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ORIGINAL ARTICLE

Impact of Covid-19 on Emergency Airway Management

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ABSTRACT

Background: The main and serious problem associated with COVID19 is pneumonia and the sequelae acute respiratory distress syndrome. For this, airway management and respiratory care is of prime importance especially as an emergency COVID-19 disease care protocol. There are various emergency airway modalities that are available for such patients. Objectives : The aim of this review was to determine the benefits and drawbacks of the various airway management methods that have surfaced as game changers in COVID19 respiratory distress.

Methodology: A thorough search was conducted across several databases, using mesh keywords and the boolean algorithm,. After removing duplicates, relevant literature was chosen, and studies were chosen for a qualitative review based on the available research on the issue. Results : It was observed that in mild to severe situations, HFNC improves oxygen saturation, but it cannot be used as the primary dependent modality. If fully achieved, awake proning is linked to better oxygenation and lower mortality. Although invasive ventilation saves lives, weaning is difficult, and significant mortality is seen in the elderly and those with comorbidities.

Conclusion: It is concluded that the type of respiratory distress, age, resources available in the setting, ability of the person in charge, and comorbidities be considered when choosing an emergency airway management therapy/modality. The efficacy of the modalities utilised in emergency airway care and acute respiratory distress due to COVID19 Pneumonia can be better explained by a complete and exclusive systematic review and meta-analysis.

Keywords : COVID19, airway management, Respiratory distress, qualitative review.

INTRODUCTION

COVID-19 was first detected in China in December 2019 as acute pneumonia. It mainly affects the respiratory system leading to symptoms such as fever, breathing difficulty, dry cough. At the same time, a few cases present with symptoms of severe pneumonia such as cough unproductive of sputum, the rise of body temperature, breathlessness, body ache, weariness, a loss of taste and smell. Nausea, stomach pain, diarrhea, or vomiting are all possible indicators of SARS-CoV-2 infection. Individuals infected with COVID-19 may develop an influenza-like respiratory tract infection, which includes fever (89%), cough (68%), tiredness (38%), phlegm production (34%), and shortness of breath (34%). Severe pneumonia occurs in about 15% of the patients and is defined as abnormal rapid breathing @>30 breaths/min, significant respiratory distress, or oxygen saturation (SpO2) ≤ 93 percent on room air along with raised body temperature.

Acute hypoxemic respiratory failure is the most common organ failure and reason for admission to the intensive care unit among COVID-19 patients (ICU). At the same time, roughly 5% of the patients are seriously afflicted (requiring ventilator and life support). Infection with SARS-CoV-2 can result in pneumonia, which can be worsened by bacterial coinfection, sepsis, ARDS, venous thromboembolism, and even late-onset lung fibrosis. (1)(2) Hence airway management and Respiratory Care become prime importance in the COVID-19 disease care protocol.

Covid19 patients with intense hypoxemia typically present with severe persistent labored breathing, in spite of the organization of oxygen @ >10-15l/min through a non-rebreather mask. As a result, various oxygen support modalities such as high-flow nasal cannula (HFNC), continuous positive airway pressure (CPAP) support, non-invasive mechanical ventilation (NIV), and invasive ventilation (IV) are considered.

This review study was done to identify the pros and cons of the available airway management modalities that have emerged as a game-changer in COVID19 respiratory distress.

METHODOLOGY

A detailed search was made on various databases, including Pubmed, Pubmed Central, Science Direct, and Google scholar, using Mesh keywords and applying the Boolean algorithm. Relevant literature was selected, and after the removal of duplicates, studies were selected for getting a qualitative review based on the available research on the topic. The following modalities came out to be the most commonly used and effective management options for airway management in respiratory distress.

HHHFNC: The high flow improves functional residual capacity, while humidification improves mucociliary clearance of secretions, thus reducing the work of breathing. The heated humidified high-flow nasal cannula (HFNC) is a non-invasive machine for respiratory support which delivers an adequately heated and humidified mixture of air and oxygen @ 20–80 L/min via wide nasal cannulas. During this Pandemic, HFNC has served as an alternative way to avoid intubation in a few patients. HFFC is safe and effective respiratory support in mild to moderate hypoxia. The circuit, cannula, and flow can be chosen according to the body weight and clinical condition.

In a study by Calligaro GL et al., 137/293 (47%) of patients were successfully weaned off from HFNC. The median duration of HFNC was 6 (IQR: 3-9) in those successfully treated versus 2 (IQR: 1-5) days in those who failed. (3) It means that half of those who receive it can be successfully weaned off.

CPAP: CPAP is a form of breathingassist which provides a continuous positive pressure in the course of all respiratory phases to the airways via an external device in aware and cooperative patients. CPAP can act as a good alternative to invasive ventilation as it can be used as an earlyremedyaimed towardaverting intubation.

Non-Invasive Ventilation: Non-invasive positive pressure ventilation (NIV/NPPV) is a ventilatory support technique used to treat acute respiratory insufficiency. Labored breathing, use of accessory muscles of respiration, paradoxical respiration, increased rate of respiration (>25 breaths/min), pH7.35 (most important parameter), arterial partial pressure of carbon dioxide (PaCO2)>45mm Hg, or rapid PaCO2 increase (>15–20mm Hg) are all signs of respiratory fatigue.

Prone positioning: Prone positioning can improve oxygenation and improve patient outcomes in ARDS, although the associated risks are there that include ET tube blockade and pressure sores. (4)(5)Full proning is found to be better and has improved outcomes when compared to partial/incomplete proning. (6)

Observations: It was discovered that invasively ventilated patients had a significant mortality rate and that extubating in many of these patients was difficult. This led to the conclusion that HFNC and NIV may be preferred and adopted proactively if any indications for the same exist so as to prevent mortality due to intubation. Also, the effect of awake prone positioning was observed to be good in COVID-related respiratory distress.

A meta-analysis done by Bocchile et al. to evaluate the effect of HFNC on the prevention of intubation in critically ill patients. It was found that HFNC was associated with a decrease in intubation rate. (7)

Table 1 compares the benefits while table 2 compares the risks associated with each management modality. Our review shows While HFNC is found to be associated with a decreased need for intubation , awake proning also is associated with reduced mortality. Nppv doesn't have much role in the management of emergency acute respiratory distress of COVID19. Invasive mechanical ventilation, however remains the life-saving procedure with associated high mortality in old age and comorbid conditions.

Table 1: Comparing the benefits associated with the respiratory modalities in COVID-19 related respiratory distress

Procedure	Study	Benefits
HFNC	Hui et al.	Exhaled air dispersion distance during application of HFNC at 60 L·min−1 is shorter than that from application of CPAP.(8)
	Bocchile et al.	When compared to standard oxygen therapy, the use of HFNC was linked to a lower requirement for intubation. (7)
Awake Proning	Paul et al.	Improves oxygenation and may prevent intubation. (9)
	Hallifax RJ, et al.	A significant association between full proning and reduced mortality (8% vs. 67%). (6)
NPPV	Xia et al.	It can be given in mild to moderate ARDS (Acute respiratory distress syndrome) when ventilators are limited in number. (10)
Tracheal Intubation	Martin J. Tobin	In severe respiratory failure, mechanical ventilation is life-saving. (11) The placement of an endotracheal tube is required for patients with severe respiratory failure. (12)

Table 2: Comparing the risks associated with the respiratory modalities in COVID-19 related respiratory distress

Procedure	Study	Risks
HFNC	Hui et al.	Aerosol dispersion distance 17.3 ± 3.3 cm at 60 L/min-1 flow rates, 13.0 ± 1.1 cm at 30 L/min-1 flow rates, whereas 6.5 ± 1.5 cm at 10 L/ min-1 flow rates. (8)
	Loh NW et al.	2.48 ± 1.03 m baseline and 2.91 ± 1.09 m with HFNC treatment. (13)
Awake Proning	Hallifax RJ, et al.	Full proning was associated with nil mortality Non-full proning – 69.2% mortality. (6)
	Munshi et al	Associated with an increased risk of endotracheal tube obstruction and pressure sores. (5)
NPPV	B. Rochwerg et al.	It is not recommended that NPPV should be used in treating acute hypoxic respiratory failure and Pandemic viral illness. (14)
Tracheal Intubation	Wong et al	Failure high in Low and middle-income Countries (Odd's ratio of 0.59). (15)
	Yao et al	Hypotension in 22%,Pneumomthorax in 6% and Cardiac arrest in 2 %.(16)
	Russotto et al INTUBE	Hemodynamic compromise in 45% ,Cardiac arrest in 3%.(17)

In a study of emergency tracheal intubations in COVID-19 patients, Wong et al. discovered that intubation first pass success was very high (89.7%), with slightly higher rates of intubation failure (0.8%) and emergency front of neck airway management (0.22 percent). A higher first-pass success rate was associated to the use of a rapid sequence induction approach, the use of a powered air purifier respirator, and previous experience with COVID-19 tracheal intubation. (15)

Russotto et al. noticed major complications such as severe hypoxemia or hemodynamic instability in 45 percent of cases, including 3 percent cardiac arrest, in their INTUBE study. Similarly, Yao et al. discovered that hypotension occurred in 18% of patients during intubation and 22% later on, pneumothorax in 6%, and cardiac arrest in 2%. Tracheal intubation of critically ill patients is associated with a high complication rate. Despite the well-known difficulties of that situation, it was also discovered that tracheal intubation of COVID-19 patients during the Pandemic was related to improved procedural care and better immediate results. High-flow nasal oxygen and tracheal intubation are two high-risk aerosol-generating techniques that can spread infection to the intubating health care provider.

Aerosol-mitigating measures, such as the use of high-energy particulate accumulator (HEPA) filters, negative–pressure rooms, and full PPE, are thus safety choices for protecting medical and nursing staff from the risk of exposure to the aerosol. In their study, Cheung et al. discovered that NPPV (non-invasive positive pressure ventilation) might prevent tracheal intubation in 70% of patients and cut the time spent in the critical care unit in half. (18)

Low flow oxygen was insufficient in 5 (27.7%) patients with severe COVID-19 illness among 18 participants who underwent oxygen supportive therapy, according to Procopio et al. Several comorbidities plagued these five patients, including hypercholesterolemia, hypertension, diabetes, chronic renal failure, and a history of transient ischemic stroke (TIA). The first attempt at CPAP or NPPV treatment was attempted in all patients. However these procedures were not well accepted, resulting in sensations of claustrophobia, anxiety, and pain despite the use of various interfaces and pressure levels. After a dramatic fall in respiratory parameters, all patients were switched to HFNC after failing to respond to CPAP or NPPV. All five patients showed a trend toward an increase in PaO2 after receiving HFNC medication. PaO2/FiO2 ratio rose after HFNC therapy. After 24 hours, SpO2 levels remained within a range of 94 to 99 percent. (19)

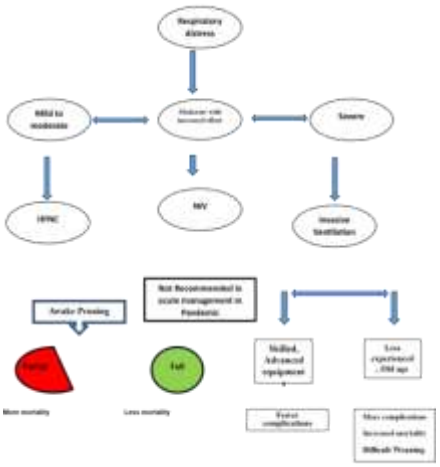

Figure 1: Flowchart of the protocol for airway management based on Risks and benefits

Newer modalities:

Helmet NIVs: A significant proportion of exhaled air is released into the surrounding air in traditional methods where oxygen is given via a nasal catheter, mask, or non-invasive ventilation (NIV). This can increase the virus's dispersion and, as a result, the likelihood of nosocomial infection. (20) Helmet NIV covers the entire face and head, and it is hoped that by replacing a face mask as the way of delivering non-invasive ventilation with a helmet, the risk of nosocomial infection will be reduced. Helmet NIV has advantages over face masks, which include a more effective seal, more effective delivery of positive end-expiratory pressure, greater tolerance, and less work of breathing. (21)

CONCLUSION

HFNC is a low-cost procedure and involves less risks compared to other modes and improves the oxygen saturation in mild to moderate cases but can't be the sole dependent modality in worsening respiratory distress. Awake proning, if fully achieved, is associated with improved oxygenation and less mortality. When coming to NPPV support, It is not recommended as a management modality in this pandemic situation, only being suitable in cases where respiratory distress is mild to moderate or where the number of ventilators is few.

Invasive ventilation is life-saving, but weaning is difficult, and high mortality is observed in old aged individuals and those with comorbidities. Also Airway management team (AMT) requires skilled and experienced personnel.

Recommendation: Based on the review of the literature related to our research question, it can be recommended that the selection of the Emergency airway management therapy/modality is based on the type of respiratory distress, age, resources present in the setup, the skill of the person responsible and also on the comorbidities present. A detailed and exclusive systematic review and meta analysis can better explain the efficacy of the modalities used in emergency airway management and acute respiratory distress related to COVID19 pneumonia.

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