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Use of Tracheostomy in COVID-19 Patients and it's Effects on Healthcare Workers

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Tracheostomy in COVID-19 patients needs important decision making and surgical planning, especially since it's an aerosol-generating procedure and poses a threat to the health care personnel involved. Various public health agencies have recognized that some particular health care procedures considerably increase the risk of transmission of respiratory pathogens because they produce aerosols.

Severe infection with SARS-CoV-2 [COVID-19] causes respiratory illness resulting in Acute Respiratory Distress Syndrome (ARDS) and respiratory failure that put patients in need of intrusive mechanical ventilation. Because it is linked to longer use of sedatives, narcotics, muscle palsy leading to a longing desire for invasive central catheters, and the patient's stationary position inflicting line infection and pressure injuries to the skin, prolonged invasive mechanical ventilation usually results in ventilator-associated pneumonia and other complications.

If patients are projected to be ventilator-dependent for a lengthy period of time, surgical treatment is considered once every 7–10 days for automatically ventilated patients. However, due to the risk faced by the health care workers, it has been recommended by organizations such as WHO, that health personnel must take appropriate measures so as to minimize the risk of contracting the deadly virus. This includes wearing personal protective equipment [PPE] while performing the

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procedure. An N-95[or above] face mask, face shield, latex gloves, full-body disposable cover, foot covers are some of the contents of personal protective equipment [PPE].
Our goal is to provide authoritative guidance to healthcare providers and healthcare systems and to highlight the possible effects of the accumulating experiences, currently available evidence, and historical lessons, tracheostomy decisions during the current COVID19 epidemic. Because incubated patients have a poor prognosis and there is a danger of transfer to providers through this highly aerosolizing procedure, the pathway of tracheostomy placement has changed.

Keywords: Tracheostomy; COVID-19; aerosol-generating procedure; healthcare workers; coronavirus.

1. INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2] has once again brought concern demanding attention to detail as to what exactly is an aerosol generating procedure [1]. As described by the WHO, tracheostomy comes under aerosol-generating procedures and therefore poses a great amount of threat to health care workers. The coronavirus outbreak has led to an increase in the number of critically sick patients in need of mechanical ventilation [2]. The SARS-CoV-2 has a greater infectivity and transfer rate than the associated viruses that cause SARS and Middle East respiratory syndrome. SARS-CoV-2 has spread across the globe, more rapidly than these other infections, resulting in a global death toll of hundreds of thousands of people. Hospitals are overburdened, forcing medical personnel to make difficult judgments about the care of critically ill patients.

In terms of the timing of tracheotomy, the lack of data to guide decision-making is the most evident feature in treating patients affected with the coronavirus. Although comprehensive community-based initiatives to mitigate COVID-19's impact on the general population are a primary concern, tracheostomy is one of several key clinical considerations for the best care of critically sick patients during the pandemic.

Aerosols are small, light respiratory particles that may float in the air for a long period, and can spread out more than 6 feet from the infected person, and pierce or navigate past surgical masks. This is why healthcare personnel is being advised to wear personal protective equipment (PPE) during all such procedures including, but not limited to tracheostomy.

We give realistic advice and ideas based on worldwide and interdisciplinary expert perspectives due to the urgent need for counselling and the dearth of trustworthy data on outcomes in the critical care unit.

Due to a paucity of data, the incidence and timing of tracheostomy, as well as its influence on survival, remains uncertain among COVID patients, hindering decision-making.

The COVID-19 pandemic has brought about an unheard-of boom within the range of sufferers who're significantly sick and require mechanical ventilation.

2. MATERIALS AND METHODOLOGY

In this article we have gathered literature on Tracheostomy in Covid from Lancet, PubMed, PMC, Jama network, Google scholar and AIIMS, while searching various databases. Keywords and phrases such as: Tracheostomy in Covid, Aerosol generating procedures, Precautions in Covid, Coronavirus etc. were used on a variety of platforms. An important source of information was also the list of relevant articles. No attempt was made to find unpublished data.

3. INDICATIONS OF TRACHEOSTOMY

In COVID-19 patients who require prolonged respiratory support, tracheostomy is one of the most important medical problems to address. However, there is a great deal of debate about the appropriateness and timing of tracheostomy in today's epidemic. For severely ill patients needing long-term artificial ventilation, a tracheostomy is a routine surgery. A tracheostomy tube can help in reducing airway dead space, weaning off respiratory assistance, airway suctioning, and perhaps lowering the risk of pneumonia that is related to ventilators.

4. TIMING

When to conduct a tracheostomy in COVID19 patients has been mentioned in several recommendations and guidelines, however the timing varies depending on the literature.

After 7–10 days, tracheostomy may be considered if mechanically ventilated patients are

expected to be ventilator-dependent for an extended period of time. Most hospitals only contemplate tracheostomy after a patient has tested negative for the virus since it generates a high aerosol risk of viral transmission.

According to UK and North American standards, a tracheostomy can be postponed for a minimum of 14 days following endotracheal intubation to permit us to gather information about the likely course of the further management of the disease to come to light and virus load to sufficiently subside. French regulations, on the other hand, recommended an increased, proactive approach, proposing tracheostomy at the early stage to gradually remove patients from intubation and relocate them to a different weaning space, so freeing up beds in the ICU for future patients [1].

The above suggestions are based on the opinion of the expert, and to establish a high level of proof, substantial data on ICU outcomes is necessary. At this moment, there isn't a lot of information about COVID-19 patients' tracheostomy results.

5. EMERGING DATA ON COVID-19

During the SARS outbreak in 2003, a study was conducted comparing those who performed the aerosol-producing procedure with those who did not. It found out that those who did the procedures of intubation and tracheostomy were at a high risk of developing the coronavirus disease, while the ones who did not assist while doing a tracheostomy were at lower risk [2]. For patients with intubation who were previously found to have had non-invasive and manual ventilation. There are few data on the infectivity of SARSCoV2, but infections and deaths have been reported among healthcare professionals.

The average incubation period of Covid-19 is approximately 7 days [range 4-14 days]. As revealed by the polymerase chain reaction of viral RNA collected from the mucosal lining of the samples of the URT, SARS-CoV-2 is most frequent during the beginning of symptoms. A lengthy swab stick is used to collect samples from the nasal and/or oropharyngeal mucosa. The viral load normally declines in the 3-4 days following the beginning of symptoms. The LRT sample remained positive for covid-19 even after the URT sample was negative for approximately 39 days. The RNA load of the virus is substantially higher in individuals with severe disease and diminishes more gradually compared to patients with a mild illness.

The antiviral antibody is normally found in URT & LRT secretions and blood approximately 7 days after the beginning of symptoms and is discovered in 90% of patients about 12 days after the onset of symptoms. The presence of the antibody reduces the detected virus's infectivity. The existence of detectable viral RNA by PCR [also known as viral shedding] does not always imply infectivity, particularly when antiviral antibodies are present. Only evidence gathered from clinical or epidemiological data, as well as intracellular virus growth in vitro, may prove actual infectivity.

The sample from the pharynx showed that the RNA of the virus reached the peak of its multiplication on the 4^{th} day in the 1^{st} week of symptoms after the throat swab was taken and stayed that way for the entire duration of the disease [2]. Despite having a high viral RNA content in feces, the infective virus was discovered in the throat and lungs but not in stools when samples were cultured. The coronavirus was not detected in blood or urine samples.

6. TRACHEOSTOMY AND THE CORONA-VIRUS PANDEMIC

Apart from the context of the SARS-CoV-2 pandemic, there is quite a lot of debate around the timings of tracheostomy. The majority of the tracheostomies are performed on an individual case basis, however, there are several guidelines for early tracheostomy in selective cases such as near-fatal brain injury and trauma-related injuries [2].

Extended period of laryngeal intubation, sedation, mechanical breathing, and stay in the ICU, all of which are associated with tracheostomy delays, may reduce the risks for healthcare staff. However, difficulties may arise as a result of such delays.

Healthcare personnel is required to take special care while performing the procedure to avoid contracting the highly infectious virus.

7. SELECTING PATIENTS

First and foremost, we evaluate tracheostomy's significance in severe illnesses and respiratory failure. A tracheostomy is required in around 8-13 percent of patients shifted to ICUs who need artificial respiratory support [3]. Facilitation of mechanical ventilation for a prolonged duration

all the while reducing complications from endotracheal intubation and weaning from ventilation to a minimum is the most important indication of tracheostomy. It may also be needed for threatened or actual obstruction of the respiratory tract, laryngeal edema (this may be a potential characteristic of COVID-19) [4] or failure to extubate because of weakness, fatigue, cough, prolonged secretions, or a combination of all of these causes. Tracheostomy in Covid-19 and its decision making is mostly based on standard guidelines of practice, because of lack of evidence regarding the procedure in critical illnesses. Out of the non-Covid patients in need of tracheostomy after a prolonged period of artificial ventilation, around 50% do not survive for more than a year, and after 1 year less than 12% of patients live a comfortable and independent life [5]. Similarly, while tracheostomy may or may not be useful in Covid patients, the operation and subsequent critical care of the patient puts medical staff at elevated risk of SARS-CoV-2 infection. Tracheostomy is frequently followed by long-term functional reliance, and rehab must be conveyed to the patient and family. These decisions can be more important in overloaded healthcare systems, where there are few resources to care for severely ill, recovering, or highly dependent patients. The decision makers have to consider various factors such as healthcare resources, shortage of staff, medications, equipment and facilities, before sending a patient for the procedure. An independent triage or ethical board can help with decision-making, communication with patients and their families, and easing the pressure on frontline health care workers [6].

8. TRANSMISSION RISK

There are 4 major factors affecting transmission in medical procedures.

A) Forced Air- Forceful expiration over respiratory mucosa produces virus-laden respiratory particles. Non-invasive positive pressure ventilation, cardiopulmonary resuscitation, heavy breathing, coughing and spirometry are therefore considered aerosol-generating procedures and carry risk of infection.
B) Symptoms & Severity of disease- Those with infection have high burden of virus and it is more likely that they will spread the infection to others via coughing, sneezing or heavy breathing. Relatives of such symptomatic patients are 10-20 times more prone to acquire the infection than patients who are asymptomatic [7].
C) Distance- Emissions from the respiratory system are the densest near the source. As the distance increases, more time and space are taken by the particles to diffuse into the surrounding environment. This reduces the chances of infection contraction significantly. It has been confirmed by several case-control studies and helps is to describe why long-distance SARS-CoV-2 transmissions are uncommon in well-aerated spaces [8,9-12].
D) Duration- The longer someone is exposed to aerosols, the more likely they are to get an illness. case-control studies of illnesses among healthcare professionals have unearthed, epidemiological studies of train passenger transmission rates, and when paired with closeness, it helps us to clarify why the rate of transfer is so high in homes [9,10].

9. PROCEDURE

The patient is paralyzed using a muscle relaxant and is put into an extension position. The site, where the incision is to be given, is cleaned properly with povidone-iodine solution. 2% lignocaine with adrenaline [to reduce bleeding] is given locally as anesthesia. A vertical incision is preferred for rapid access and minimal bleeding; diathermy is avoided. Trachea is identified after layer-by-layer dissection, by aspiration of air in a syringe filled with saline.

On tracheal incision, a few 4% lignocaine drops are used to suppress cough. A circular opening is created between 2^{nd}-3^{rd} or 3^{rd}-4^{th} tracheal rings. An appropriate-sized endotracheal tube is placed and taped in place. To avoid subcutaneous emphysema, the skin incision should not be sutured or packed firmly. The stoma is surrounded by a gauze bandage [11].

10. PRECAUTIONS TO BE TAKEN

With appropriate information on the elements that contribute to increased transmission risk, hospitals and health care personnel should be able to make more informed decisions about respiratory protection and negative airflow rooms [12]. The surgical crew faces an elevated infectious risk, just like with any AGP, due to inhalational virus particles that can spread for up to three hours, if not longer. The staff that

conducts examinations, suctioning, dressing changes, and other post-tracheotomy care is also at a higher risk of viral infection [13]. It is advised to avoid the procedure of tracheostomy when the patients' breathing is unstable or when he has increased chances of becoming dependent on artificial respiration.

In environments with low SARS-CoV-2 frequency, surgical masks alone are likely sufficient for controlled procedures in asymptomatic patients [12]. However, for health professionals working in high-prevalence situations who must be near to patients' respiratory tracts while substantial quantities of air are blown over the respiratory mucosa, higher-level respiratory protection may be required. For example, during positive pressure ventilation, tracheostomy, spirometry, heavy-breathing, coughing, high flow oxygen requires the health care workers to wear a N-95 mask at the least [12].

During the SARS-1 outbreak, the use of personal protective equipment (PPE) [1] was demonstrated to reduce the incidence of infection in healthcare professionals. Being a high-risk aerosol-generating procedure, tracheostomy requires certain precautions, especially in times of the SARS-CoV-2 pandemic. Tracheostomy operations should be performed by qualified workers in rooms that have a pressure that is negative or in ICUs with a high-efficiency particle air filter, with time-outs and checklists if resources allow [14]. A N95 mask, powered air-purifying respirator, or equivalent [filtering facepiece 3 (FFP3)] should be used by nurses and anyone else participating in the process. with or without a surgical mask and face shield that has been fit-tested [14].

Fig. 1. An image showing some basic components of a PPE kit

Standard personal protective equipment includes [14]:

- N-95 or FFP3 mask
- Surgical mask
- Respirator
- Gloves
- Goggle
- Face shield
- Gown
- Shoe and Headcovers

For quality assurance, a skilled health care practitioner should monitor donning and doffing [14]. The number of health care professionals involved in the tracheotomy process and post-procedure supervision should always be reduced to a minimum [13,15]. This strategy avoids more personnel at risk of getting infected with the coronavirus [16-23].

11. CONCLUSION

The times of the coronavirus pandemic require a slightly different approach regarding the procedure of tracheostomy. Appropriate measures are to be taken at all times by all medical health professionals to avoid the spread of this deadly virus. The particulate matter generated in a tracheostomy procedure can only be steered clear of when the right guidelines are followed. We cannot afford to lose any more of our health personnel to this viral illness as it can certainly be evaded.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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