

Comparison of High Flow Nasal Cannula and Continuous Positive Airway Pressure in Patients of COVID 19 Pneumonia

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Abstract

Noval corona virus 2019 which also called as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) lead to severe pneumonia and acute respiratory distress syndrome. CPAP and HFNC as been used as non invasive mode of ventilation during this pandemicity declared by the WHO as a global public health emergency [1]. HFNC is a recent therapy for covid -19 pneumonia, curiosity to know more about HFNC and CPAP lead us to conducted a retrospective study of CPAP vs HFNC in our institute for covid-19 positive patients treatment admitted in ICU during 19 October 2020 to 30 January 2021. A sample size of 26 patients included in our study with mean spo2 at the time of admission of CPAP group 85% and HFNC group 89% and mean age is comparable in both groups. We found more patient discharge and less death (60%) in HFNC group as compare to CPAP group were death is (91%) in our ICU setting. As well as comorbidities are more associated with HFNC group (80%) as compare to CPAP group (36.4%). The limitation is that it is single centre study, so further large-sample studies will be required to validate the conclusion and preferably through prospective randomized trials.

Keywords: corona-19 pneumonia, high flow nasal cannula {HFNC}, continuous positive airway pressure {CPAP}, death, intensive care unit {ICU}.

INTRODUCTION:

Covid -19 virus first emergence in Wuhan, China, more than 11 Million cases and 1,56000 deaths have been recorded in India due to COVID-19 pneumonia [2]. Most of the patients with COVID-19 have mild influenza-like illness or they are asymptomatic, small number of patients will develop severe pneumonia, acute respiratory distress syndrome (ARDS), multi-organ failure (MOF), and death [3]. The clinical application of High-flow nasal cannula oxygen therapy (HFNC) is not long, recent studies have confirmed that the use of HFNC in covid-19 patients with acute respiratory failure (ARF) is safe and effective [4,5]. One large randomized control trial comparing the effectiveness of conventional oxygen therapy, CPAP and HFNC in hypoxemic ARF demonstrated that HFNC alone reduced need for invasive mechanical ventilation (IMV) in the most severe ($\text{PaO}_2/\text{FiO}_2, \leq 200$ mm Hg) subgroup of patients. HFNC patients also had the higher 90-day survival rate of the covid-19 patients [6]. Therefore HFNC is widely used in patients with severe COVID-19. Prior to this CPAP is only obtain for severe and moderate pneumonia patients, so we conducted the study comparison of CPAP and HFNC in covid-19 pneumonia ICU patients admitted in our institute using data from October 2020 to January 2021.

OBJECTIVE:

To compare CPAP and HFNC in the clinical outcome of covid-19 pneumonia ICU patients ventilated non

invasively by one of these modality.

INTERVENTION:

GROUP 1: COVID 19 confirmed ICU patients who were admitted used CPAP as a mode of non-invasive ventilation

GROUP 2: COVID 19 confirmed ICU patients who were admitted used HFNC as a mode of non-invasive ventilation

Inclusion criteria

1. Age >18yr
2. Moderate and severe case of COVID 19 with RTPCR confirmed case (as per national guideline release by ICMR)

Exclusion criteria

1. Age <18yrs.
2. Pregnant patient and lactating patient.
3. Patients who require elective intubation.
4. Patients ventilated with both HFNC and CPAP non invasive ventilation mode.

MATERIAL AND METHOD:

Our study population is RTPCR COVID 19 confirmed patients who were admitted in covid-19 ICU of ATAL BIHARI VAJPEE GOVERNMENT MEDICAL COLLEGE VIDISHA, M.P. and utilized HFNC or CPAP as the mode of non-invasive ventilation during October 2020 to January 2021. We had done a Retrospective observational study involving 26 ICU covid-19 confirmed cases with moderate to severe pneumonia. Moderate COVID-19 Pneumonia with no signs of severe disease i.e. Adolescent or adult with presence of clinical features of dyspnea or hypoxia, fever, cough, including SpO₂ <94% (range 90-94%) on room air, Respiratory Rate $\geq$ 24 per minute. (2) Severe COVID-19 Pneumonia i.e. Adolescent or adult with clinical signs of Pneumonia with one of the following; respiratory rate >30 breaths/min, severe respiratory distress, SpO₂ <90% on room air. (2)

Those cases who fulfilled the inclusion criteria has be involved in our study after institutional permission. Moderate to severe pneumonia patients basic parameters measured like oxygen saturation, heart rate, breathing rate and blood pressure at the time of admission and assigned ICU beds if needed. Physician decides which mode of ventilation to be applied according to the patients need and clinical status, oxygen saturation is maintained above 94% during there hospital stay. Patients lungs conditions were assessed with the help of chest x-rays and oxygen saturation. Other investigations like CRP, D-dimer, N/L ratio, LFT, RFT, ABG and coagulation profile were done and repeated according to patient condition. Patients who were ventilated with both CPAP and HFNC were not considered in this study. Patients not maintaining on NIV were considered for invasive ventilation. The transition to Non invasive positive pressure ventilation (NPPV) or invasive mechanical ventilation (IMV) will be decided by the physicians. Different physicians will have different opinions for selection of mode of ventilations.

For CPAP we used ResMed Astral 100 by NIV face mask and for HFNC we used inspired O₂FLO with a adult integrated heated breathing circuit and adult nasal prong used according to the guideline of manufacture.

Data was analyzed using Microsoft excel. Mean and standard deviation computed for quantitative variables. Categorical variables will be expressed as frequencies and percentages. Continuous variables will be compared using the Student *t* test.

RESULTS:

We analyzed data of covid-19 positive patients having severe to moderate pneumonia after institutional approval from October 2020 to January 2021. Out of 132 patients admitted in ICU ABVGMV VIDISHA, 11 patients were considered in group 1 who were applied CPAP as mode of NIV, 15 were considered in

group 2 who were applied HFNC as mode of NIV and 18 were excluded as they were applied both CPAP and HFNC as mode of NIV. The mean age of patients in both the group was comparable group 1 is 58.96 years and 60.26 years in group 2 (TABLE 1).

TABLE-1		
GROUP	CPAP (GROUP 1)	NFNC (GROUP 2)
MEAN AGE OF PATIENTS IN YEARS	58.96 YEARS	60.26 YEARS

We found that there is 80% comorbidities (like hypertension, diabetes, CAD, CKD, Hypothyroidism etc) present in group 1 patients admitted to ICU as compare to group 1 only 36.36% (TABLE-2). So there are more aged and comorbid patients in HFNC group. The mean oxygen saturation of patients at the time of admission is almost same in both the groups (TABLE-3).

TABLE-2		
GROUP	CPAP (GROUP 1)	NFNC (GROUP 2)
COMORBIDITIES PRESENT	36.36 % CASES	80% CASES
COMORBIDITIES ABSENT	63.63% CASES	20% CASES

TABLE-3		
GROUP	CPAP (GROUP 1)	NFNC (GROUP 2)
MEAN OXYGEN SATURATION OF PATIENTS AT THE TIME OF ADMISSION	84.63%	89.46%

Clinical outcome of the patients were measure by calculating the percentage of patients discharged, referred or death in CPAP and HFNC group (TABLE-4). In our study patient of HFNC have high discharge percentage as compare to CPAP group, and also higher death noticed in CPAP group as compare to the HFNC group. As per above data HFNC seems better mode of non-invasive ventilation then CPAP in covid-19 ICU patients with moderate to severe pneumonia. This data taken from single institute needs further study with large sample size and multi centric study needed.

TABLE-4		
GROUP	CPAP (GROUP 1)	NFNC (GROUP 2)
PATIENTS DISCHARGE IN PERCENTAGE	0%	26.67%
PATIENTS REFERRED IN PERCENTAGE	9%	13.33%
PATIENTS DEATH IN PERCENTAGE	91%	60%

DISCUSSION:

In our ICU of COVID-19 patients were admitted with moderate to severe pneumonia. At the time of admission presented with shortness of breath, cough, fever, dyspnea and loss of taste. There initial vitals were taken at triage area, most of the patients having oxygen saturation below 90% and respiratory rate more then 25/min. All of them started ventilation with the help of HFNC or CPAP depending on patient clinical condition and physician decision. According to our study HFNC is better mode of ventilation then CPAP with less patient mortality and more discharge. In one of the study conducted by JUN DUAN, BAIXU CHEN ET AL the duration NIV, intubation rate and mortality didn't differ in HFNC and NIV. Among 23 patients on HFNC 10 needed rescue ventilation and among 13 patients on NIV 1 use rescue ventilation [6]. While in our study failure of ventilation with CPAP or HFNC of pneumonia patient lead to

invasive ventilation.

In another study conducted in china experts have suggested that HFNC and NIV is used in patients with $\text{PaO}_2/\text{FiO}_2 \geq 150$ mmHg and NIV can be used cautiously in patients with $\text{PaO}_2/\text{FiO}_2$ between 100 and 150 mmHg[7]. Most of patient suffering from acute respiratory distress syndrome treated with oxygen therapy with HFNC or CPAP. We didn't find any added advantage in patients with $\text{PaO}_2/\text{FiO}_2$ between 100 to 150 mmHg of using HFNC, this part need evaluation to prefer HFNC our CPAP.

The surviving sepsis campaign COVID-19 subcommittee has suggested that the HFNC is superior to NIV in COVID-19 patients with acute hypoxemic respiratory failure [8]. Same results were found in our study as well discharge percentage is high in HFNC patients and also death percentage is low as compare to CPAP group in moderate to severe pneumonia patients. Although the sample size is small but we are trying to do multicentric study to bring out reliable conclusion in support of this study. (on going project)

There are high chances of infection in ICU with a aerosol generating machines specially in covid-19. Theoretically NIV have more pressure so generates more aerosols as compare to HFNC [9]. Lots of health care worker got infected across the world inspite of using proper guideline and precaution. Use of HFNC can also prevent from aerosol generation saving valuable staff at the time of such crisis.

We have several limitations during this study, as sample size is too small for effective result which can be applied universally, another drawback is that decision of application of any mode of ventilation is done by different physicians. Study was done in single center ICU of medical college, multicentre randomize control trial study needed with a large sample size.

CONCLUSION:

We conclude that HFNC can be first choice in moderate to severe covid-19 pneumonia patients then NIV to improve outcome of covid-19 patients observed in our ICU center. There is less chances of aerosol generation and patient acceptance is also better in HFNC. We are not generalizing this data for each and every centre, for formulation of guideline about use of HFNC and CPAP large sample size and multicentric study required.

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