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Review

Airway Management

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Tracheostomy in Patients with Coronavirus Disease 2019: An Overview

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Abstract

As the coronavirus disease 2019 (COVID-19) pandemic is gripping the entire world, many patients are mainly presenting with respiratory problems and subsequently require intubation and mechanical ventilation in severe cases. The need to perform tracheostomy may arise, and the intensivist, anaesthetist, and other surgical specialties may be asked to perform a tracheostomy in known COVID-19 or suspected patients. Surgeons should be prepared for this eventuality while performing the procedures, taking all the measures to keep themselves and their team members safe from the undue risk of infection and exposure. This is a brief review of all the evidence present, till now, for those who will be performing tracheostomy in such patients.

Keywords: Coronavirus disease 2019, decannulation, percutaneous tracheostomy, tracheostomy, tracheostomy care

Introduction

The recent outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the associated coronavirus disease 2019 (COVID-19) has led to a global pandemic and a significant health crisis. Since its beginning in late December in Wuhan, China, it has infected more than 575,444 people throughout the world, causing an estimate of 99,500 deaths, with Italy recording the highest death toll. This can be attributed to the high virulence via aerosols transmission and now suggested asymptomatic transmission. This can lead to far-reaching effects with the extent of spread outnumbering that of SARS.

Although the recent trend suggests a lower mortality rate in COVID-19 (2.3%) compared with that of SARS (11%), a notable fraction of COVID-19–infected people require invasive mechanical ventilation.[1] This has led to overwhelmed intensive care units (ICU) in many countries. Patients may require prolonged ventilation in view of severe respiratory involvement, leading to acute respiratory distress syndrome and thus respiratory failure. Such patients may require tracheostomy to optimize weaning from the ventilatory support.

During the SARS outbreak, open tracheostomy was the most common surgical procedure performed on infected patients. The benefits of performing early tracheostomy in critically ill patients with COVID-19 are still unclear, and data are limited. The need for mechanical ventilation in SARS-1, which is a similar virus to SARS-CoV, was associated with a 46% mortality rate.[2]

As an aerosol-generating procedure, the chance of increasing the viral load to the health care professional is high with tracheostomy. Therefore, minimising the risk of nosocomial outbreak of COVID-19 to other health care teams and patients is crucial while performing the procedure.[3]

Recently, few guidelines were released for tracheostomy procedures in patients with COVID-19. In this challenging time, there is a lot of confusion and misinformation regarding the management of patients. Considering that there may be a rise in tracheostomies, we wish to elaborate on the methodology to conduct tracheostomies in patients with

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COVID-19. Therefore, a review is required to understand the correct methodology and analyse the emerging evidence, so that the correct procedure is followed.

Planning

Airway management involves good planning in preventing any untoward incidents. The outbreak of COVID-19 has led to a high rate of infection amongst health care workers despite the strong preventive measures adopted. Tracheostomy surgery is a high aerosol-generating procedure; indeed, the risks are higher for both surgeon and anaesthetist. Therefore, definitive planning is required to minimise the risk of exposure and infection in view of the severity of the COVID-19 pandemic. The planning includes the decision of performing tracheostomy and forming a core airway team till decannulation is done. Various measures required have been elaborated with separate headings.

Personal Protective Equipment

It needs to be emphasized that barrier precautions are of critical importance in managing patients with COVID-19. The risk of exposure to COVID-19 during the procedure is very high because of direct access to the airway and mechanical ventilation, which generates a large number of droplets. This will be increased exponentially in case an air leakage from the cuff occurs.[4, 5]

Standard personal protective equipment (PPE) is essential, and level 3 protection is required. This comprises the N95 mask, surgical cap, goggles, impermeable surgical gown, shoe cover, gloves, and full head hood.[6] Of the published cases of tracheostomies performed in Singapore, Hong Kong, and Canada during the SARS outbreak, in addition to standard PPE, all 5 health care institutions further used enhanced PPE measures ranging from face shields to powered air-purifying respirators (PAPRs).[7-10] The effectiveness of these PPE measures was validated, as all members of the surgical teams remained healthy after performing tracheostomies across institutions.

Main Points:

- Tracheostomy is play vital role in patients who requires long term ventilator support.
- The technique of tracheostomy needs to be modified in the ongoing COVID-19 times to minimise aerosol generation and ensure adequate protection of health care workers.
- Tracheostomy should be considered in patients with stable respiratory conditions but should not be considered in less than 2-3 weeks from intubation and, preferably, with negative COVID-19 status.
- If tracheostomy is needed in a COVID-19 positive patient, emphasis needs to be laid on personal protective equipment, use of muscle relaxation and minimising disconnections of the ventilator circuit.

It is important to note that the donning and doffing of PPE are sequential processes requiring proper training, because improper removal may result in operator contamination. In our institute, these processes are closely supervised by dedicated infection control nursing staff.

Why a COVID-19 Airway Team?

First, the experience of the team is clearly of value to perform tracheostomies efficiently and meticulously and to avoid excess aerosolization. Second, it will minimise the time spent in the contaminated room. Having a dedicated, experienced team consisting of a surgeon, an anaesthetist or intensivist and a scrub nurse to perform tracheostomies will allow familiarity and minimise setup time. Pre-planned communication should be established within the room and with others because conversing through PPE and PAPRs can be extremely difficult. Moreover, certain non-verbal communication such as hand movements and signs can also be developed amongst the closed group.[11]

Indication and When to Perform?

Studies from China have shown that most of the patients who become critically ill with COVID-19 rapidly develop severe pneumonia, leading to acute respiratory distress syndrome, respiratory failure and death. The benefits of performing early tracheostomy in critically ill patients with COVID-19 are still unclear, and data are limited. The need for mechanical ventilation in SARS-1, which is a similar virus to SARS-CoV, was associated with a 46% mortality rate.[2]

Where to Perform?

Tracheostomies in the ICU are bedside procedures and should be well planned and rehearsed. Specific issues may include limited space in the ICU room, suboptimal positioning of the patient, and the movement of essential equipment and to surgical instruments. The advantage, however, is limited transport of the patient. We suggest that keeping all necessary equipment for tracheostomy in a single sterile pack greatly simplifies the procedure in the ICU itself.[12]

If the tracheostomy is planned in the operating room (OR), it should ideally be performed in negative-pressure ORs in well-demarcated areas within the OR complex with dedicated routes for patient transport.[13] The reorganization of the OR should be done, which is effectively described in the article by Chee et al.[7]

Minimising the Aerosols

The time of exposure to aerosolized secretions intraoperatively should be minimised. This may be achieved by complete paralysis of the patient throughout the procedure to prevent coughing, stopping mechanical ventilation just before entering into the trachea via tracheostomy and reducing the

use of suction during the procedure. If suction is used, this should be within a closed system with a viral filter.

Equipment

The tracheostomy tube used in patients with COVID-19 should be cuffed non-fenestrated tubes. A tracheostomy bag should be prepared and kept ready at all times. Tracheostomy tube of appropriate sizes, tracheostomy set, heat moisture exchanger (HME) with viral filter and catheter mount should be checked.[14] The post-procedure waste disposal and decontamination of equipment need careful consideration to minimise contamination of the environment. Whenever possible, disposable equipment should be used. Personnel handling the decontamination of surgical equipment should also be appropriately protected in standard PPE.

Percutaneous Versus Open Tracheostomy

It should be emphasized that percutaneous tracheostomy (PCT) involves more extensive airway manipulation such as bronchoscopy and/or serial dilations during entry into the trachea. Patients with high ventilatory settings may also require repeated connection and disconnection from the ventilatory circuit. These factors may cause increased aerosolization compared with open tracheostomy, in which entry into the trachea is performed quickly with an incision and aerosolization risks can be mitigated as mentioned previously.

Therefore, open tracheostomies were preferred over PCT during the SARS outbreak.[7, 9] It should be noted that techniques for PCT have progressed since then. However, the various protocols of safety and PPE requirements for PCT in an infected, aerosolized setting have yet to be established in the literature. Takhar et al.[15] have advocated the safe use of PCT in patients with COVID-19 with careful modifications to technique and appropriate enhanced PPE.

Steps for Tracheostomies

Here, we are not going to discuss the details of surgical steps for tracheostomy but rather will be highlighting the points that will be helpful in minimising aerosolization and the risk of infection.[16-18]

Step 1. Positioning: The patient should be placed in a supine position with the neck in a hyperextended position and a roll under the shoulders covered by the drape. The patient needs to be paralyzed using adequate neuromuscular drugs to avoid any swallowing and cough reflexes before positioning.

Step 2. Once the anterior wall of the trachea is exposed by the surgeon, oxygenation may be achieved with positive end-expiratory pressure (PEEP). Ventilation should then be stopped with the flows turned off. Passive expiration should be allowed with adjustable pressure-limiting (APL) valve open.

Step 3. Endotracheal tube (ETT) should be clamped, and the cuff should be advanced beyond the proposed tracheal window. The cuff should be hyperinflated, and oxygenation should be re-established with PEEP.

Steps 4. There should be clear communication with the otolaryngologist when the patient is adequately oxygenated. Before opening the trachea, ventilation should be ceased.

Step 5. Tracheal window is created, taking care to avoid the ETT cuff damage. The flows are turned off with an open APL valve and allow the passive expiration with the ETT being clamped again.

Step 6. After the tracheal window is created, the ETT cuff is deflated, and ETT is drawn back proximal to the tracheal window under direct vision.

Step 7. The window should be of sufficient size to allow easy insertion of the tracheostomy tube without injury to the cuff. A cuffed fenestrated tracheal tube (TT) is inserted, and the cuff is inflated immediately. The introducer is immediately removed, and the tube is connected with the circuit and HME. The tube position should be confirmed with end-tidal carbon dioxide only. Stethoscopes should not be used to avoid contamination and will be difficult to use after donning. The clamped ETT is removed.

Step 8. The TT should be secured with sutures, and tapes should be applied with proper dressing of that area.

Vargas et al.[19] have recommended the use of double-lumen endotracheal tube (DLET) for safer tracheostomy in patients with COVID-19. The rationale behind using DLET is that the endotracheal tube and the tracheal cannula can be simultaneously inserted inside the trachea. The ETT can be pushed down beyond the site of TT insertion, which may avoid the spread of aerosol and add extra security for the medical staff. However, the availability and familiarity with DLET are a limiting factor for this practice.

Tracheostomy Care

The dressing should not be changed, unless there are frank signs of infection. Only closed suction connections should be used. The cuff pressure should be checked periodically, and it should not be deflated without considering the risks to the patient, staff and the environment. The first tube change should be delayed to 7-10 days, and whenever it should be done, it should be done with full PPE. For this, the same sequence of pauses in ventilation, with the flow off before deflating the cuff and inserting a new tube with immediate reinflation of the cuff and reconnection of the

circuit, should be done. The previously mentioned technique can be performed in patients on a ventilator in ICU. But if patients in ward and on spontaneous breathing, the change of TT can wait till the COVID-19 test result comes negative.[20]

Decannulation

If the COVID-19 test result comes negative and the patient has been shifted to the COVID-19 negative ward, then a trial of cuff deflation should be considered. Readiness for decannulation depends on various factors, and it is at the discretion of the treating physician and the patient's medical condition.

Key Messages

- The hospital staff should adhere to the strict donning and doffing steps, which may be based on the local hospital protocol or as advised by the World Health Organization. This is the first and foremost important message.
- Decision of tracheostomy will depend on the patient's condition, at the discretion of the ICU team, the surgical team involved and the hospital policy.
- Tracheostomy should be avoided in COVID-19–positive or suspected patients during periods of respiratory instability or very high ventilatory requirement.
- It should be considered in patients with stable respiratory conditions but should not be considered in less than 2-3 weeks from intubation and, preferably, with negative COVID-19 status.
- The number of providers performing the tracheostomy procedure and its post-procedure management should be restricted.
- Tracheostomy procedures should be performed under adequate muscular relaxation.
- Monopolar electrocautery use should be avoided, and cold instrumentation should be preferred.
- Advance the ETT and cuff safely below the intended tracheotomy site and hold ventilation while incising the trachea.
- Tracheal suctioning should be minimised during the procedure to decrease the aerosolization.
- A cuffed, non-fenestrated tracheostomy tube should be chosen.
- Appropriate cuff pressure and inflation should be maintained post-operatively and any further cuff leaks should be avoided.
- Circuit disconnections and closed suctioning should be avoided.
- An HME should be attached with a high-efficiency particulate air (HEPA) filter at the tracheostomy end once the tracheostomy tube is disconnected from ventilators.
- Routine postoperative tracheostomy tube changes should be delayed until the COVID-19 negative report.

Conclusion

The present COVID-19 infection has put forth a huge challenge to the global medical fraternity. For health care professionals who had experienced the SARS epidemic, memories of the fear of contracting SARS still linger, in addition to the recollections of infection control precautions implemented then. Yet, the key principles remain the same and have evolved little. The meticulous team-based approach amongst the stakeholders and strict adherence to the barrier precautions remain the same. As the COVID-19 pandemic further escalates, so will the requirement for tracheostomies in patients with prolonged ventilation. Therefore, it is crucial that COVID-19 airway teams are well prepared and ready to act when called upon.

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