Section: Anesthesiology

Original Research Article

A DESCRIPTIVE CROSS-SECTIONAL STUDY EXAMINING THE EFFECTIVENESS OF NON-INVASIVE VENTILATION (NIV) ON COVID-19 PATIENTS

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Received : 09/05/2024
Received in revised form : 29/06/2024
Accepted : 15/07/2024

Keywords:
Non-Invasive Ventilation (NIV), COVID-19.

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DOI: 10.47009/jamp.2024.6.4.24

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (4); 114-118

Abstract

Background: To assess the efficacy of non-invasive ventilation in mitigating the need for invasive ventilation among individuals with COVID-19, along with its outcomes and rate of success. In cases of acute hypoxemic respiratory failure in COVID-19 patients, non-invasive ventilation serves as a valuable alternative. **Materials and Methods:** The following criteria were used in this study to identify and manage 60 ICU patients: (a) RR>30/min; (b) SpO2 < 90%; (c) abnormal ABG Analysis; and (d) PaO2/FiO2<200. The main mode chosen was BiPAP; initial FiO2, IPAP, and EPAP were established, and frequent and as-needed ABG analysis was performed in addition to monitoring (a) the hemodynamic parameter and (b) PaO2/FiO2. ABG, PaO2/FiO2, and other hemodynamic parameters were closely monitored during the stepwise transition from BiPAP to CPAP and then NRBM. When patients required intubation, the NIV's failure was taken into account. **Results:** The baseline mean PaO2/FiO2 of sixty patients was 83±.15 at admission. After receiving BiPAP treatment for three to four days, patients' mean FiO2 was 78.4 ±6.05, their IPAP was 13.2±.25, and their EPAP was 10.02±0.2. Additionally, their mean PaO2/FiO2 improved. All patients had an average hospital stay of five to seven days, and their mean PaO2/FiO2 improved to 434±1.16. 53 patients in all were successfully weaned off of NRBM. The remaining 7 patients required intubation; 4 had several comorbidities, and 3 had complications from BiPAP, such as subcutaneous emphysema or pneumothorax. **Conclusion:** As a result of its better success rate, shorter hospital stays, and fewer complications, NIV is considered one of the best approaches for treating COVID 19 patients with acute hypoxemic respiratory failure. A better assessment of the true efficacy of NIV and a deeper comprehension of respiratory support modalities are necessary for COVID-19 ARDS. NIV was found to be the preferred treatment option for COVID-19 patients with acute hypoxemic respiratory failure in a prospectively enrolled study population of 60 patients admitted to the COVID ICU because it has a higher success rate, shorter hospital stays, and fewer complications.

INTRODUCTION

The COVID-19 outbreak in 2019 is characterized by its rapid transmission and the associated levels of morbidity and mortality. The most significant global health crisis since the 1918 influenza pandemic is the highly contagious viral illness known as severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). It has had a devastating impact on global demographics, killing over 3.8 million people worldwide. On December 31, 2019, the World Health Organisation received a notification from Chinese authorities regarding the emergence of a new corona virus illness in patients originating from Wuhan, Hubei province.[1]. In a short amount of time, it quickly spread over the world, causing the World Health Organisation (WHO) to proclaim On

ISSN (O): 2687-5365; ISSN (P): 2753-6556

March 11, 2020, a global pandemic was declared. COVID-19, which was proclaimed a global epidemic, has overrun several hospital systems globally. Despite significant advancements in clinical research that have improved our understanding of SARS-CoV-2 and how to treat COVID-19, many nations dealt with a second or third wave of epidemics of this viral disease, mostly as a result of the introduction of mutant forms.[2]

Similar to other RNA viruses, SARS-CoV-2 is susceptible to genetic evolution as a consequence of developing mutations over time, leading to mutant forms that may exhibit distinct characteristics, even if it has adapted to its new human hosts. According to the WHO's most current epidemiological report, as of June 22, 2021, four SARS-CoV-2 VOCs have been discovered since the pandemic's start.

While the source of SARS-CoV-2 remains unknown,. but according to genomic analysis, SARS-CoV-2 most likely originated from a bat strain.[3]

The principal means of acquiring SARS-CoV-2 is by contact with respiratory droplets containing the virus, either from patients who are asymptomatic, pre-symptomatic, or symptomatic. The transmission of COVID-19 by airborne transmission using aerosol-generating processes has also been linked to its proliferation. Numerous research has led to the proposal that SARS-CoV-2 contamination of inanimate surfaces might transmit the virus.

NIV is commonly used in the care of patients with chronic respiratory disease, so it may be useful in COVID19. In COVID-19, BiPAP may have a clinical use to improve the work of breathing and hence useful in patients with acute respiratory failure due to COVID 19.

MATERIALS AND METHODS

The Government Medical College and SSG Hospital in Vadodara conducted a descriptive cross-sectional study titled "The Outcomes of Using Non-Invasive Ventilation (NIV) in COVID 19 Patients on Mechanical Ventilation – A Descriptive Cross-Sectional Study" for patients admitted to the intensive care unit of SSGH and who require NIV for management of COVID 19 starting in February 2021 for a period of six months. The study was authorised by the Institutional Ethical Committee for Human Research. Sixty patients participated in the descriptive cross-sectional research. The following are specifics about the methodology and research design.

Inclusion Criteria

1. Age from 18 years to 75 years
2. Both Gender
3. Following clinical features
4. breathlessness at rest;
5. RR> 30 /min, use of accessory respiratory muscles, paradoxical breathing.
6. SpO2<90% (even on NRBM with 15L/min for 2 hours) 4. PaO2/FiO2<200

Exclusion Criteria

1. Signs of altered consciousness.
2. Unstable hemodynamics.
3. Inability to protect the respiratory tract. (absence/diminished protective airway reflexes)
4. Excessive bronchial secretion.
5. Uncooperative patients.
6. Facial trauma, burns, anatomical disorders that prevent masking. 7.Patients with uncontrolled DM and/or HTN.

RESULTS

The COVID ICU at SSG Hospital and Medical College in Baroda served as the study's site. In this descriptive cross-sectional investigation, 60 patients older than 18 years who needed NIV as a management strategy for ARDS related to COVID-19 were included. This study was carried out over a six-month period beginning in February 2021. Hemodynamic parameters, ventilatory settings, ABGA, PaO2/FiO2, and NIV-related problems were all detected in this research. Using the MedCalc 20.011 software, statistical analysis was performed for the different parameters.

Patients with age more than 18 years till 75 years were included in our study and the mean age was 55.2 years.

Both genders, with clinical features of Breathlessness at rest; RR> 30 /min, use of accessory respiratory muscles, paradoxical breathing, SpO2<90%, abnormal ABG Analysis and PaO2/FiO2<200 were included in this study and found to be having a greater number of male patients than female. Out of 60 patients, 16 of patients showed history of interstate travel within 1 month of COVID positivity. Most common co-morbidities among COVID patients were found to be diabetes mellitus in 35% and 18% of patients had both DM and HTN, only 8% of patients didn‘t have any co- morbidities [Table 1]

In this study, 8 (13.3%) patients were ≤40 years of age, 16 (26.7%) patients were 41-50 years of age, 14 (23.3%) patient were 51-60 years of age,16 (26.7%) patients were 61-70 years of age and 6 (10.0%) patients were 71-75 years of age. The value of p is 1, which shows that there is no significant relation between age and severity of COVID in our study. [Table 2]

Total 60 100.0%

In our study, 17 (28.3%) patients were Female and 43 (71.7%) patients were Male. The value of p is <. 001. Even though there was a significant P value that is, number of males were more than females, but the outcome of NIV management was independent of this factorM. [Table 3]

In our study, 96 % patients presented with complaints of breathlessness, and all 60 patients had Spo2 <90% as these were included in the inclusion

ISSN (O): 2687-5365; ISSN (P): 2753-6556

criteria and other symptoms like fever cough and sore throat was seen only in 80-86% of patients. Here the p < 0.001 which shows a significant relation of breathlessness and low Spo2 with severity of the disease. [Table 4]

In our particular study, 5 (8.3%) patients were shifted from HFNO and 55 (91.7%) patients were shifted from NRBM after giving oxygen supply for 15/min for >2 hours. These patients were having worsening degree of breathlessness with increase in respiratory rate and no increase in Spo2 which in turn lead them to shift to NIV. [Table 5]

In this study, 16 (26.7%) patients had history of Travel to endemic places mostly interstate travel within 1 month of becoming COVID positive. The value of p is < 0.001. It shows that there is a significant relation with history of travel and that may have led to transmission of COVID 19. [Table 6]

Table 1: Demographic Data

Serial no	Variable	Patients N=60	Percentage (%)
1	Age (years)	55.2	NA
2	Gender, (male/ female)	Male: 43, Female: 17	NA
3	History of travel within 1 month	16	26%
4	Shifted from NRBM/HFNO to BiPAP	Shifted from NRBM: 55 Shifted from HFNO: 5	
5	No Co morbidity	5	8.3%
	Co-morbidities:		
	DM	21	35%
	DM HTN	11	18.3%
	DM, ANC	1	1.7%
	DM, HTN	3	5%
	DM, IHD	2	3.3%
	DM, OBESITY	4	6.7%
	DM, HTN, IHD	4	6.7%
	HTN	7	11.7%
	HTN COPD	1	1.7%
	HTN DM	1	1.7%
6	Complications (Out of 60)		
	PNEUMOTHORAX	2	3.3%
	SUBCUTANEOUS EMPHYSEMA	1	1.7%
	No complications	57	95%

Table 2: Age Distribution (In Years)

Age in group	Frequency	Percent
≤40	8	13.3%
41-50	16	26.7%
51-60	14	23.3%
61-70	16	26.7%
71-80	6	10.0%
Total	60	100.0%

Table 3: Gender Distribution

Sex	Frequency	Percent
Female	17	28.3%
Male	43	71.7%
Total	60	100.0%

Table 4: Chief Complaints: Presenting Symptoms and Signs

Chief complaints	Frequency	Percent
Breathlessness	58	96.6%
Fever	52	86.6%
Low SPO2 (<90%)	60	100.0%
Cough	48	80%
Total	60	100.0%

Table 5: Previous Oxygen Therapy Prior to NIV Application

Shifted from	Frequency	Percent
HFNO	5	8.3%
NRBM	55	91.7%
Total	60	100.0%

Table 6: History of Travel to Endemic Areas

History of Travel	Frequency	Percent
No	44	73.3%
Yes	16	26.7%

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Total	60	100.0%

DISCUSSION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a highly infectious viral infection that mostly affects the respiratory system. On March 11, 2020, the World Health Organisation (WHO) proclaimed it to be a worldwide pandemic. Significant advancements in clinical research have improved our understanding of SARS-CoV-2 and how to manage COVID-19,. Like other RNA viruses, SARS-CoV-2 is susceptible to genetic evolution as a result of mutations that occur over time, and as the virus continues to wreak havoc around the world, its variants have become an increasing concern.[2]

ARDS is frequently developed by patients with severe COVID-19 infection, and the illness typically manifests acutely (within a week).It is characterised by bilateral ground glass opacities associated with pulmonary edema as shown on the chest radiograph or CT, together with a PaO2/FiO2 ratio <300 mmHg with a minimum PEEP of 5 cmH20 PEEP and respiratory failure that is not caused by cardiac failure or pulmonary overload.

Individuals diagnosed with a mild COVID-19 condition have to be admitted to a high dependency unit (HDU) for close observation. It is recommended that healthcare professionals should use the proper personal protection equipment (PPE) when engaging with these patients. All hospitalised patients should get supportive treatment, and if the patient's SpO2 is low, oxygen therapy using face masks, nasal prongs, NRBM, or even HFNO should be started, depending on the patient's needs and clinical monitoring. Mild cases may require supplemental oxygen in form of nasal prongs, simple oxygen mask, NRBM whereas moderate to severe cases may require mechanical ventilation in the form of noninvasive mode such as BIPAP, HFNC or CPAP; or in the form of invasive ventilation. Antibiotics like azithromycin 500 mg OD ,zinc, vitamin C along with other supportive therapy to be started to all patients. Remdesivir with dexamethasone may be prescribed to hospitalised patients who needs oxygen therapy[6,18]

Those with severe COVID-19 sickness need to be admitted to an intensive care unit. Intubation is not necessary for patients who qualify for NIV but when a patient stops responding to NIV, endotracheal intubation should be started as soon as feasible to prevent further respiratory collapse. Hospitalised patients who need oxygen through non-invasive or invasive ventilation are highly advised to give dexamethasone, according to the National Institutes of Health's (NIH) Covid-19 Treatment Guidelines Panel. In hospitalised patients on NIV or IMV with evidence of disease progression, combination treatment with dexamethasone and remdesivir or baricitinib, or tocilizumab is also advised. It is recommended that all patients should continue receiving preventive anticoagulation considering COVID 19 is linked to prothrombotic state. If a patient is hemodynamically unstable, vasopressors should be initiated in order to keep the mean arterial pressure (MAP) between sixty and sixty-five mmHg. The recommended first vasopressor is norepinephrine, and switching from NIV to IPPV ventilation is taken into consideration. When a patient has refractory respiratory failure, ECMO should be considered if feasible.[2,6,8]

CONCLUSION

A better assessment of the true efficacy of NIV and a deeper comprehension of respiratory support modalities are necessary for COVID-19 ARDS. NIV was found to be the preferred treatment option for COVID-19 patients with acute hypoxemic respiratory failure in a prospectively enrolled study population of 60 patients admitted to the COVID ICU because it has a higher success rate, shorter hospital stays, and fewer complications. Therefore, based on these preliminary findings from this study, which focused on COVID-19 patients receiving non-invasive ventilation, we draw the conclusion that NIV can be very important tool in the care of patients experiencing respiratory failure linked to COVID-19. Our study convincingly demonstrated that NIV is a successful COVID 19 management strategy with a low failure rate. However, more extensive multicentre research in the future, will be required to make more firm judgements about the application of NIV and its results in the treatment of COVID-19 patients.

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