

Role of Non-Invasive Ventilation in Type II Respiratory Failure Individuals

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Abstract:

Introduction: Noninvasive ventilation (NIV) involves administering positive pressure to the lungs without the use of an endotracheal tube. A study was taken to find the role of non-invasive positive pressure ventilation (NIPPV) in patients with type II respiratory failure and also to assess outcome.

Methods: It was a prospective observational study conducted in the department of Respiratory Medicine, ASRAM Medical College, Eluru. Study was conducted from January 2017 to August 2018. Study protocol was approved by Institutional ethical committee. Individuals of both gender between 40 – 80 years, on moderate to severe dyspnea for <2 weeks were included in this study. Respiratory rate (RR), heart rate (HR), arterial blood gas analysis (ABG) was recorded. Routine blood investigations and chest radiography were carried as per the institutional protocol. All patients were administered NIPPV using the Bilevel positive airway pressure (BiPAP) ventilator support system. Presence of sustained clinical improvement with reduction RR, HR and presence of normal arterial blood gas (ABG) analysis were required before weaning from NIPPV. P <0.05 were considered to be statistically significant.

Results: Total 50 (100%) members were included, mean age was 56.82 ± 9.36 yrs. The male female ratio was 4. Before NIPPV, the mean \pm SD dyspnoea score was 9.08 ± 1.14 and it was 1.21 ± 0.41 at the time of discharge; statistically there was significant difference. Similarly, there was significant improvement in the mean RR and HR. ABG parameters were also improved and statistically there was significant difference.

Conclusion: The findings in the current study suggest that NIPPV is a promising therapeutic approach for managing selected patients experiencing exacerbations of COPD.

Keywords: Failure, Outcome, Respiratory, Study.

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Introduction

Noninvasive ventilation (NIV) involves administering positive pressure to the lungs without the use of an endotracheal tube. [1] NIV has proven effective in managing acute respiratory failure, leading to a notable decrease in mortality rates, reduced requirements for endotracheal intubation, and shorter hospital stays compared to standard therapeutic approaches. It is commonly employed for the treatment of acute respiratory failure resulting from various causes. [1]

NIV, by circumventing endotracheal intubation, mitigates complications linked to invasive ventilation, such as issues with the airway, nosocomial pneumonia (21%), and sinusitis (5-

25%) according to studies. [2] The initiation of NIV was based on criteria involving symptoms indicative of hypercapnia (such as dyspnea, morning headaches, sleep disturbance, and diurnal sleepiness) along with a PCO₂ level exceeding 6 kPa, or evidence of nocturnal arterial oxygen desaturation. Sleepiness was regarded as a symptom suggestive of either sleep-disordered breathing or hypoventilation. Furthermore, patients with an intact upper airway maintain the capability to eat, swallow, and communicate verbally. NIV can be administered utilizing the majority of contemporary intensive care ventilators, presenting distinct advantages for more critically ill patients. [3] A study was taken to find

the role of non-invasive positive pressure ventilation (NIPPV) in patients with type II respiratory failure and also to assess outcome.

Methods

It was a prospective observational study conducted in the department of Respiratory Medicine, ASRAM Medical College, Eluru. Study was conducted from January 2017 to August 2018. Study protocol was approved by Institutional ethical committee. An informed written consent was taken from all the study participants. Individuals of both gender between 40 – 80 years, on moderate to severe dyspnea for <2 weeks were included in this study. Non cooperative, cardiac or respiratory individuals, those with extreme claustrophobia, severe upper gastrointestinal bleeding, hemodynamic instability, encephalopathy, glasgow Coma Score < 8 were not considered in this research.

After recruiting the participant in the study, detailed clinical history was collected. All the findings were recorded in the study proforma. Respiratory rate (RR), heart rate (HR), arterial blood gas analysis (ABG) was carried. Routine blood investigations and chest radiography were carried as per the institutional protocol. All patients were administered NIPPV using the Bilevel positive airway pressure (BiPAP) ventilator support system. A well-fitting oronasal mask was used for the study. The procedure was carried as per the guidelines [4] and treatment is given. Presence of sustained clinical improvement with reduction of RR <24/min, HR <100/ min and presence of normal pH and O₂ saturation >90% on ABG analysis were required before patients were considered for weaning from NIPPV. If there is no improvement, NIPPV was considered to be failed.

Statistical Analysis: The data were analysed using SPSS version 21. It was presented in mean and percentage. Chisquare test was used for statistical analysis and P <0.05 were considered to be statistically significant.

Results

Total 50 (100%) members were included, majority (38%) were in 51 – 60 years, mean age was 56.82 ± 9.36 yrs. The male female ratio was 4. Total 9 (18%) members were deteriorated, required intubation within 6 hrs. Before NIPPV, the mean ± SD dyspnoea score was 9.08 ± 1.14 and it was 1.21±0.41 at the time of discharge; statistically there was significant difference (P<0.0001). Similarly, there was significant improvement in the mean RR and HR (P<0.0001). ABG parameters were also improved and statistically there was significant difference.

Discussion

NIV demonstrates effectiveness in managing chronic ventilatory failure arising from chest wall deformities. [5] However, limited research exists on

the application of NIV when these patients experience acute illness, as they constitute a minority among those facing respiratory failure. Absence of randomized controlled trials leaves only a handful of retrospective case series, which imply that NIV can ameliorate gas exchange abnormalities and avert the need for intubation in individuals with kyphoscoliosis presenting with respiratory failure. [6]

In this research total 50 (100%) members were included, majority (38%) were in 51 – 60 years, mean age was 56.82 ± 9.36 yrs. The male female ratio was 4. These findings were almost similar to the reported studies. [7, 8] In the study conducted by Verma et al. [9] a majority of the participants fell within the 41-59 age range and exhibited acute causes of respiratory failure, encompassing both Type I and Type II cases. The lower female representation in this study could be explained by the fact that many females with COPD experienced milder exacerbations, with only slight deviations in pH and PaCO₂ from normal values at the time of presentation. Some females declined consent for NIV, and only those meeting the ABG criteria and other eligibility criteria were included in the study.

In our study cohort of acute exacerbation of COPD, NIV demonstrated success in 83.3% of patients. A study by Verma et al. [9] in a northern Indian ICU reported a success rate of 90% with NIPPV, while Umberto Meduri et al. [10] found a success rate of only 66% in a comparable group of hypercapnic patients. The outcomes from our study align with findings from previous studies. [9, 11, 12]

In our study, the dyspnea score exhibited improvement, decreasing from 9.08±1.14 at baseline to 7.38±1.68 (p<0.0001) at 1 hour. Barbe et al. [13] noted a significant reduction in dyspnea during hospitalization at 72 hours, 80 hours, and discharge in patients treated with NIV. Keenan et al. [14] observed that the BORG index at 1 hour and day 2 showed significant improvement in the NIV-treated group. The findings in our study regarding the enhancement of dyspnea scores align with the results of these earlier studies. [13, 14]

In the present study it was observed that RR at baseline was significantly higher in the patients who failed NIPPV (33.7±4.6 vs 37.56±2.4 (P<0.001). In the current study, NIPPV led to improvements in ABG analysis parameters, specifically pH and PaO₂, at 4, 12, and 24 hours in the study members when compared to baseline. For patients with type II respiratory failure, NIPPV resulted in enhancements in pH, PaO₂, and PaCO₂ at the end of 4, 12, and 24 hours compared to baseline. Ventrella et al. [15] supported these findings, and a study by McLaughlin et al. [16] reported improvements in ABG parameters, specifically pH and PaCO₂, at the end of 1 and 4 hours compared to baseline in patients.

The findings in the current study suggest that NIPPV is a promising therapeutic approach for managing selected patients experiencing exacerbations of COPD with respiratory acidosis. The study revealed a relatively lower respiratory rate at baseline and a significant improvement in clinical and blood gas parameters within the first hour of initiating NIPPV, indicating a favorable response. However, additional studies are necessary to validate these findings and assess other potential predictors of success for better outcomes with NIPPV.

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