



# Infection Control Important Points During Anesthesia and Surgery in the COVID-19 Era: A Concise Summary

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## Abstract

The COVID-19 pandemic has raised a huge sense of anxiety in people and health care staff. Yet, there are concerns regarding the exact routes of transmission and the best protective measures in health centers. It seems that a major route of transmission is via respiratory droplets, but it could be spread in an airborne mode in some airborne-producing procedures. This study provides a protocol as a quick, concise infection control module for those who work in operating rooms at the time of the outbreak of COVID-19 or similar infectious diseases.

**Keywords:** COVID-19, Infection Control, Anesthesia, Surgery, Guideline

## 1. Context

The novel coronavirus disease, known as COVID-19, emerged in late 2019 in China, and eventually led to a global pandemic with a high mortality rate. It should be kept in mind that some patients with COVID-19 may require anesthesia and surgery even in the current outbreak. Therefore, a comprehensive protocol seems to be needed to deal with these patients in the Operating Room (OR).

A guideline was developed by reviewing the literature with a particular emphasis on infection control tips. It may be updated if needed.

## 2. Methods

All the published papers in the English language from December 2019 to March 2019 were searched with keywords COVID-19, SARS-CoV-2, novel coronavirus, infection control, anesthesia, surgery, guideline, and protocol through the Google Scholar search engine. The websites of the World Health Organization, Centers for Disease Control and Prevention (CDC), American College of Surgeons, American Society of Anesthesiology, and Anesthesia Patient Safety Foundation were also searched precisely.

## 3. Results

### 3.1. Safe Patient Transfer to the Operating Room

Prepare the patient at least 30 minutes before transfer to OR.

The nurse who transfers the patient to OR should be informed of the disease and wear personal protective equipment (PPE).

Patients should wear surgical masks throughout the whole time.

If the patient is connected to a portable ventilator, place an effective “high quality” viral filter between the ventilator and the endotracheal tube.

A patient transition coordinator must first perform hand hygiene and wear appropriate PPE. Ideally, the second coordinator without protection is needed to interact with the patient’s environment (1).

Transfer staff should wear all PPE components, including gloves, surgical masks, goggles, and disposable face shields covering all parts of the face.

Do not take the patient directly to the OR or Post-Anesthesia Care Unit (PACU) (2).

A separate and specific PACU should be designed for COVID-19 patients.

After entering the OR, deliver the patient to a well-protected circulating technician in the OR to transport the patient to the anteroom.

The route of patient transfer should be as short as possible and marked with a distinct color if possible.

### 3.2. General and Technical Tips

The patient's intubation is a very high-risk procedure due to the presence of high viral load (3).

It is better to exclude high-risk staff in the OR (e.g., pregnant women) in the elective operation of COVID-19 patients.

Postpone non-urgent surgeries.

Whenever possible, it is better to schedule elective surgery of COVID-19 patients at the end of each working day. The pre-designed operating room should be prepared in the case of emergency surgery.

Patients should be admitted to an examination room for pre-anesthesia checkup (PAC) separately to minimize close contact with the physician and patients.

Consider a dedicated OR for patients with COVID-19 to better control the outbreak.

The dedicated OR should have a high-frequency air-exchange system to reduce viral loads in the OR (12 - 25 air exchanges per hour)

The entrance to the dedicated OR should be marked.

Minimize healthcare members in the OR.

Get rid of all unnecessary materials in the dedicated OR.

Consider a separate access room (anteroom) for the dedicated OR (2).

The preparation room is where the patient removes his/her PPE, and the staff performs hygienic practices for the last time. All patient's equipment is kept in this room.

All the personnel, including circular nurses, technicians, anesthesiologists, and surgeons must use PPE all the time in the dedicated OR.

Circular staff should separate all drugs and instruments of COVID-19 patients.

General anesthesia is recommended for reducing the risk of coughs and the virus spread even for a suspected patient. Other types of anesthesia can be selected depending on the type of surgery and the patient's need.

Intubation should be done in a negative pressure room whenever it is needed. Do not intubate the patient in a positive pressure room (4).

Only essential staff must remain in the OR at the time of intubation.

Avoid fiberoptic intubation unless it is necessary.

Preoxygenation must be done for 5 minutes with a FiO<sub>2</sub> of 100% (4).

Perform rapid sequence induction (RSI) to prevent the need for manual ventilation and decrease the likelihood of virus aerosolization.

Consider video laryngoscopy if needed (4).

It is recommended to cover the patient's nose and mouth with two layers of wet gauze to prevent the patient's discharge.

Apply the anesthetic face mask on the wet gauze. It must be ensured that the gauze does not block the patient's airway.

Use an adequate dose of muscle relaxant to prevent cough during intubation.

RSI can change according to specific clinical conditions. Use small tidal volumes if manual resuscitation is needed.

If manual ventilation is inevitable, two educated and expert staff should perform the ventilation; one holds the mask with two hands, and the other applies ventilation to the patient using an ambu bag.

Make sure that there is a high-quality Heat and Moisture Exchanging Filter (HMEF) that eliminates at least 99.97% of 0.3-micron particles or bigger (4).

Place the HMEF between the patient's endotracheal tube and the Y-piece, and effective anti-viral filters must be installed in the anesthetic output tubes.

Cover the laryngoscope with the Double Glove technique immediately after intubation.

Use two gloves during intubation. Use outer gloves to cover the laryngoscope blade and replace the inner gloves as soon as possible. The person doing the intubation can wear the third pair of gloves and remove them immediately after intubation.

Put the equipment used for intubation in a zippered plastic bag and reinsert it in another container and then send for disinfection procedure.

The opening of the patient's airway circuit and the anesthesia device should be limited. If this circuit is opened, the patient's endotracheal tube (ETT) must be pre-clamped.

Wear gloves and cover the face with a shield during the extubation.

It may be difficult to estimate the proper location and depth of ETT using breathing sounds when wearing extra clothing and PPE. Use the following instead (4):

Observe bilateral chest expansion;

Ventilator breathing waveform;

Respiratory parameters.

End-tidal CO<sub>2</sub> is a better marker for successful intubation, as oxygen exchange is significantly impaired in these patients, and oxygen saturation does not always increase immediately after intubation.

Pressure maneuvers or displacements of the cricoid cartilage are required if the vocal cords are difficult to see or the patient's fasting status is uncertain. The suction device should be easily accessible.

Repeated attempts to ETT insertion increase the viral spread. Therefore, a laryngeal mask should be inserted if the intubation fails. In such conditions, tracheostomy should be considered as soon as necessary.

Use a layer of transparent hand sanitizer to keep the glasses from fogging.

Consider the preventive use of antiemetic drugs to reduce the risk of vomiting and virus spread.

All necessary equipment for airway management and other required items should be placed in a highly equipped trolley.

Use disposable airway equipment as far as possible.

During cardiopulmonary resuscitation (CPR), try prophylactic intubation to prevent the need for immediate interventions (rapid intubation) that increase the risk of COVID-19 transmission.

Consider mechanical chest compression instead of a manual one to avoid the medical staff's further exposure.

The airway should be embedded in a method with the highest chance of success for the first time, including the use of a video laryngoscope, to prevent repeated airway manipulation.

If the patient has an acute respiratory failure in the specific PACU, immediately perform tracheal intubation. Non-invasive ventilation techniques such as CPAP or BiPAP can increase the risk of infection transmission (4).

The patient should wear a mask during surgery without general anesthesia.

To perform general anesthesia:

Insert a "high quality" viral filter between the Y-piece of the respiratory circuit and the patient's mask, ETT, or laryngeal mask.

For children or patients who may have problems with the extra size or weight of the filter, insert the filter at the end of the expiratory tubes.

Make sure the gas sampling tubing is protected by a "high quality" filter.

Cover the portable ultrasound device and its cables.

The anesthesiologist must remain in full PPE until the patient is transferred to a specific PACU. Then, he/she removes PPE in the preparation room.

Taking samples from patients with suspected or definite COVID-19 disease should be done by persons wearing PPE (gown, gloves, face shield, N95 respirator). After putting the sample in its appropriate media and closing the door of the container, it should be put in a leak-proof secondary container with proper labeling that denotes the probable or definite coronavirus infection (5).

Extubate the patient if possible in a negative pressure room or ICU out of the OR (6).

Recovery should be performed in a negative pressure room or a dedicated ICU or dedicated COVID-19 room.

### 3.3. Post-Operation

Contaminated equipment should not be moved to a clean area. These devices should be disposed of or disinfected according to strict instructions.

All materials not used in the OR should be sterilized or disposed of.

Discard the used pens.

Samples should be kept in two bags and transported to the laboratory by a person wearing PPE (5).

All anesthetic equipment and machines should be removed before transferring the patient. They should be placed in a safe container and removed or disinfected immediately.

It is recommended to replace the soda-lime canister among the patients.

The surfaces of the anesthetic machine, laryngoscope knobs, and other non-disposable equipment should be cleaned and disinfected with hydrogen peroxide (2% to 3%), 2 to 5 g/L chlorine disinfectant wipes, or 75% alcohol wipes.

Other anesthetic equipment should be cleaned and disinfected after the same procedure.

The operating room used for patients with confirmed or suspected COVID-19 should be disinfected entirely with 2% - 3% hydrogen peroxide products and then apply a 0.5% Chlorine disinfectant solution. The transition bed used for COVID-19 patients should be cleaned and disinfected with 2 to 5 g/L chlorine disinfectant.

After the patient leaves the OR, close the room totally to purify 99.9% of the operating room's air. Predisposed staff should remove their gloves in the preparation room and wash their hands using an alcohol-based solution.

There should be at least a one-hour interval between surgeries to disinfect all surfaces, plates, keyboards, cables, monitors, and anesthesia machines.

All unused items in the anesthesia trolley should be discarded.

All employees must shower before ending their daily work.

As an additional precaution, after definitive COVID-19 surgery, use a hydrogen peroxide vaporizer to disinfect the dedicated OR for COVID-19 patients.

Clean the environment regularly. Ultraviolet disinfectants can also be added to the cleaning process.

### 3.4. Standard Precautions

Standard precautions should be used in all patients, whether the patient has an infectious disease or not. Therefore, all medical staff should disinfect their hands before and after touching the patient. Soap and water are the best solutions, followed by the use of an alcoholic solution. As the virus is transmitted from hands to the mucous membranes, avoid touching your face and rubbing the eyes. Wear gloves and gowns to protect yourself when exposed to the patient's blood or body fluids, damaged skin, or mucous membranes (7-9).

IMPORTANT: As an infectious disease, COVID-19 is transmitted by droplets and close contact with the patient.

### 3.5. Contact Precautions

The main components of contact precautions are wearing gloves, coverall gowns, glasses, and footwear.

### 3.6. Droplet Precautions

The main element of the droplet precaution is wearing a surgical mask when the distance from the patient is less than 1-2 meters.

The following recommendations are used for routine care of a patient with suspected or confirmed COVID-19:

- Hand hygiene;
- Disposable headcover;
- Coverall gown;
- Surgical mask;
- Gloves;
- Footwear;
- Glasses.

### 3.7. Airborne Precautions

An N95 respirator should be used for this precaution and to protect the medical staff when conducting an aerosol-generating procedure. These masks can be worn continuously or intermittently for eight hours. Once the mask is applied, its outer surface should not be touched, because it increases the risk of contamination. The N95 respirators are used to protect the user against 95% of tiny droplets or aerosols (6, 7).

Aerosol-generating procedures include:

- Tracheal intubation;
- Non-invasive ventilation;
- Facemask ventilation;
- Fiber-optic intubation;
- Bronchoscopy;
- Open suction;
- Nasogastric (NG) tube insertion;
- CPR.

Learning how to use PPE is mandatory for all personnel, and all medical staff should wear PPE to avoid close contact with the patient.

Steps of wearing PPE (in order): Detailed.

- Disinfect your hands;
- Use protective footwear;
- Wear the first glove;
- Put on the coverall gown;
- Use N95 respirator (in COVID-19 dedicated OR or while performing aerosol-generating procedures);
- Use eye and face protectors (mere face shields or eye protectors do not provide proper protection);
- Wear the second gown;
- Wear a disposable headcover;
- Use the second glove;

Steps of wearing PPE (in order): Common:

- Disinfect your hands;
- Wear the coverall gown;
- Use the N95 respirator (in COVID-19 dedicated OR or while performing aerosol-generating procedures);
- Use eye and face protectors (mere face shields or eye protectors do not provide proper protection);
- Use gloves;
- PPE removal in the preparation room (in order):
- Remove gloves;
- Remove disposable helmet and face protectors;
- Remove the gown;
- Remove the mask (out of the preparation room and OR);
- Perform hand hygiene between each step;
- Remove PPE in a way that your hands touch only the inner surface of the gown;
- Put PEE in yellow trash cans while just touching the straps of the equipment;
- Do not touch your hair or face till washing your hands;
- Disinfect your hands again (7);
- Protecting the families of staff and doctors in the OR;
- Avoid hugging family members and take a shower immediately when returning home;
- Wash used clothes.
- Sterilize cell phones, pens, and other items that are often used in the workplace and at home.

## 4. Conclusions

Health care staff safety is always considered of paramount priority in infectious disease outbreaks. This safety is reached through the implementation of infection control rules. The above-mentioned infection preventive measures are best selected to maintain staff safety. They could be used in any disease that is transmissible in a manner like COVID-19.

## Footnotes

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