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IPAC BEST PRACTICES GUIDELINE
Airborne Precautions in the Operating Room

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PURPOSE

- To reduce the risk of staff and patient airborne exposure to communicable diseases during surgical procedures (Appendix A)
- To describe best practice for managing patients with a suspected or confirmed diagnosis of an airborne illness who require surgery (Appendix B and Appendix C).

PROCEDURE

1 General Infection Prevention and Control Principles

- Routine Practices are a standard of care used for all clients, at all times, to reduce the risk of infection.
- Transmission-based Precautions (Airborne, Droplet, Contact) are Additional precautions used in conjunction with Routine Practices to prevent the transmission of specific organisms or infections.
 - Airborne Precautions are used for microorganisms transmitted through the air over extended time and distance by small particles (Appendix A).
 - Some infections (e.g., disseminated shingles) need a combination of transmission-based precautions, since some microorganisms can be transferred by more than one route.
- Operating Room (OR) and peri-operative staff should know their own immune status for communicable disease and must be N95 fit tested (reviewed each year)
 - Only immune staff may enter the room of a patient with confirmed or suspected measles
 - Staff with known VZV immunity may choose to forego the N95 respirator for patients with confirmed or suspected chicken pox or disseminated shingles
 - Confirmed immunity includes:
 - Serological proof of immunity or
 - Documentation of 2 appropriately timed doses of vaccine
- If possible, delay elective surgical procedures on patients with an airborne communicable disease until the patient is no longer infectious. Consult with Infection Prevention and Control, an Infectious Disease Specialist, or Medical Microbiologist as needed.

- If surgery is required for patients with any of the airborne transmissible diseases (Appendix A); consult Infection Control, the Medical Microbiologist, or Respiriologist responsible for the patient.
- If surgery cannot be delayed, the Patient Care Coordinator or designate will notify the surgeon and anaesthesiologist of the suspected or confirmed diagnosis and requirement for surgery. The manager or designate should ensure that:
 - An operating room is available as outlined in Section 2, Facility Infrastructure Requirements.
 - All staff members assigned to the case, including the anaesthesia team, are notified of the suspected or confirmed diagnosis and the need to implement Airborne Precautions.
 - The case is scheduled as the last case of the day. If the case cannot be scheduled as the last of the day consult Facility Maintenance and Operations (FMO) to ensure adequate air clearance/settle times. (Appendix E)

2 Facility Infrastructure Requirements

- An operating theatre with negative pressure is required
- Use an OR theatre with an attached anteroom. (Refer to Appendix C for additional information and consult with site FMO)
- If an OR theatre with an attached anteroom is not available, transfer the patient to a facility with a proper OR theatre and anteroom for this purpose. (Appendix C)
- If transfer is not possible and surgery cannot be postponed, consult with site FMO to select an OR theatre for use that is negatively pressurized relative to the corridor/adjacent spaces and provides at least 15 total air exchanges per hour (Appendix D).

3 Preoperative Considerations

- If possible, intubate the patient in an airborne infection isolation room. A disposable bacterial filter should be placed on the patient's anaesthesia breathing circuit at the endotracheal tube or expiratory side of the circuit.
- If not intubated, ensure the patient is wearing a surgical mask during transport.
 - Note: N95 respirator protects the wearer from small, desiccated airborne particles, whereas a surgical mask will suffice to block particles as they are breathed out
- Staff accompanying must wear an N95 fit tested respirator during transport.
- Aerosol generating medical procedures (e.g., suctioning) should not be performed on route.
- Transport the patient directly into the OR theatre and bypass the holding area.

4 Perioperative Consideration

- All of the health care team in the OR theatre should follow Airborne Precautions (staff wear fit tested N95 respirators).
- Post an Airborne Precautions sign on every door into the theatre (e.g., semi-restricted hallway, sterile core).
- If a portable HEPA filtered air scrubber is available it may be used during intubation and extubation (turned off during the case).
- Strictly control traffic into and out of the theatre (doors to the operating room should be kept closed except when moving patients and supplies in or out) so adequate air exchange is maintained.
- A disposable anaesthesia circuit should be used to minimize the risk of contaminating anaesthesia equipment. If a disposable circuit is not available, the entire circuit should be changed after the surgery is complete and reprocessed according to the manufacturer's instructions.

5 Postoperative Considerations (See Appendix B)

- Extubate and recover the patient in the OR theatre unless there is an airborne isolation room in the Post-Anaesthetic Care Unit (PACU).
- Limit the amount of staff in the OR theater during extubating to essential staff only
- Doors to the operating room should be kept closed except when moving patients and supplies in or out to ensure adequate air exchanges are maintained.
- If not intubated, ensure the patient is wearing a surgical mask during transport to an airborne infection isolation room (AIIR) on an inpatient unit.
- After the patient is discharged from the OR:
 - Keep the OR theatre door closed to allow airborne particles to clear/settle;
 - Consult FMO as needed to ascertain air clearance as settle times will vary based on facility air exchanges (See Appendix D and E);
 - Any staff entering room before complete air clearance should wear an N95 respirator;
 - The room may be entered for discharge cleaning after air clearance time has lapsed. If cleaning staff must enter the room to do discharge cleaning before air clearance time has lapsed, the cleaning staff must wear an N95 respirator.
- Clean room according to the VCH Environmental Services requirements.
- Send instruments to Medical Device Reprocessing Department in the routine manner.
- Handle all laundry and garbage following Routine Practices.

6 Monitoring of Pressure Differential, Alarms, and Testing

- Room pressurization alarms for the OR should be incorporated into a central monitoring system to verify the alarms are working at all times through manual test or alarm and subsequent verification.

- Testing and calibration should be set up in the facility maintenance and engineering's preventative maintenance program to be done quarterly. Test results should be recorded.

DEFINITIONS

Airborne exposure may occur if small particles (i.e. aerosols containing droplet nuclei) with viable microorganisms are generated, propelled over short or long distances and inhaled.

Airborne infection isolation room (AIIR) is a room that is designed to maintain negative pressure relative to adjacent areas; and is constructed and well ventilated to limit the spread of microorganisms from an infected occupant to the surrounding areas of the health care facility.

Air exchange means the ratio of the airflow in volume units per hour to the volume of the space under consideration in identical volume units, usually expressed in air exchanges per hour (ACH).

Air clearance time means the time in minutes needed, and is based on the number of air exchanges per hour, to reduce airborne contaminants in the room by 99% or 99.9%.

Anteroom means a small room or space at the entrance to an airborne isolation room that is separated by doors from both the outside, and the main space of the airborne isolation room.

Fit testing means the use of a qualitative or quantitative method to evaluate the fit of a specific make, model and size of respirator on an individual.

HEPA filtration (high-efficiency particulate air filter) means an air filter that is certified to remove $\geq 99.97\%$ of particles $0.3 \mu\text{m}$ in size. The filter can be either portable or stationary.

Negative pressure means special ventilation to create inward directional airflow to the room, relative to the adjacent area. Negative pressure keeps air from flowing out of the room and into adjacent rooms or areas.

N95 respirator means a disposable particulate respirator that is $\geq 95\%$ efficient at removing $0.3 \mu\text{m}$ particles (the most penetrating particle size) but is not resistant to oil.

Pressure differential means a measurable difference in air pressure that creates a directional airflow between adjacent compartmentalized spaces. For older rooms (e.g., designed before 2010) the pressure value (Pascal) negative pressure is a minimum pressure gradient of 2.5 Pascal measured between the room to the corridor. For new rooms (e.g. designed after 2010) it is minimum pressure gradient of 7.5 Pascal measured between the room to the corridor. (See Appendix C)

REFERENCES

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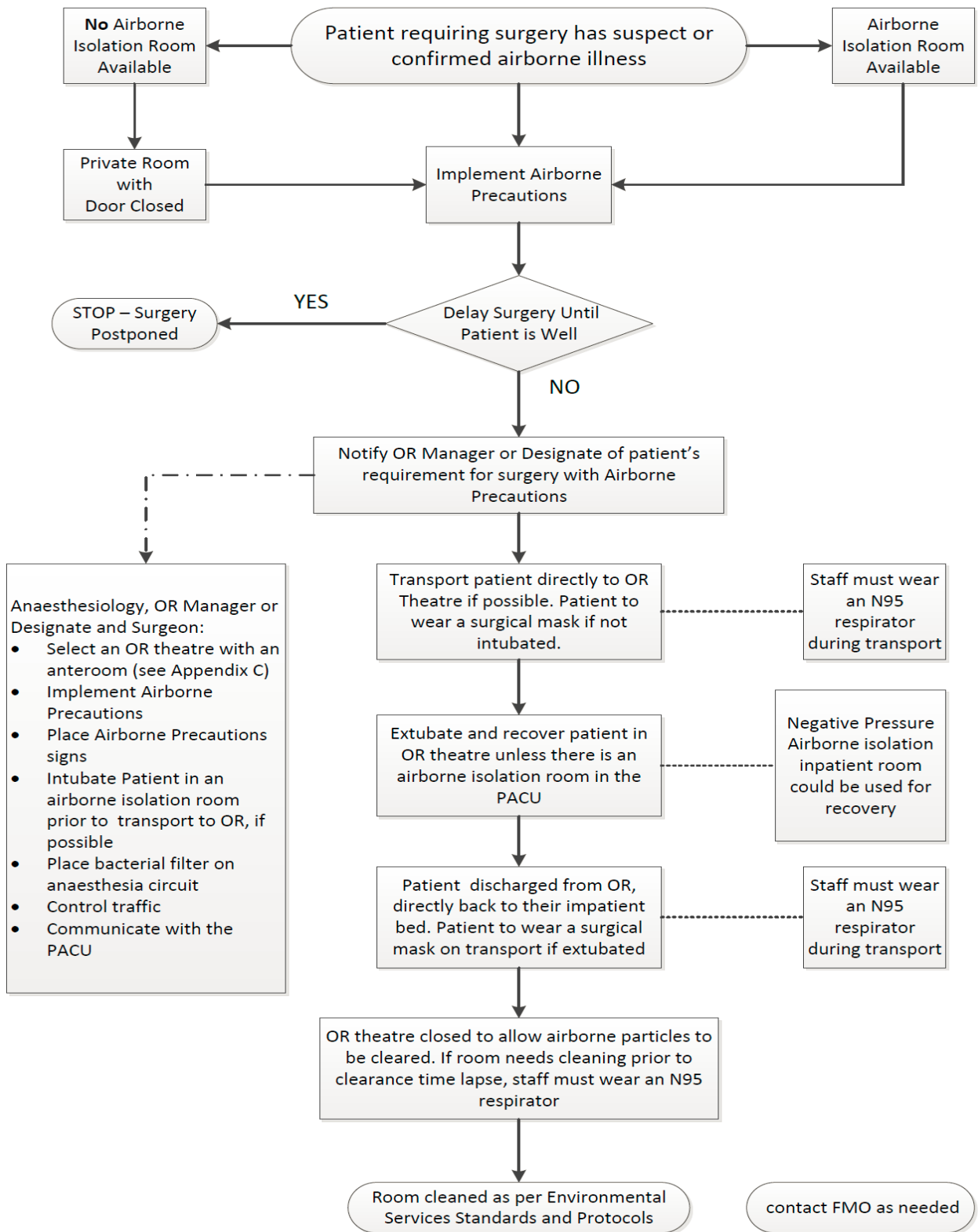
Appendix A:

Airborne Communicable Diseases

Airborne communicable diseases include, but are not limited to:

- Tuberculosis
 - o Potential for transmission is generally limited to cases with respiratory forms of the disease (i.e., pulmonary, laryngeal or miliary tuberculosis)
 - o Airborne precautions are required for extra pulmonary or non-respiratory TB only if draining lesions present or if there is suspicion of miliary tuberculosis with pulmonary involvement.
- Rubeola (measles)
- Varicella zoster virus (chickenpox) - includes exposed and susceptible individuals who are in the incubation period of the disease
- Disseminated herpes zoster virus (shingles)
- Localized shingles that cannot be covered in an immunocompromised patient
- Less commonly found diseases such as:
 - o Monkeypox
 - o Smallpox
- Some emerging respiratory pathogens or novel viruses (i.e. pandemic influenza, SARS, MERS)
- An AIIR should also be used for performing AGMPs on patients with TB, SARS, viral hemorrhagic fever and respiratory infection with an emerging pathogen for which transmission routes are not yet fully known (Follow PHAC Guidance <http://www.phac-aspc.gc.ca/eri-ire/index-eng.php>)

Appendix B Algorithm for Implementing Airborne Precautions in the OR

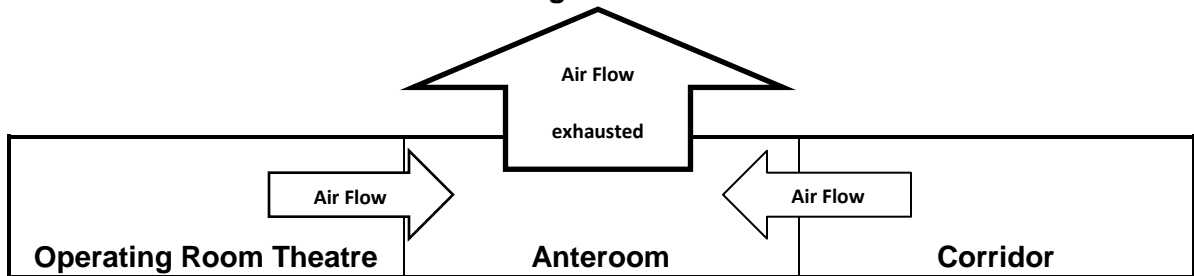


Appendix C:

Selecting an Operating Room (OR) Theatre

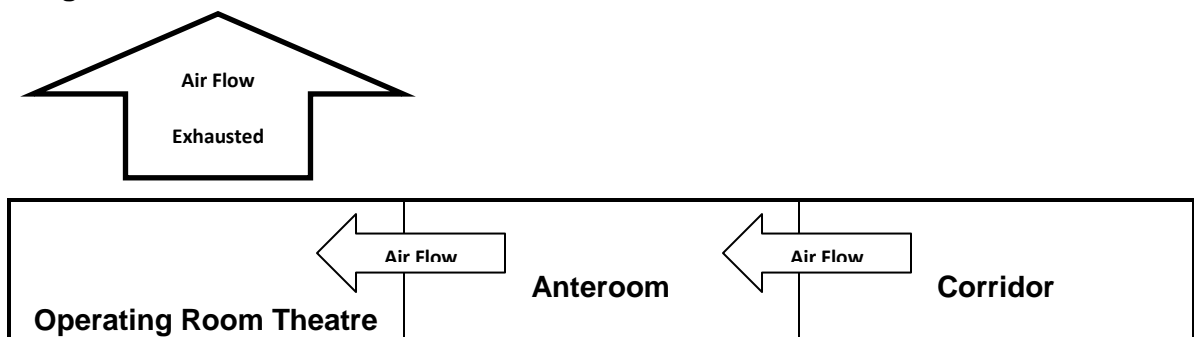
- Use an OR with an anteroom (as described in 1 and 2). Consult with FMO if necessary.
- Positive and negative pressures refer to a pressure differential between two adjacent air spaces. Air flows away from areas or rooms with positive pressure (pressurized), while air flows into areas with negative pressure (depressurized).
- If an OR with an anteroom is not available in the facility; transfer the patient to a facility that has an OR theatre with an anteroom.
- If the patient cannot be transferred and OR theatre with an anteroom is not available, see 3.

1. Positive Pressure OR Theatre with Negative Pressure Anteroom



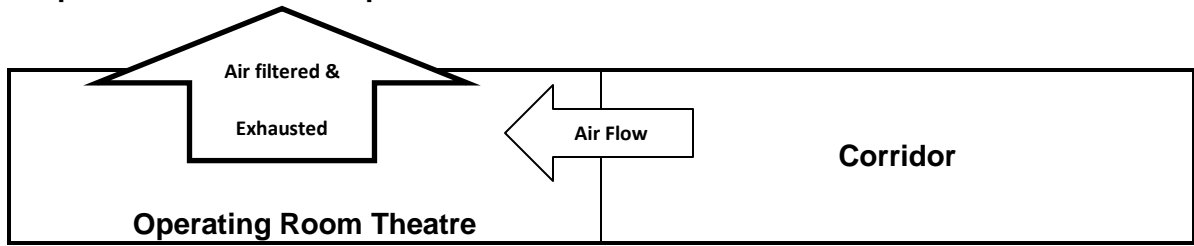
- OR theatre is positively pressured to the anteroom (air flows from OR into the anteroom)
- Corridor is positively pressured to anteroom (air flows from corridor into anteroom)
- Anteroom is negatively pressured to OR theatre and corridor with air being discharged to the outside (air flows into the anteroom and is exhausted outside)
- Anteroom is not to be used for donning and removal of personal protective equipment (infectious organisms are drawn into the anteroom before being discharged outside).

2. Negative Pressure OR Theatre with Positive Pressure Anteroom



- OR theatre negative to anteroom (air flows from anteroom into OR theatre)
- Anteroom positively pressured to OR theatre (air flows into OR from anteroom)
- Corridor positively pressured to anteroom (air flows from corridor into anteroom).

3. If patient transfer is not possible ensure:



- Corridor positively pressured to OR theatre
- OR theatre negatively pressured with air flow to the outside
- High Efficiency Particulate Air (HEPA) filtration required (may be a portable unit)

Appendix D

Ventilation Recommendations for Operating Rooms

Recommending Agency	Number of mechanical air exchanges per hour
Canadian TB Standard (February 2014)	15
Canadian Standards Association (2010)	20
CDC (2005)	15
AHSRAE (2008) in FGI (2010)	20

ORs within older AHS facilities (designed before 2010) should have a minimum of 15 air exchanges and any newly built (designed after 2010) ORs should have a minimum of 20 air exchanges with HEPA filtered supply.

Appendix E

Air Settle/Clearance Times

VCH IPAC Acute Care Resource Manual TB Recommendations for air settle/clearance times are as follows:

- Do not admit a new patient into room for at least 1 hour. If entering room before 1 hour, and non-immune, wear an N95 respirator.

Alternatively, if specific air exchange rates for the room are known, refer to the air clearance rates to determine air clearance times.

Time in Minutes Needed (by number of air exchanges per hour) to Reduce Airborne Contaminants by 99% or 99.9%. (Adapted from CDC MMWR, 2005)

Air exchanges per hour	99%	99.9%
12	23	35
15	18	28
20	14	21