.

Management after the procedure

Once the surgical procedure is over, the following sequence is recommended^{19,23-29,34}:

- Remove external gloves immediately and perform hand hygiene with water and alcohol rub *before* removing the garments.
- After removing garments, staff must avoid touching their heads or bodies before washing their hands a 2nd time.
- Disposal of PPE at the end of the procedure must be done without touching the contaminated areas.
- Anesthesia material must be cleaned with adequate decontamination detergents.
- Notify the destination service before initiating transfer and wait until the service confirms readiness to receive the patient.
- Coordinate with the security team of the hospital to ensure that patient transfer proceeds as smooth as possible (use of elevators, avoiding risk areas, or hallways, etc.).
- In the event extubation is decided, the patient must remain in the operating room during the postanesthetic period. For transfer to the room, the patient must be wearing a surgical mask and the process must follow the protocol described above.
- Monitoring during patient transfer must be based on the judgment of the treating anesthetist. Protection, cleaning, and disposal of the materials used must follow the established protocols.
- Housekeeping staff must be called in to clean the operating room and the anesthesia materials.
- Environmental waste attenuation strategies must be implemented based on a combination of deep cleaning with surface disinfectants and short-wavelength ultraviolet light (UV-C).

Conclusion

As experts in airway management, anesthetists are faced with a significant challenge when caring for COVID-19 patients. Consequently, adequate information as well as preparedness for protection during aerosol generating procedures are essential. Knowledge about prevention and protection, and careful adherence to the measures and actions described herein are critical for achieving the best results. Given the rapidly changing landscape regarding the available evidence on this emerging disease, many of the recommendations contained in this article will be subject to revisions or future adjustments.

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Conflicts of interest

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