



Options for Operating Room Configuration and Use When a Patient with Suspected or Confirmed COVID-19 Requires Emergent Surgery

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This document replaces the previous version published on November 16th, 2020. This revision includes the removal for the option of a negatively pressurized operating room in alignment with recommendations from the Canadian Standards Association (CSA) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

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Purpose

This document outlines key considerations and presents options for operating room configuration to minimize SARS-CoV-2 transmission risk when performing surgery on patients who are suspected or confirmed to have COVID-19.



Key Terms

Air clearance time: The time needed to sufficiently reduce air contaminants in a room, measured in minutes. It is based on the number of air exchanges per hour.

Air exchanges: The ratio of airflow, in volume units per hour, to the volume of the space under consideration, in identical volume units.

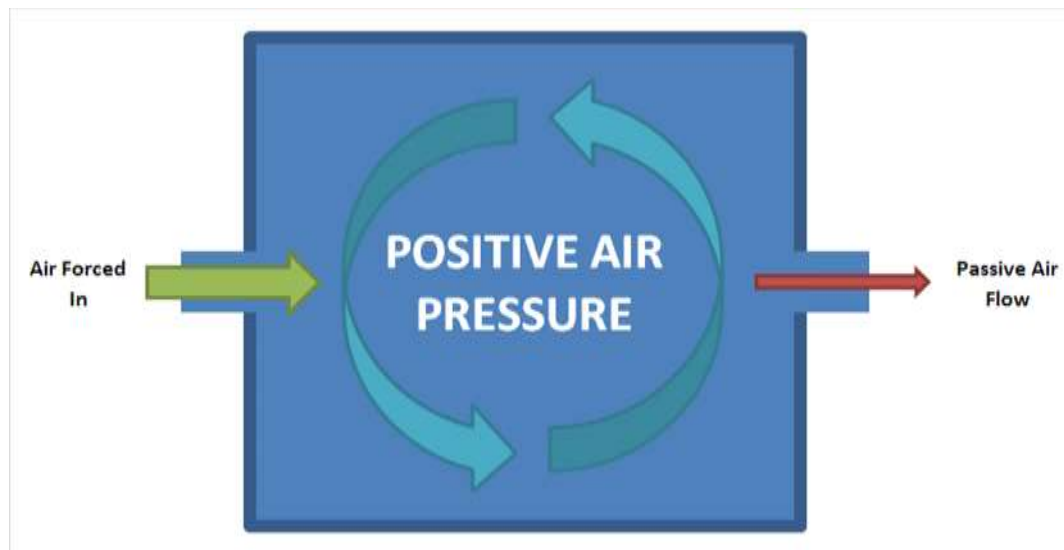
Airborne infection isolation room (AIIR): A single patient occupancy room, which is intended to minimize the transmission of infectious agents spread by the airborne route or from the aerosolization of body fluids. An AIIR must meet design, construction and ventilation requirements.

AIIR anteroom: A room directly adjacent to the entrance of the AIIR that provides an airlock between the patient room and the rest of the health-care facility.

Operating room (OR): The room where a surgery takes place.

Operating room suite (OR suite): The combination of the OR, the anteroom (if there is one), the scrub room/area and the clean corridor.

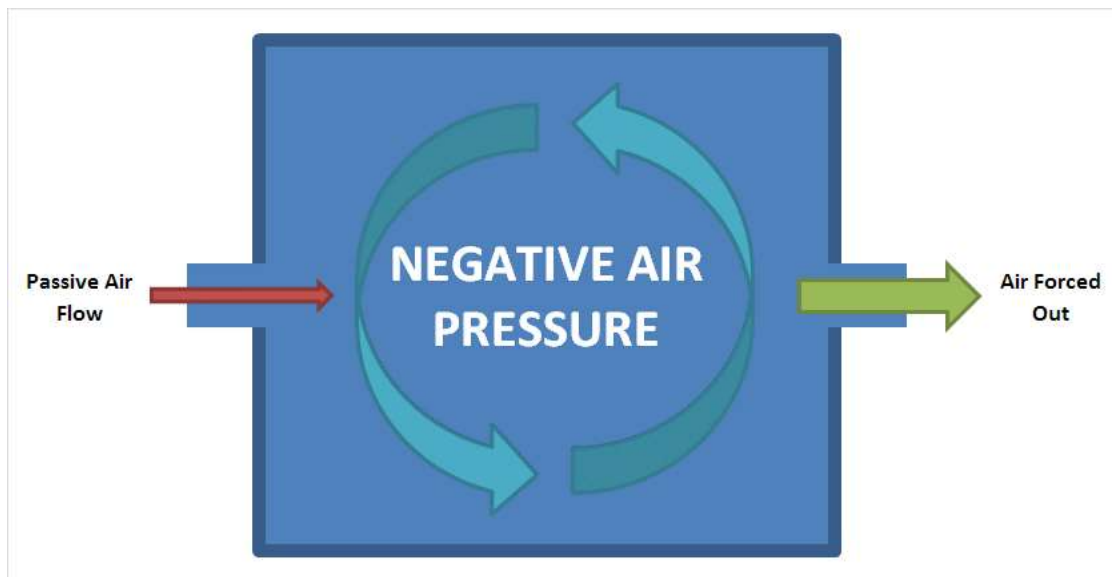
Positive pressure: Air flows away from areas or rooms with *positive pressure* (pressurized) as more air is supplied to the room than is exhausted. Air flows by mechanical means (i.e., fans pushing air through the room).¹



¹ Image source: https://en.wikipedia.org/wiki/Positive_pressure



Negative pressure: Air flows towards areas with negative pressure (depressurized) as more air is exhausted from the room than is supplied. Air flows by mechanical means (i.e., fans pulling air through the room).²



Background

Current best practices recommend ORs to be positively pressurized relative to adjacent areas to prevent the circulation of pathogens, to protect open wounds and sterile fields from contamination, and to prevent surgical site infections. The following are key considerations for managing patients suspected or confirmed to have COVID-19 in the OR:

- There is an increased risk of aerosolized respiratory droplets from [aerosol-generating medical procedures \(AGMPs\)](#).
- The [BC Centre for Disease Control's infection prevention and control \(IPC\) protocol for adult surgical procedures during the COVID-19 pandemic](#) guidance should be consulted and followed.
- Switching back and forth from positive pressure to negative pressure modes is not recommended by the CSA or the ASHRAE.
- Changing settings in the heating, ventilation and air conditioning (HVAC) system of the OR may affect ventilation dynamics in other areas of the facility and result in reduced air exchanges. Changes must be thoroughly planned and properly designed prior to implementation. This includes testing, verification and proper, continuous monitoring of the room pressure. This work should be undertaken by engineers and specialists with expertise in HVAC systems, in consultation with facility management, IPC and workplace

² Image source: https://en.wikipedia.org/wiki/Negative_room_pressure



health and safety (WHS) teams to ensure appropriate procedures are undertaken and intended parameters are met.

Key Assumptions & Requirements Used to Develop OR Configuration Options

- Assumptions
 - Surgery cannot be performed using spinal or local anesthesia. General anesthesia (intubation) is required.
 - There is an increased likelihood of performing [aerosol generating medical procedure \(AGMP\) in the OR \(e.g., intubation and extubation\)](#).
 - Surgery cannot be postponed.
- Requirements
 - When considering changes to the OR configuration or HVAC system, facilities management engineers, HVAC specialists, WHS and IPC teams must be consulted. Facilities management engineers and HVAC specialists are to lead any changes to the HVAC system or any modifications made to air flow in the OR, including anteroom construction.
 - Designate an OR for surgical procedures with patients suspected or confirmed or having COVID-19 away from high traffic areas or in a far corner of the surgical floor.
 - Relative humidity of the OR suite is maintained at 40-60%.
 - All of the health-care team in the OR suite follow appropriate use of personal protective equipment (PPE).
 - Droplet/contact precaution and AGMP signs are posted on the door into the OR. Refer to the sample BCCDC [AGMP](#) sign.
 - Traffic into and out of the OR is strictly controlled so that adequate pressure is maintained and air turbulence is minimized. Doors to the OR should be kept closed except when moving patients and supplies in or out.
 - A disposable anesthesia circuit is used to minimize the risk of contaminating anesthesia equipment. If a disposable circuit is not available, the entire circuit is changed after the surgery is complete and reprocessed according to the manufacturer's instructions.
 - A disposable bacterial filter should be placed on the patient's anesthesia breathing circuit at the endotracheal tube or expiratory side of the circuit.
 - A discharge isolation clean should be done after the patient leaves.
 - Observing air clearance time after an AGMP is a provincial recommendation. However, further decision-making based on risk assessments at the health authority level with local IPC, WHS and facilities management teams may have recommendations in determining and/or establishing air clearance times for specific OR suites. [Table 1](#) can be referenced to assist with determining air clearance times.

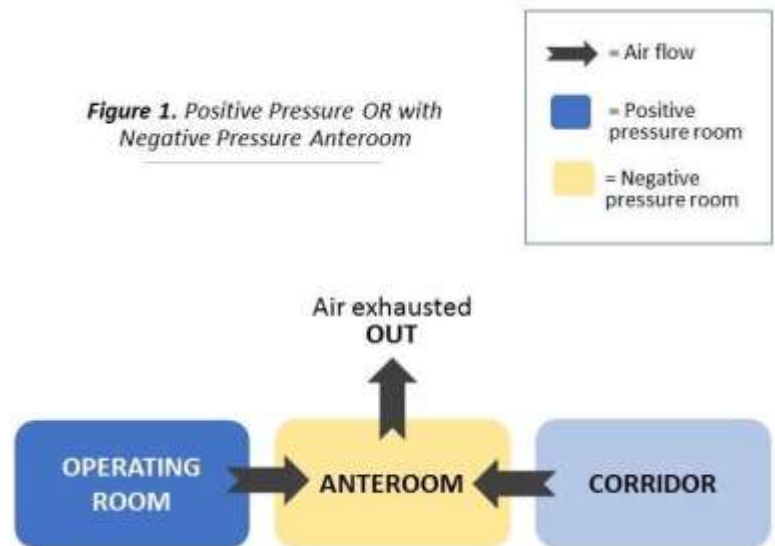


Options for OR Configuration and Use When a Patient with Suspected or Confirmed COVID-19 Requires Emergent Surgery

Important: OR configuration options should be determined in advance. Implementing any of the options below should never occur in circumstances where delays may occur and result in patient harm (e.g., obstetrical patients including those with a planned general anesthesia or emergency anesthesia where delays result in maternal and fetal harm).

Option 1: Use a positive pressure OR with negative pressure anteroom (where available)

- OR is positively pressured to the anteroom (i.e., air flows from the OR into the anteroom).
- Ensure outlet air vent is not close to an intake air vent.
- Corridor is positively pressured in relation to the anteroom (air flows from the corridor into anteroom).
- The anteroom is negatively pressured in relation to the OR and corridor, with air being discharged to the outside (i.e., air flows into the anteroom and is exhausted outside).
- Anteroom is not to be used for donning and doffing of PPE. Infectious organisms are drawn into the anteroom before being discharged outside; therefore, the anteroom area should be considered contaminated while the patient is in the operating room and for a time period after.
- Modification equipment such as a portable air handling unit high-efficiency particulate air (HEPA) filter may be used for maintaining negative pressure in the anteroom only.



Option 2: Use a positive pressure OR

- If possible, perform intubation/extubation and other AGMPs in a designated airborne infection isolation room (AIIR)/negative pressure*, otherwise intubate and extubate the patient in the OR.
- Doors to the OR must remain closed. Staff are restricted from adjoining corridors.
- Limit personnel in the OR for intubation/extubation to the minimum number of trained staff.
- Complete surgical procedure. Surgical team leaves OR once complete.
- Limit staff in OR (registered nurse, anesthesiologist, respiratory technologist) until ready to move the patient to a designated unit:
 - Extubate and recover in OR, an AIIR or a private room.



- When medically suitable, patient can be returned to their room in the patient care unit.

* Considerations when using an AIIR or a private room for AGMP outside the OR suite:

- This option may not be medically suitable for some patients, as it extends anesthesia time and requires movement of an unconscious, intubated patient.
- Use an AIIR as close to the OR as possible or a private room (if the facility does not have an AIIR).
- Intubate the patient in an AIIR.
 - A disposable bacterial filter should be placed on the patient's anesthesia breathing circuit at the endotracheal tube or expiratory side of the circuit.
 - An AGMP should not be performed while moving to the OR.
- Transport the patient directly into the OR and bypass the holding area.
- Complete surgical procedure in an OR that is under positive pressure.
- When surgery is complete, transfer patient to an AIIR or private room in the post anaesthetic care unit (PACU) or as close to PACU as possible.
- Recover and extubate the patient in the AIIR or private room.
- When medically suitable, the patient can be returned to their room on the patient care unit.



Table 1: Air Changes/Hour and Time Required for Airborne-Contaminant Removal by Efficiency^{3*}

Air Changes/ Hour (ACH)	Time (mins.) Required for Removal 99% Efficiency	Time (mins.) Required for Removal 99.9% Efficiency
2	138	207
4	69	104
6	46	69
8	35	52
10	28	41
12	23	35
15	18	28
20	14	21
50	6	8

* Table 1 (above) was originally adapted from a 1973 National Institute for Occupational Safety and Health (NIOSH) article for industrial particulates. It has been used since then as a guideline for room clearance and has never been updated. The table is a general guideline only, particularly as air handling systems have become more sophisticated since the formula used for this table was first developed.

Observing air clearance time after AGMP is a provincial recommendation. However, further decision-making based on risk assessments at the health authority level with local IPC, WHS and facilities management teams may have recommendations in determining and/or establishing air clearance times for specific OR suites. For example, clearance times may differ based on air flow and rate of air exchanges in the OR suite. Determining appropriate times for air clearance post-AGMP should be made for each OR suite in consultation with IPC and facilities management.

³ Source: <https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html>



References

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