Intubation outside of the operating room: new challenges and opportunities in COVID-19 era

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Purpose of review

Airway management in patients outside the operating room is associated with increased difficulties and risks, and the setting of the COVID-19 global pandemic adds another layer of complexity. Therefore, endotracheal intubation (ETT) of a patient who is presumptive COVID-19 or COVID-19 positive presents an additional challenge to an anesthesiologist. The aim of this review is to summarize the important principles of airway management outside of the operating room during the COVID-19 pandemic.

Recent findings

Several professional societies have formulated guidelines on airway management COVID-19 suspect and proven patients. Additionally, anesthesiologists working in hospitals treating many infected patients have developed specialized teams responsible for airway management outside the operating room. These documents and protocols focus on the importance of wearing personal protective equipment and the skills of the providers responsible for securing the airway. Staff safety is always a priority when performing ETT outside operating room.

Summary

The COVID-19 pandemic redefined the management of patients requiring aerosol generating procedures (droplet and airborne precautions). ETT is one of them and anesthesiologists are experts in performing airway management. Although the operating room is a highly controlled environment, airway management outside of this setting is not always the easiest task.

Keywords

COVID-19, endotracheal intubation, personal protective equipment

INTRODUCTION

Severe acute respiratory syndrome-corona virus-2, which causes coronavirus disease 2019 (COVID-19), is highly contagious. COVID-19 virus is primarily transmitted by respiratory droplets and contact routes, although airborne routes may be possible, particularly when aerosol-generating procedures are performed [1^a,2]. Although symptomatic patients are more likely to pose a higher risk of transmission, asymptomatic patients may also be infective [3]. Hence, it is essential to treat all airway interventions as high-risk procedures.

Airway management in patients outside the operating room is associated with increased risks and the setting of the COVID-19 global pandemic adds another layer of complexity [4]. There are recently published reports on airway management in COVID-19 proven and suspect patients within the operating room which are applicable to the nonoperating room environment, however additional measures need to

be considered to reduce the risk of infection to health-care providers and to optimize patient safety [5^a,6^a].

As anesthesiologists, we are experts in airway management, therefore the current pandemic creates several new challenges and opportunities for our profession. The aim of this short review is to summarize the most important principles of airway management outside the operating room during the COVID-19 pandemic. These principles will apply to

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KEY POINTS

- ETT in patient infected with COVID-19 virus presents a unique challenge to an anesthesiologist.
- ETT in COVID-19 positive patient is a high-risk procedure where droplet and airborne precautions need to be taken.
- Personal protection takes a priority before embarking on this task.
- Special requirements for ETT of COVID-19 patients outside of the operating room have prompted many hospitals to create special, anesthesia-based teams responsible for airway management.

any situation when an anesthesiologist is engaged in the airway management of a patient with an infection which can spread by airborne or droplet transmission.

INFECTION PREVENTION: ENVIRONMENT

In the setting of a global viral pandemic, nonoperating room procedures should be limited to time-sensitive and/or urgent interventions. Procedures on COVID-19 suspect or proven patients should be performed in a negative airflow room or in a room with more than 12 air changes per hour to reduce dissemination of the virus outside the room. It may not be possible to modify existing nonoperating room locations into negative airflow areas. Consideration should be given to designating a separate room within the facility to be used only for these patients who require urgent procedures. Unnecessary equipment should be removed from the procedure room and there should be disinfection workflows set up for decontamination of surfaces and equipment left within the procedure room. Signs should be placed on the doors to alert other healthcare workers not to enter the room without personal protective equipment (PPE). An attached anteroom should be available as an area for equipment donning and doffing.

INFECTION CONTROL: PERSONAL PROTECTIVE EQUIPMENT

All personnel in the procedure room must use appropriate airborne/droplet PPE, including either a fitted N-95 respirator or powered air-purifying respirator (PAPR), gloves, fluid-resistant gown, eye protection, and head covering. Although PAPRs may confer higher protection to the wearer compared to the N-95 respirator and may be more

comfortable to wear, there is a higher risk of contamination with doffing and cleaning of PAPR, and communication while using PAPR can be difficult [7[¶]]. It is recommended to use checklists and a 'buddy system' where an observer not involved in the procedure helps to ensure correct donning and doffing procedure is followed. Quite commonly, doffing of PPE is the moment where medical personnel are at risk of getting infected. Staff safety is of paramount importance and sometimes takes priority over urgency. Reports from countries which were severely affected during the pandemic showed that among physicians who were commonly infected while working on the frontline are anesthesiologists, ENT specialists, and emergency physicians. It clearly indicates that proximity to patient's airway without proper PPE is a major risk factor of being infected with COVID-19.

INFECTION CONTROL: REDUCING AEROSOL GENERATING PROCEDURES

Aerosol generating procedures should be reduced as far as possible. Procedures such as bronchoscopy, upper gastrointestinal tract endoscopy, and transesophageal echocardiography can generate viral aerosols, but the focus is on airway management [8]. Noninvasive positive pressure ventilation and high flow nasal oxygenation should be avoided to reduce the risk of aerosolization. Adequate preoxygenation and rapid sequence induction should be done to avoid the need for bag-mask ventilation. Tracheal intubation is preferred over use of a supraglottic airway device because of the better seal. Adequate sedation/anesthesia and muscle relaxant should be administered prior to laryngoscopy to reduce the risk of patient coughing. The most skilled practitioner should manage the airway to maximize first pass success. Use of video laryngoscopy should be considered to increase the distance between the operator and the patient's face. After intubation, disconnections between the patient and the ventilator circuit should be avoided. A high efficiency particulate air (HEPA) filter should be placed at the patient end of the ventilator circuit and the expiratory limb.

DEVELOPMENT OF AN EMERGENCY RESPONSE INTUBATION TEAM

Anesthesiologists are arguably the most adept at managing the airway. By forming an Emergency Response Intubation Team (ERIT) to be involved in all hospital intubations, including those in the emergency room and the intensive care unit, the goal is to reduce the risk of exposure of all healthcare

team members by improving the likelihood of successful intubation on the first attempt.

The ERIT is designed to be self-sufficient and involve the smallest number of staff necessary, so that it can perform its role at any location and with minimal assistance. It consists of a staff anesthesiologist, an anesthesia assistant, and a nurse. The anesthesia assistant prepares the airway equipment, injects the induction medications, and is the runner to get our emergency airway equipment as needed. The nurse in the room ensures that monitors are attached, suction is available, and assists with the intubation. A second ERIT nurse stays outside the room to pass in equipment as needed and to assist with donning and doffing. The roles of each team member are outlined in our ERIT intubation checklist.

Principles of airway management

Preparation

Preparation of a tracheal intubation pack that can be taken to the patient and decontaminated after use. Team members should be familiar with their roles and use of PPE. All equipment is stored in appropriate boxes. Our ERIT (Toronto General Hospital) is equipped with four boxes. Box number one contains all basic airway equipment including bag-valve-mask ventilation unit, laryngoscope, set of tracheal tubes, PEEP valve, CO₂ detector, and clamp for tracheal tube. Box number two consist of additional airway equipment including bronchoscope, supra-glottic airway, additional airway filters, and a set to perform front of the neck access (FONA). Box number three is designated to facilitate additional intravenous access, arterial access, and central venous access if needed. Finally, box number four contains all elements of PPE including gowns, shields, goggles, long gloves, and all necessary sanitizing solutions. Each member of the team secures his/her own N-95 mask. The anesthesiologist is responsible for medications used during intubation.

Avoid aerosol-generating procedures where possible

Patient positioning with a modified sitting position of 20–30 degrees of head elevation can improve preoxygenation effectiveness and increase the time to desaturation. Consider rapid sequence intubation with preoxygenation to minimize apnea time, avoid manual ventilation and minimize respiratory aerosolization. If manual ventilation is required, maintain a good mask seal with a firm two-handed V-E grip and use small tidal volumes. A HEPA filter or a heat and moisture exchanger filter should be placed between the mask and the bag-mask-valve unit.

Drugs

As a result of hypoxia and hypercarbia, these patients may have elevated pulmonary artery pressures and some degree of right ventricular dysfunction. Combined with the loss of sympathetic drive at induction of anesthesia, patients may decompensate and require preinduction or immediate inotropic or vasopressor support. In this setting, and for the sake of simplicity, the use of ketamine as the sole induction agent is often recommended. High dose rocuronium (100 mg for patients <100 kg; 150 mg for patients >100 kg) is preferred to succinylcholine to ensure patients do not cough if intubation takes longer than predicted. The onset of medication effect can be prolonged in critically ill patients and sufficient time should be allowed for the drugs to work (e.g. assigning a team member to start a timer countdown).

Stick to established methods

Laryngoscopy should be done by the most experienced operator, and by using the device most likely to achieve first pass success in tracheal intubation. In most cases, the video laryngoscope is likely to be the choice as many anesthesiologists are familiar with its use. The video laryngoscope also maximizes the distance between the patient and the operator's face. Where practical, single-use laryngoscope blades should be used.

Intubation

Start mechanical ventilation only after cuff inflation to a measured cuff pressure of 20–30 cmH₂O and ensure that there is no leak after tracheal intubation. Confirm tracheal intubation with capnography or capnometry. Confirming depth of insertion may be difficult over the noise generated by PAPR so watch for equal bilateral chest expansion and obtain imaging (chest x-ray or lung ultrasound) when feasible. Clamp the tracheal tube and stop the oxygen flow before any circuit disconnections subsequently. Suctioning of the tracheal tube should be done through a closed suctioning system.

Failure to intubate

If the videolaryngoscopy intubation attempt fails, with limited reserve, the patient will desaturate quickly. Gentle bag mask ventilation or ventilation through a supraglottic airway device may be necessary to temporize the situation. A second attempt at videolaryngoscopy is reasonable, but immediate transition to a backup method of securing the airway must be considered. As an alternative, backup airway Box #2 also contains an #4 iGel, a portable bronchoscope that can easily be connected to our videolaryngoscope screen, and a 7.5 ETT. Placement

of the iGel may help stabilize patient oxygenation. In addition, with the 7.5 ETT loaded on the bronchoscope, the ETT can be advanced through the iGel and into the trachea with visualization. In cannot intubate, cannot ventilate situations, prompt consideration to emergent front of the neck access (FONA) is essential as it is recommended in current guidelines.

Extubation

The focus is again on minimizing aerosol generation and on the use of appropriate PPE. Use of drugs such as lidocaine or opioids to reduce coughing at extubation is unproven. Staged extubation to noninvasive ventilation or high-flow nasal oxygenation is not desirable because of the risk of aerosolization. After extubation, ensure that the patient wears a face mask over their oxygen mask/nasal cannulae if feasible.

Decontamination

Decontamination of PAPR and surfaces should be done as per hospital protocol. Staff should shower and change into a new set of scrubs.

Documentation

Names of all participating healthcare workers should be recorded to facilitate contact tracing.

Code blue team

The COVID-19 pandemic redefined how Code Blue Teams responsible for in-hospital management of cardiac arrest patients function. Currently, the majority of patients who suffer from in-hospital cardiac or respiratory arrest are treated as COVID-19 positive or presumptive COVID-19 positive patients. Therefore, aforementioned principles of airway management also apply to this population. Usually in the case of cardiac arrest there are significant time constraints in the context of donning PPE; however, staff safety should be the top priority without any exceptions.

CONCLUSION

The COVID-19 pandemic redefined the management of patients requiring aerosol-generating procedures. ETT is one of them and anesthesiologists are experts in performing airway management. Since the highest viral load of SARS-CoV-2 is seen in airway secretions, performing quick and smooth intubation is of paramount importance in order to minimize exposure and the risk of infection within hospital setting. Although the operating room is a

highly controlled environment, airway management outside of this setting is not always the easiest task. Thus, the COVID-19 pandemic has created new challenges and opportunities for our specialty. This brief summary describes principles of the ETT outside of the operating theatre in the context of COVID-19 pandemic.

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Conflicts of interest

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