6201.02: Droplet & Aerosol: Airway, Oxy, Vent

INTRODUCTION

New and emerging infectious diseases are a part of our existence as far back as time and each one may pose specific hazards to airway management both for the patient and clinicians. In contrast to non-infectious patients, here our first priority is safety of personnel. Personal protective equipment (PPE) is paramount, as rushed or incomplete donning of PPE has resulted in clinicians contracting serious diseases such as SARS and novel coronavirus, COVID-19. Appropriate doffing of PPE is equally as important.

Special airway considerations will depend on whether a disease is airborne or droplet spread, and the intervention being performed. An airborne disease is one where the droplet nuclei are particles of respiratory secretions <5 microns and therefore can remain suspended in air for extended periods leading to inhalational exposures. A disease transmitted by droplets indicates respiratory secretions of ≥5 and so only remain suspended in the air for limited periods of time and transmission generally occurs within about 2 metres of the source. Since airway management necessitates close contact; PPE is paramount and aerosolizing procedures should be avoided.

As an infectious disease outbreak occurs, more information regarding its transmission and appropriate precautions may become known later. For example, meningitis spread by *Neisseria meningitidis* would require droplet precautions but if it is known to be due to tuberculosis, airborne precautions would be recommended. Many respiratory illnesses are droplet spread however airborne precautions may still be recommended depending on its pathogenicity or the intervention being performed. Additional special precautions would be required for specific diseases like ebola or other viral hemorrhagic fevers.

SAFETY

Invasive airway management is an aerosol generating medical procedure. Interventions such as intubation and suctioning all expose the paramedic to aerosolized particulate matter that has the potential to be infectious. Since infectious status of patients is not usually known at the time of assessment, paramedics should always approach every airway using universal precautions, i.e. goggles, gown, gloves and mask, for any airway intervention. For a suspected airborne or droplet spread illness, if airway interventions are required then PPE should further include N-95 mask and face shield and fluid-resistant gown. Donning and doffing should be observed by a partner as this can help detect potential self-contamination before it occurs.

In cases of respiratory pathogens, having the patient or their caregiver place a mask on them prior to assessment can help in containing sources of contamination, if tolerated by the patient.

From both the novel coronavirus as well as the 2003 SARS outbreak it is well recognized that transmission of the virus to health care workers is often a result of incomplete or rushed PPE. And it's important to remove PPE properly once the patient interaction is complete as this is another frequent source of self-contamination.

During an outbreak, more information may become available regarding transmission as the situation unfolds, it is important to heed expert advice regarding any additional precautions to be taken.

NON-INVASIVE TREATMENTS

Most methods of oxygen supplementation remain safe and can be used in patients with droplet or airborne considerations with certain precautions. In most infectious diseases causing acute respiratory distress, supporting oxygenation is the mainstay of therapy. Oxygen administration should be titrated to keep SpO2 greater than 90%. In some disease processes, it may be extremely difficult to completely correct hypoxia and weighing better oxygen saturations against potential exposure to care providers may result in the acceptance of a lower target SpO2.

Metered-Dose Inhalers

Metered-dose inhalers (MDI) with aerochamber should be used to deliver medication in the cooperative/spontaneously breathing patient or through an MDI-adapter in patients receiving positive pressure ventilation with a BVM or advanced airway.

Aerosolized medication can spread droplets and airborne particles. Nebulizers must not be used.

6201.02: Droplet & Aerosol: Airway, Oxy, Vent

Nasal Cannula
Mild to moderate hypoxemia can be treated by nasal cannula as usual. Flow rates of greater than 6 L/min via nasal cannula have the potential to aerosolize infectious material and should be avoided. A surgical mask should be worn by the patient over the nasal cannula.

Filtered Non-Rebreather (fNRB)
Typical Non-Rebreathers are open systems which can aerosolize airway particles at high flow rates, therefore flow rates should not exceed 15 L/min. Filters may be applied to the exhaust ports on some models which reduces the risk but the provider should be aware that it is not entirely eliminated. Patients who need high concentrations of oxygen by fNRB will often progress to requiring mechanical ventilation and this should be used as a bridge to definitive airway management in the ED.

Figure 1. Filtered Non-Rebreather

AEROSOL GENERATING PROCEDURES

Many of the interventions that are typically used for airway management, such as high flow nasal prongs, positive pressure ventilation with either CPAP or BiPAP, have the potential to aerosolize infectious particles and increase the risk of transmission to health care providers.

Any procedure with the potential to generate aerosolized pathogen should be undertaken only if there is a clear benefit and after appropriate PPE has been donned by all personnel. This is includes:

- N-95 or higher-level respirator
- Goggles or face-shield that covers the front and sides of face
- Fluid resistant gown
- Gloves

If the procedures are being undertaken in the ambulance and the vehicle's HVAC system contains an exhaust feature, it should be activated. If the vehicle's HVAC system is a fresh air fan only, it should be turned off to avoid pressurizing the patient compartment and circulating viral particles. The door/windows separating the patient compartment from the cab of the vehicle must be tightly closed.

Continuous Positive Airway Pressure
CPAP with a tight mask seal can be used with an inline viral filter if necessary. Use the lowest flow necessary to achieve target oxygen saturations. An inadequate seal will allow gas to leak around the edges of the mask severely reducing its effectiveness while also increasing exposure to the provider. In patients with predicted poor mask seal (beard, edentulous, distorted facial anatomy) CPAP should not be tried.

Bag Valve Mask with filter
In patients with spontaneous respiratory efforts who remain hypoxemic despite nasal cannula or fNRB, a standard cuffed-seal facemask with head-straps, a PEEP valve and filter system can be used.

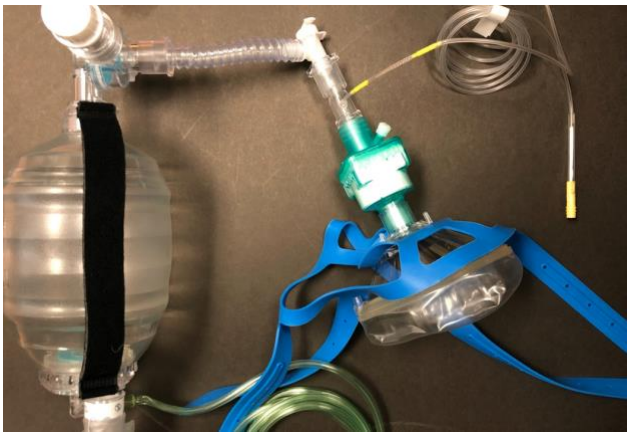


Figure 2 Cuffed-seal facemask with head-straps (SCFM) in line system with PEEP valve

A two-handed approach is ideal to achieve a tight seal. With a good seal, flow rates up 15 L/min can be given. Squeezing the bag to assist insufflations can increase potential risk to crew therefore initial BVM is to provide passive oxygenation enough to prevent respiratory arrest. If this doesn't improve saturations, nasal prongs can placed under the mask so long as this doesn't appear to disrupt the seal. Prior to

removing the mask from the patient's face for any reason, the provider should turn the flow rate to zero, in order to avoid aerosolizing particles on the mask. The flow rate would be turned back up once you have regained a good seal.

Patients with inadequate respiratory effort will require manual ventilation. As with respiratory arrest of any other cause, tidal volume should be just enough to produce chest rise and delivered steadily at the lowest pressure necessary. The rate should not exceed 10-12 breaths per minute. Overly aggressive ventilation is harmful to the patient and increases air leak around the mask.

As with fNRB, bag-mask ventilation is to bridge the patient to definitive airway management in the ED and should not be used for any longer than is necessary to prepare for intubation.

ADVANCED AIRWAY MANAGEMENT

The premise of airway management is to optimize oxygenation/ventilation while minimizing risk to personnel.

Intubation

Prehospital intubation of a patient with suspected droplet/airborne illness should be avoided if possible. Patients who are sick enough to require intubation will be hypoxic and will frequently desaturate profoundly with any manipulation of their airway. It is best that the first attempt be the only airway attempt and that this be done by the clinician with the most experience, with only minimal essential personnel present and by rapid sequence intubation. No attempts should be made with sedation-only or with patient awake. Using anything less than a rapid sequence intubation has a low likelihood of a success and will further complicate this already physiologically difficult intubation by having the patient coughing and exposing the paramedic to more harm.

The ideal place for managing this airway is in the ED in a negative pressure room, with minimal personnel in the room and with video-laryngoscope under rapid sequence intubation. Direct laryngoscopy places the clinician closer to the patient and at higher risk of inhalational exposure to aerosolized particles during the procedure.

Extraglottic devices

It is recognized that in the prehospital environment, outside of critical care transport, RSI and videolaryngoscopes will not be available. For the patient in respiratory arrest or who cannot protect their airway despite all other interventions, a supraglottic device can be considered. In this case, the airway shouldn't be manipulated prior to supraglottic device placement, i.e. usual awake intubation preparation such as lidocaine spray will put the provider at high risk of exposure.

OTHER CONSIDERATIONS

In some cases, hypoxic patients may become agitated or combative. It may be necessary to administer intra-muscular sedation with Midazolam to facilitate appropriate medical management, maintain the integrity of protective equipment and ensure the safety of providers.

Older patients and those with comorbidities are those most at risk of deteriorating due to respiratory infectious illness. It is important to consider other causes or contributing causes of illness.

TRANSFER OF CARE

The transfer of potentially infectious patients due to a droplet/airborne disease necessitates direct communication with the receiving facility. It is important to tell the receiving physician what interventions the patient has received, whether a filter has been applied, what the oxygen flow rates are and what their clinical course has been.

Follow trip destination protocol as directed by comms, usual trip destination protocol may change in the event of an outbreak or epidemic.

Once arrived at the receiving facility, do not disembark until the physician has confirmed it is safe to do so. If a filter is needed for the BVM / advanced airway, they can pass it to you via the window.

Once confirmed it is safe to disembark, i.e. hallways cleared and room is ready, only then should the ambulance doors be opened and the crew will proceed directly to the designated room. Do not stop at charge desk or any other space. Handover will be given from one member of the crew to the receiving physician in the room, the paramedic will leave the

6201.02: Droplet & Aerosol: Airway, Oxy, Vent

room with the stretcher and go to the appropriate area for cleaning the stretcher and doffing.

Doffing PPE:

It is worth emphasizing the importance of doffing as this is the time you are at greatest risk for self-contaminating. Always donn and doff in pairs so that the observer can spot any potential errors leading potential self-contamination.

AIRWAY MANAGEMENT DECISION PRINCIPLES FOR DROPLET OR AIRBORNE DISEASE

Compared to the usual respiratory distress patient, the patient with a potentially droplet/airborne spread disease poses significant risk to clinicians with any manipulation of the airway. A paradigm shift on many fronts is needed to adequately manage these patients while also protecting personnel.

1. Provider safety takes priority over the patient.
We must resist our usual tendency to run to the aid of a critically ill patient and instead ensure that we take the time to properly don personal protective equipment first.

2. Permissive hypoxia
While usually an unacceptable event, we must understand that these patients will be hypoxic. Our usual preoxygenation attempts will pose greater risk to provider safety and will be less successful than normal as patients are very likely to desaturate significantly during intubation.

3. Avoid aerosolizing interventions
Flow rates by nasal canula should be kept less than 6 L/min. Use metre-dose inhalers with spacer rather than nebulizers. Usual non-invasive treatments such as CPAP should only be done if a filter is available.

4. Rapid Sequence Intubation is advised.
An awake or sedation-only intubation has a lower chance of success for these patients and a potential risk to the provider as patients continue to cough and gag; aerosolizing virus in the process.

5. First attempt success is imperative.
If unsuccessful on first attempt, practitioners will likely face a patient who is rapidly desaturating and a situation in which any intervention to reoxygenate the patient has the potential to aerosolize virus particles. As such, the international recommendation is to use a videolaryngoscope for the first attempt.

CHARTING

Record in detail the factors considered when deciding on an airway strategy. Be sure to record the following accurately:

- Hypoxic events
- Airway interventions applied
- Supraglottic device placement
- If intubation attempted, how many attempts
- filtered NRB or filtered BVM
- Any potential breaks or difficulties in PPE
- challenges experienced during management.

Ensure the airway registry is completed in the ePCR.

KNOWLEDGE GAPS

The optimal airway management strategy in EMS remains in question. The specific patient population, device selection, provider training, and timing are the subjects of ongoing research.

For airway management in suspected droplet/airborne precautions, all recommendations made here are expert opinion. More research is needed both for ED and EMS providers. In the event of an outbreak or epidemic, the most appropriate airway strategy may change as the situation evolves and more is known transmission patterns.

QUALITY IMPROVEMENT

Management of the airway under droplet/airborne precautions in the setting of a pandemic/epidemic is an area in need of research. Information regarding transmission patterns may become available that leads to changes in PPE or recommended interventions. It is important to stay up to date with current leadership recommendations/updates as they become available.

REFERENCES

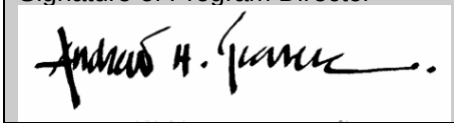
Kovacs, G., & Law, J.A. (2011). *Airway Management in Emergencies* (2nd ed.). Shelton, CT: People's Medical Publishing House–USA

http://www.gov.ns.ca/health/ehs/
https://www.cdc.gov/coronavirus/2019-ncov/hcp/guidance-for-ems.html
NOTES from George Kovacs and Nick Sowers
https://www.cdc.gov/hai/pdfs/ppe/PPE-Sequence.pdf
Transmission-based precautions:https://www.cdc.gov/infectioncontrol/guidelines/isolation/appendix/transmission-precautions.html

6201.02: Droplet & Aerosol: Airway, Oxy, Vent

Program Document Number Management System

PDN: 6201.02	**Title:** Airway & Ventilation: Droplet/Aerosol	**Type:** CPG
Effective Date: April 24 2020		**Revision Date:** May 11 2020
Approval Date: April 24 2020		**Revision Date:**
Review Date: April 24 2020		**Revision Date:**
Replaces: *New*		**Revision Date:**
Signature of Program Director 		Signature of Program Document Coordinator *Tanya Fraser* Electronically Signed

PDN: 6220.99.01.01	**Title:** TBD	**Type:** Field Guide
Effective Date: TBD		Revision Date:
Approval Date: TBD		Revision Date:
Review Date: TBD		Revision Date:
Replaces: new		Revision Date:
Signature of Program Director 		Signature of program Document Coordinator *Tanya Fraser* Electronically Signed