

Comparison of COVID and NON-COVID patients' outcome depending on the mode of ventilation

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Abstract

Background: To compare the effectiveness and compliance of patients on HFNC and NIV in COVID Positive and NonCOVID patients admitted in Respiratory Intensive Care Unit. **Settings and Design:** Prospective cohort study at single centre. **Methods and Material:** The sample size was 200 patients divided into two groups. Group A had 100 Covid positive patients while group B had 100 Covid negative patients. Each group was further divided into two subgroups of 50 each with one on HFNC (High Flow Nasal Cannula) and other on NIV(Non-invasive ventilation). **Statistical analysis used:** Descriptive analysis using Chi-square test. **Results:** In group A, out of 50 patients on HFNC, 48% were improved and wean off whereas from patients on NIV 64% were improved and wean off. In group B, 52% of patients on HFNC were improved and wean off and 72% of patients on NIV were improved and wean off. **Conclusions:** Patients on NIV (Bi-PAP/C-PAP) has better outcome and cure rate than patients on HFNC in both COVID Positive and NonCovid patients.

Keywords: Covid-19, Respiratory failure, Mode of ventilation, HFNC, NIV, BiPAP.

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INTRODUCTION

During December 2019, first case of Covid-19 was detected and within few months it spread throughout the world affecting millions of cases so much so that on March 11, 2020; WHO announced it as pandemic.¹ Covid-19, also known as Novel coronavirus infected pneumonia (NCIP) is an acute respiratory infection caused by Severe acute

respiratory syndrome coronavirus 2 (SARAS-CoV-2). It causes severe inflammation throughout the body, specially the respiratory tract. The patient usually presents with symptoms like cough, cold, fever, dyspnea, myalgia, fatigue and radiographic evidence of pneumonia.² Patients with severe Covid-19 infection developed type 1 respiratory failure with severe hypoxemia. Many patients developed acute respiratory distress syndrome (ARDS) and died because of it. Those patients who develop respiratory failure require support through one or the other mode of ventilation.³

There are wide range of modes of ventilation available depending on the variables - Pressure, volume and flow, that you control. But for this study we would focus on High flow Nasal cannula (HFNC), Non-invasive ventilation (NIV) which includes Bilevel positive airway pressure (BiPAP) and Continuous positive airway pressure (CPAP); and Invasive mode of ventilation (IMV).⁴

High flow nasal oxygen (HFNO) is used for patients with increased respiratory effort e.g., tachypnea, shortness of breath, increased work of breathing in presence of hypoxia. HFNO is initially commenced at flow rate of 60 L /min and O₂ to achieve the target saturation (SpO₂). Bilevel positive airway pressure (BiPAP) is a type of non invasive ventilation (NIV) which is used clinically to improve work of breathing. Inspiratory positive airway pressure (IPAP) can range from 12 to 35 cmH₂O to achieve adequate tidal volume. Expiratory positive airway pressure (EPAP) can range from 6 to 10 cmH₂O. Pressure support (ΔP) calculated by IPAP-EPAP and there should be a difference of at least 8 cmH₂O.⁵

The aim of study was to compare the symptoms and outcomes of the patients who were given HFNC with the patients given NIV. Further evaluation was also done to compare Covid-positive and Covid-negative patients.

MATERIAL AND METHODS

The study was prospective cohort study at single centre, Respiratory Intensive Care unit - Department of Anaesthesiology, P.D.U Medical College and Hospital, Rajkot. The inclusion criteria was Covid positive and Covid negative patients who required respiratory support. Sample size was decided to be 100 for each group and then each group was divided into half depending on the respiratory support - HFNO or BiPAP, the patient was given.

Permission to conduct the study was taken from Institutional Ethics Committee, P.D.U Medical college and Hospital, Rajkot. Written consents were taken from the patients and they were explained about the study and were informed that they would not receive any incentive.

A pro-forma was created which included patients' information, mode of respiration he was on, vitals and treatment. Data collection was done through this form. Final outcome was decided on the basis of improvement of patients and number of patients wean off from the ventilator' and both the groups were compared. Patients were observed and data was collected for 48 hours. Standard monitoring equipment like ECG, Pulse oximeter and non-invasive blood pressure monitor were connected and monitored throughout ventilatory support and baseline readings of pulse rate, blood pressure, respiratory rate, oxygen saturation, arterial blood gas analysis were recorded.

The collected data in forms was transferred to Microsoft Excel 2016. For statistical purposes Med Calc. V 20 was used. For finding, statistical significance Chi-square test was applied.

RESULTS

Participants' characteristics and their outcome are mentioned in Table 1. A chi-square test of independence was performed to find out if there was any relation between mode of ventilation and outcome of the patient. For overall sample population, $X^2(1, N=200) = 6.69, p=.009$ which is significant at $p<.09$. For the group A, $X^2(1, N=100) = 2.59, p=.107$. It was not significant at $p<.05$. Similarly, Chi-square test was performed for group B and it was found out as $X^2(1, N=100) = 4.24, p=.039$ which was significant at $p<.05$. Thus, Covid positive patients had no difference in outcome regardless of the mode of ventilation, however, Covid negative patients had better prognosis with BiPaP ventilation.

Table 1

Outcome:	Number of patients wean off	Changed to invasive mode of ventilation
Group A (Covid Positive Patients)		
On HFNC:	24	26
On NIV:	32	18
Group B (Covid Negative Patients)		
On HFNC:	26	24
On NIV:	36	14

DISCUSSION

At the end of the study we figured out that NIV was a better mode of ventilation in terms of providing respiratory support, treating the symptoms and avoiding the need of intubation in both the groups. The difference was also statistically significant for non covid patients. However, there are number of studies with different views on the same question. A systematic review with sample size of 5354 covid patients, showed that HFNC had lower mortality rate compared to NIV. {6} Another systematic

review consisting of 9 studies suggested that HFNC was better in improving symptoms compared to NIV but there was no significant difference when it came to prevention from intubation.⁷

The need for such study is to determine which type of respiratory support is better. HFNC has better compliance, washes out nasopharyngeal dead space, higher volume delivery and pressure upto 4cm H₂O. The limitation of HFNC is that it generates very limited PEEP (Positive end expiratory pressure). Similarly, the limitations of BiPAP and CPAP includes air leak, poor tolerability, costlier

equipments, injury to surrounding structures with long term use and full inspiration synchronisation may lead to swings in pressure and tidal volume. NIV is better than HFNC in certain aspects like higher PEEP generation, higher alveolar recruitment, unloading of inspiratory muscles and regulation of both inspiration and expiration.⁵

CONCLUSION AND LIMITATIONS:

There are pros and cons to every mode of ventilation and choice is very subjective institution to institution. In our study we found NIV was better than HFNC but there are multiple studies who do not support this hypothesis. Thus, the condition of the patient should be evaluated properly and mode of ventilation should be suggested accordingly and careful observation should be carried out to make any necessary changes.

There are certain limitations to the study. First, the study is single centre study so external validation is uncertain. Secondly, the sample size was small so a definitive conclusion cannot be reached. Third there might be a bias because higher attention was given to patients on NIV.

Event though, the study has limitation, it surely is a progressive step in the field of research in this area.

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