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Efficacy of Non Invasive Ventilation Techniques in Acute Respiratory Failure

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Abstract: One of the leading causes of hospitalization, illness, and mortality globally is acute respiratory failure (ARF). One of the major causes of chronic obstructive pulmonary disease (COPD) is acute exacerbations, which provide a significant barrier to therapy. Improving patient outcomes while reducing the need for intrusive mechanical breathing requires effective management methods, such as non-invasive ventilation (NIV). The purpose of this research was to compare the effectiveness of conventional treatment for ARF caused by AECOPD with that of non-invasive ventilation administered via a portable device. Seventy patients hospitalized to Saudi Arabia's Buraidah Central Hospital with ARF as a result of AECOPD were the subjects of a prospective cohort research. One group of patients received standard treatment, whereas the other group received NIPPV, or non-invasive positive pressure breathing. While mortality rate, co-morbidities, length of stay in the intensive care unit, and longevity of NIV usage were secondary objectives, NIPPV failure was the major result. The patients' average age was 61.08, and 86% of them were men. The success rate of the NIPPV group was 74%, which was significantly greater than the conventional treatment group's rate of 54%. The leading cause of NIPPV failure was deteriorating arterial blood gases (33%), whereas the most common consequence was face skin abrasion (17%). Acute exacerbation of chronic obstructive pulmonary disease (AECOPD) patients who are experiencing acute respiratory failure may benefit from NIV as a first-line treatment. It is already an essential part of ARF therapy, and its link to reduced mortality, fewer intubation rates, and quicker acidosis correction just adds to that.

Keywords: Acute respiratory failure (ARF), acute exacerbation of COPD (AECOPD), non-invasive positive pressure ventilation (NIPPV), non-invasive ventilation (NIV)

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INTRODUCTION

The inability of the respiratory system to sustain sufficient gas exchange leads to the potentially fatal disease known as acute respiratory failure (ARF). A combination of hypoxemia and hypercapnia, or neither of these, might result from this failure. Despite advances in medicine resulting in higher death rates, it remains a leading cause of hospitalizations and ICU visits worldwide [1]. Acute respiratory distress syndrome (ARDS), pneumonia, cardiogenic pulmonary edema, pulmonary embolism, and chronic obstructive pulmonary disease (COPD) are among the many potential causes of acute respiratory failure (ARF).

Non-Invasive Ventilation (NIV): An Evolving Therapeutic Strategy

Instead of using an intrusive artificial airway, ventilator assistance is provided via external interfaces (e.g.,

a face mask, nasal mask, or helmet) in the technique known as non-invasive ventilation (NIV). Recently, NIV—noninvasive mechanical ventilation—has emerged as a cornerstone of ARF therapy [2]. Its many benefits over invasive mechanical ventilation (IMV) are the main reasons for this, including a reduced mortality rate, a shorter ICU stay, and a decreased incidence of ventilator-associated infections [3].

Clinical Relevance in COPD Exacerbations and Other Causes of ARF

Researchers have demonstrated that non-invasive ventilation (NIV) may effectively correct acidosis, boost oxygenation, and reduce the need for intubation in patients having acute exacerbations of chronic obstructive pulmonary disease (AECOPD) on many occasions [4]. Furthermore, new studies show that hypoxemic extracorporeal membrane oxygenation (ARF) may be helpful in some cases, like pneumonia and ARDS, especially when delivered through more contemporary interfaces like helmets [5]. These findings show that NIV has more potential uses in ARF than previously thought.

Variations in smoking behaviors and other environmental variables are likely to blame for much of the increase in the prevalence of chronic obstructive pulmonary disease (COPD) and acute respiratory failure (ARF) in Saudi Arabia [6]. Uneven adoption persists even after proving the NIV's benefits. This is so regardless of how critical local data is for guiding therapeutic treatment. One way to learn more about how to reduce the need for intensive care units (ICUs), improve patient mortality, and reduce complications is to compare the outcomes of non-invasive ventilation (NIV) with those of standard therapy in Saudi hospital settings.

OBJECTIVES

1. To investigate the relative efficacy of non-invasive ventilation (NIV) and standard therapy in improving clinical outcomes for individuals with acute respiratory failure.
2. To evaluate how NIV affects hospitalized patients with ARF in a Saudi hospital context in terms of intubation rates, mortality, and comorbidities.

RESEARCH METHODOLOGY

For the purpose of this prospective cohort research, the intensive care unit (ICU) was located at Buraidah Central Hospital (BCH), which is located in the Al-Qassim region of Saudi Arabia. A group of patients who were hospitalized owing to acute respiratory failure (ARF) were recruited to participate in the investigation. Comparing standard therapy with non-invasive ventilation (NIV) methods was the major objective of this research, which aimed to improve clinical outcomes for patients diagnosed with atrial fibrillation as the primary focus.

Inclusion and Exclusion Criteria

Participants required having symptoms of either type I (hypoxemic) or type II (hypercapnic) respiratory failure in their clinical and laboratory examinations. Along with that, individuals needed to have a medical background that included asthma, COPD, pneumonia, or ARDS. We sought for patients who met the following criteria for this study: a respiratory rate that was more than thirty breaths per minute, PaO2 levels that were lower than sixty millimeters of mercury on room air, PaCO2 levels that were higher than fifty

millimeters of mercury with a pH that was lower than seven point three, and blood bicarbonate levels that were either normal or elevated. Additionally, patients required being awake, but with a slight to severe impairment; in addition, they needed to exhibit signs of respiratory encephalopathy, such as lethargy, disorientation, or flapping tremors. Patients who required immediate intubation, had hemodynamic instability (such as low blood pressure or an irregular pulse), had upper airway obstruction, had facial injuries, had copious secretions, had intolerance to mask fitting, had tracheotomy, refused non-invasive breathing, and so on were all excluded from the study.

Demographics and Clinical Data

A comprehensive clinical examination was performed on each and every patient as soon as they were admitted. Symptoms of respiratory distress that were emphasized throughout the examination were dyspnea, cyanosis, the use of auxiliary muscles, and changes in mental state. These were the primary symptoms of respiratory distress. Patients who were unable to give a complete history were sent to their immediate family members for assistance. Aside from the standard clinical metrics like pulse, respiration rate, and arterial blood gas (ABG) values (pH, PaCO2, PaO2, and SaO2), we also recorded the patient's gender, age, and other demographic details. For the purpose of monitoring the progression of these parameters over time, they were measured three times: once at the beginning of the study, once after the first 12 hours of treatment, and once again on the second day.

Study Groups

Two groups were formed from the individuals who took part in the research. Patients who could not or did not choose to have non-invasive ventilation upon arrival made up the first group, formerly known as the conventional treatment group. Antibiotics, bronchodilators, corticosteroids, anticoagulants, oxygen therapy, the avoidance of stress ulcers, and the repair of electrolyte imbalances were all components of the traditional medical care that was administered to these patients. Additionally, the second group, which was referred to as the NIV group, was provided with non-invasive ventilation via the use of a portable ventilator in addition to the standard therapy. NIV was administered to patients while they were positioned in bed at a 30-45 degree tilt. Patients were also wearing full-face masks. Through the process of titrating the aspiratory and expiratory positive airway pressures, also known as IPAP and EPAP, respectively, the gas exchange and patient comfort, respectively, were maximized.

Study Outcomes

The most significant outcome of the experiment was a failure of the non-invasive ventilation (NIV) technique, which was defined as the need of endotracheal intubation due to the presence of rising hypercapnia, persistent hypoxemia, or a decrease in mental status within fifty minutes after initiating the NIV technique. The total number of hours that the non-invasive ventilation (NIV) was used, the number of days that the patient was in the intensive care unit, the changes in arterial blood gas (ABG) values, the overall mortality rate, and any problems that were associated with the use of the NIV, such as skin abrasions, stomach distension, or intolerance to the mask interface, were included as secondary outcomes. When it came to determining whether or not intubation was required, the professional judgment of the attending physician became the decisive factor in every single case.

Sample Size Calculations

Epitools Epidemiological Calculators were used in order to determine the sample size [7]. The following assumptions were utilized in order to arrive at the sample size: 80% statistical power, 90% confidence interval, estimated relative risk of 5, predicted incidence of 0.055 among persons who had not been exposed to the virus. Taking all of these considerations into account, we were able to ascertain that a sample size of 66 patients, with 33 patients belonging to each group, would be sufficient. Patients who met the inclusion and exclusion criteria were recruited using a suitable sampling technique until the target sample size was reached. This process continued until the desired sample size was reached.

Statistical Analysis

For statistical analysis, percentages and frequencies were used to represent categorical data, while the mean plus or minus the standard deviation (SD) was used for continuous variables. This study used the independent T-test to compare continuous variables across groups. However, for categorical data, the Chi-square ($\chi 2$) test was used. The statistical significance of a p-value below 0.05 was established. All of the analyses were conducted using SPSS, or the Statistical Package for the Social Sciences.

RESULT AND DISCUSSION

Patient demographics and clinical information

The male gender predominated among the AECOPD patients who took part in this study. When comparing the gender distribution of the groups given NPPV and traditional medicine, no statistically significant difference was found. In a similar vein, the mean age of patients in both groups was almost same, which is evidence of adequate baseline comparability (Table 1). The elimination of selection bias and the strengthening of the validity of outcome comparisons are both achieved via this alignment in demographic features.

Table 1. Patient demographics and clinical information (N = 70)

Variable	NPPV (n = 35)	%	Standard (n = 35)	%	P-value
Gender					
Male	30	86	29	83	0.74
Female	5	14	6	17	
Age (years)	61.08 ± 5.56	–	61.05 ± 4.62	–	0.9

Clinical follow-up with the patient upon admission, twelve hours later, and on the second day:

Upon admission to the study facility, neither group showed any statistically significant changes in HR,

MAP, RR, pH, PaCO2, PaO2, or SaO2. Still, significant improvements in clinical outcomes were seen throughout the follow-up:

- **Heart Rate (HR):** When compared to the control group, the NPPV group had better hemodynamic stability, as shown by a marked and gradual decrease in HR at 12 hours and on day two.
- **Respiratory Rate (RR):** Reduced respiratory effort was shown by a significant decrease in RR at 12 hours and the second day in patients treated with NPPV.
- **PH and $PaCO_2$:** When compared to usual treatment, NPPV effectively reduced hypercapnia and reversed acidosis, demonstrating its usefulness in controlling ventilator failure.
- **PaO_2:** In contrast to the control group's mild gains, the NPPV group's oxygenation levels were much greater.
- **SaO_2:** By the second day, the NPPV group had a greater SaO_2, even though there was no significant difference at admission or 12 hours.

In acute COPD exacerbations, the results in Table 2 demonstrate that non-pharmaceutical pressure ventilation (NPPV) produces physiological stabilization more rapidly than traditional treatment.

Table 2. Clinical follow-up with the patient (at admission, 12 hours, and 2 days)

Variable	Time Point	NPPV (n=35) Mean ± SD	Standard (n=35) Mean ± SD	P-value
Heart Rate (HR)	Admission	105.84 ± 6.75	107.68 ± 7.46	0.393
	12 Hours	88.42 ± 5.13	97.42 ± 7.20	0.001
	Second Day	84.73 ± 5.40	92.57 ± 5.02	0.001
Mean Arterial Pressure (MAP)	Admission	98.99 ± 8.65	98.91 ± 8.78	0.973
	12 Hours	94.36 ± 5.74	94.24 ± 4.87	0.944
	Second Day	94.04 ± 3.42	94.48 ± 2.72	0.645
Respiratory Rate (RR)	Admission	32.15 ± 2.18	32.26 ± 2.55	0.878

	12 Hours	21.92 ± 2.44	26.94 ± 2.46	0.001
	Second Day	21.11 ± 2.25	24.26 ± 2.18	0.001
pH	Admission	7.28 ± 0.024	7.28 ± 0.024	1.000
	12 Hours	7.35 ± 0.037	7.31 ± 0.027	0.001
	Second Day	7.37 ± 0.029	7.33 ± 0.016	0.001
$PaCO_2$ (mmHg)	Admission	74.03 ± 10.87	74.73 ± 9.85	0.826
	12 Hours	59.61 ± 7.05	66.57 ± 8.96	0.001
	Second Day	54.80 ± 6.46	63.42 ± 7.91	0.001
PaO_2 (mmHg)	Admission	52.11 ± 7.11	52.00 ± 6.35	0.955
	12 Hours	74.73 ± 12.31	62.36 ± 5.05	0.001
	Second Day	72.73 ± 12.94	61.78 ± 6.18	0.001
SaO_2 (%)	Admission	80.38 ± 7.85	81.52 ± 6.31	0.604
	12 Hours	91.34 ± 10.15	89.21 ± 2.48	0.232
	Second Day	92.46 ± 4.31	90.36 ± 2.85	0.019

Secondary Patient Outcome

The NPPV group showed a lower mortality rate (6% vs 14%), despite the fact that the difference did not reach the level of statistical significance and was thus lost. It is important to note that the NPPV group had a much shorter stay in the critical care unit (mean 3.73 days) compared to the regular group (mean 5.89 days), which highlights the potential role that NPPV may play in reducing the burden on healthcare

distribution networks. In addition, following treatment, 74% of patients in the NPPV group had an improvement in their condition, while only 54% of patients in the control group experienced such an improvement. Despite the fact that the difference was not statistically significant, clinical implications indicate that non-invasive positive pressure ventilation (NPPV) is more successful than invasive ventilation in averting invasive breathing and boosting outcomes (Table 3).

Table 3. Secondary Patient Outcomes

Variable	NPPV (n = 35)	%	Standard (n = 35)	%	P-value
Mortality					
Died	2	6	5	14	0.232
Survived	33	94	30	86	
ICU Stay (days)	3.73 ± 1.11	–	5.89 ± 1.48	–	0.001
Treatment Outcome					
Succeeded	26	74	19	54	0.081
Failed	9	26	16	46	

Note: Data are expressed as number of patients (%) or mean ± SD. NPPV = Noninvasive positive pressure ventilation

Issues and Reasons for NPPV Failure

Uncooperativeness (22% of patients), decreased awareness (22% of patients), and severe respiratory distress (22% of patients) were the next most common causes of non-pulmonary pulmonary ventilation (NPPV) failure. The most common cause of NPPV failure was a decrease in arterial blood gases (33% of patients). Skin abrasions on the face were the most often reported effects in both successful cases (5.7%) and failed cases (11.4%). Patients who were not compliant and had complications such as stomach distention, air leakage, eye pain, and discomfort were also seen. Because of these relatively minor issues, it is essential to ensure that masks are correctly fitted, that patients are educated, and that they are continuously monitored while they are undergoing NPPV (Table 4).

Table 4. Issues and Reasons for NPPV Failure (n = 35)

Variable	No. of Patients	%
Causes of NPPV Failure		
Uncooperating	2	22.0
Deterioration of ABGs	3	33.0
Deterioration of consciousness	2	22.0
Exaggerated respiratory distress	2	22.0
Complications in Successful NPPV		
Facial skin abrasion	2	5.7
Eye irritation	2	5.7
Gastric distension	1	2.8
Air leakage	2	5.7
Uncooperation	1	2.8
Complications in Failed NPPV		
Facial skin abrasion	4	11.4
Eye irritation	3	8.6
Gastric distension	1	2.8
Air leakage	3	8.6
Uncooperation	4	11.4

Note: ABGs = Arterial Blood Gases; NPPV = Noninvasive positive pressure ventilation.

Comparing the NPPV Group's Successful and Failed Cases

There were significant differences in the physiological characteristics of the NPPV cases that were successful compared to those that were not successful. Cases that were unsuccessful were characterized by the presence of older patients, higher HR, RR, and PaCO2 levels upon admission and during the duration of follow-up, and delayed pH correction. In addition, patients who did not recover required further time in the critical care unit as well as increased pressures during inhalation and exhalation (also known as IPAP and EPAP treatments). On the basis of these data, it would seem that the failure of non-pulmonary pulmonary ventilation (NPPV) is highly predicted by advanced age, persistent hypercapnia, and higher initial respiratory and hemodynamic stress. NPPV was a viable option that had a higher probability of being effective for patients who had positive early responses in pH, PaCO2, RR, and HR.

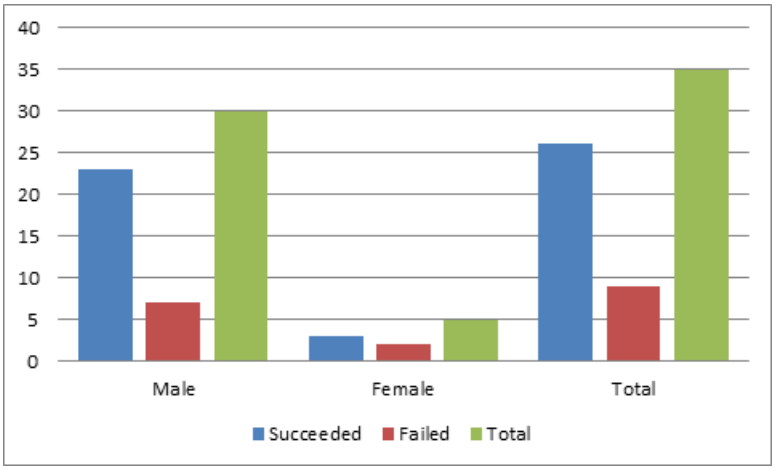

Figure 1. Comparison of Successful and Failed Cases by Gender in the NPPV Group.

The majority of patients who underwent NPPV and were successful were much younger than those who did not have success. This was the case in terms of age. Based on the findings of the statistical analysis, it was shown that the HR mean of the NPPV success group declined at a faster rate than that of the NPPV failure group at admission, 12 hours, and day 2 respectively. When compared to the NPPV failure group, the NPPV success group saw a statistically significant decrease in the mean MAP at the time of admission. According to the findings of the statistical analysis, the NPPV success group saw a higher drop in RR than the NPPV failure group did at the time of admission, 12 hours later, and on day two. When compared to the NPPV failure group, the NPPV success group had a considerably higher mean pH at admission, 12 hours, and on day two. This difference was statistically significant. The mean PaCO2 values of the NPPV success group were considerably lower than those of the NPPV failure group at the time of admission, 12 hours after admission, and during the second day after admission.

The NPPV success group saw a larger rate of rise in mean PaO2 levels at 12 hours compared to the NPPV failure group, and this tendency remained throughout the second day of the study. In the group that did not have a successful NPPV, the PaO2 mean rose at a faster pace than in the group that had a successful NPPV. During the first twelve hours of the experiment, the mean SaO2 levels in the NPPV success group were considerably greater than those in the NPPV failure group. However, by the end of the second day, the difference had vanished. While the NPPV success group saw a slower rate of rise in the mean SaO2 level, the NPPV failure group experienced a faster rate of increase. When compared to the NPPV success group, the NPPV failure group had an average length of stay in the intensive care unit that was much

longer. According to the findings of the statistical analysis, the group that did not get NPPV had a greater increase in their mean IPAP level than the group that received NPPV. According to the findings of the statistical analysis, the group that did not get NPPV had a greater increase in their mean EPAP level than the group that received NPPV. When compared to the group that was successful with NPPV, the group that was unsuccessful with NPPV showed a statistically significant increase in the mean number of hours that they really used NPPV (Table 5).

Table 5. Comparing the NPPV Group's Successful and Failed Cases

Variable	NPPV Succeeded (n = 26) Mean ± SD	NPPV Failed (n = 9) Mean ± SD	P-value
Age (years)	58.73 ± 4.24	67.88 ± 2.26	0.001
Heart Rate (HR)			
At Admission	105.84 ± 6.75	121.66 ± 6.10	0.001
At 12 Hours	88.42 ± 5.13	109.77 ± 4.50	0.001
Second Day	84.73 ± 5.40	102.55 ± 9.80	0.001
Mean Arterial Pressure (MAP)			
At Admission	98.99 ± 8.65	109.95 ± 9.50	0.003
At 12 Hours	94.36 ± 5.74	98.65 ± 8.48	0.098
Second Day	94.04 ± 3.42	93.92 ± 4.06	0.271
Respiratory Rate (RR)			
At Admission	32.15 ± 2.18	34.22 ± 2.33	0.022
At 12 Hours	21.92 ± 2.44	29.55 ± 1.94	0.001
Second Day	21.11 ± 2.25	26.11 ± 3.58	0.001
pH			

At Admission	7.28 ± 0.024	7.24 ± 0.033	0.001
At 12 Hours	7.35 ± 0.037	7.21 ± 0.085	0.001
Second Day	7.37 ± 0.029	7.27 ± 0.097	0.001
$PaCO_2$ (mmHg)			
At Admission	74.03 ± 10.87	79.44 ± 9.90	0.016
At 12 Hours	59.61 ± 7.05	94.66 ± 31.40	0.001
Second Day	54.80 ± 6.46	64.88 ± 14.50	0.007
PaO_2 (mmHg)			
At Admission	52.11 ± 7.11	47.88 ± 7.16	0.130
At 12 Hours	74.73 ± 12.31	63.00 ± 9.65	0.014
Second Day	72.73 ± 12.94	77.00 ± 13.00	0.040
SaO_2 (%)			
At Admission	80.38 ± 7.85	74.77 ± 8.70	0.081
At 12 Hours	94.34 ± 10.15	87.44 ± 9.70	0.008
Second Day	92.46 ± 4.13	94.00 ± 5.54	0.023
ICU Stay (days)	3.73 ± 1.11	7.22 ± 1.64	0.001
IPAP (cm H_2O)	13.65 ± 1.71	18.77 ± 1.98	0.001
EPAP (cm H_2O)	5.11 ± 0.76	7.11 ± 0.78	0.001
NPPV Duration (hours)	26.15 ± 7.58	33.00 ± 9.84	0.038

Note: Data are expressed as mean ± SD. NPPV = Noninvasive positive pressure ventilation; IPAP =

Inspiratory positive airway pressure; EPAP = Expiratory positive airway pressure

DISCUSSION

In the event that the respiratory system is unable to maintain adequate gas exchange, as shown by PaO2 levels that are lower than 60 mmHg and/or PaCO2 values that are higher than 50 mmHg, this condition is referred to as respiratory failure. In the event that arterial blood gas abnormalities are identified, respiratory failure is classified as either Type I or Type II [8]. The symptoms of dyspnea and acute respiratory failure are among the top five causes why individuals visit the emergency room according to [9]. Hypoxia and hypercapnia, which are both symptoms of respiratory failure, have the potential to induce dysfunction in a number of organs, which highlights the need of immediate management. The provision of ventilatory support is an important element of traditional respiratory treatment, and oxygenation is a crucial strategy for extending the patient's life. On the other hand, sedation is often required for invasive mechanical ventilation, which means that patients are required to remain in the critical care unit for a longer period of time and are at a greater risk of contracting infections from the ventilator [10].

For the purpose of this study, seventy patients who were diagnosed with AECOPD and were admitted to the critical care unit at Buraidah Central Hospital in the Alqasim Area were evaluated. The ages of the patients varied from 51 to 71 years old, and there were 59 men and 11 females among them. The primary objective was to identify straightforward markers of the success or failure of NPPV, assess the efficiency of the procedure in treating issues related to gas exchange, and eliminate the need for endotracheal intubation. A prospective cohort research was conducted in which the outcomes of traditional oxygen therapy were compared to those of non-invasive pulmonary ventilation (NPPV) delivered by the use of a portable non-invasive ventilator. When compared to conventional therapy alone, our findings indicate that non-invasive peripheral pulmonary ventilation (NPPV) significantly improved patient outcomes, reduced the number of patients who required intubation, and shortened the amount of time spent in the critical care unit.

When comparing the results of the NPPV group to those of the conventional treatment group, the comparisons were more believable since the demographics of both groups were comparable. In accordance with the findings of Schmitt et al. [11], the majority of patients in both the NIV (59%) and conventional oxygen therapy (58%, P = 0.99) groups were male. According to the research that has been conducted, women who have severe chronic obstructive pulmonary disease (COPD) are more likely to be hospitalized and to pass away as a result of respiratory failure. Furthermore, smoking is associated with an approximately fifty percent higher chance of developing COPD in comparison to men [12]. Approximately 61 years of age, which is the average age of the patients, is consistent with what is often seen in AECOPD [13]. As per the findings of prior study [14], the probability of experiencing acute COPD exacerbations increases by twenty percent for each decade of age.

One of the most important indicators of clinical improvement that is simple to see and keep track of is an improvement in vital signs. At the end of the first hour of the experiment, there was a statistically significant reduction in HR, MAP, and RR for both groups by comparison to the beginning of the experiment. Although there were no statistically significant differences between the MAP and NPPV groups, the NPPV group showed a much bigger decline in HR and RR from the first hour until the second

day. This was the case even though the MAP group showed no such changes. This outcome is consistent with the findings of Phua et al. [15], who discovered that COPD patients who were undergoing hypercapnic acute respiratory failure exhibited improvements in RR, HR, and systolic blood pressure one hour after receiving NIV. According to Liu et al. [16], the NPPV group showed significant decreases in HR and RR after just two hours, but the conventional therapy group needed 72 hours to exhibit comparable improvements. This was the case for the NPPV group. It is possible that the early recovery in vital signs in both groups may be attributed to medical treatment (bronchodilators, steroids, antibiotics, and oxygen therapy) that tackles reversible triggering mechanisms such as bronchospasm. When compared to the other groups, the NPPV group demonstrated superior improvement due to the fact that it increased tidal volume, lowered inspiratory muscle activity, and avoided respiratory muscle weariness. It was also discovered by Brochard et al. [17] and Wedzicha [18] that the RR dropped dramatically after one to two hours of beginning NIV treatment.

The analysis of arterial blood gas revealed that after one hour, there was a considerable improvement in pH, PaCO2, PaO2, and SaO2 in both groups. NPPV beat conventional therapy in terms of improvements to PaCO2, PaO2, and SaO2 from the first hour until the second day, although the change in pH became notably obvious after three hours. This indicates that NPPV was more effective than traditional treatment. As a consequence of the fact that Doshi et al. [19] saw a progressive drop in PaCO2 in the NIV group and Golmohamad et al. [20] discovered early improvements in pH and PaCO2 with NPPV, our findings are consistent with the findings of these researchers. Further, Liu et al. demonstrated that the NPPV group was able to achieve significant changes in PaCO2 and PaO2 in only two hours, but the conventional treatment group required a period of seventy-two hours to achieve the same results.

It is possible that the earlier improvement in PaO2 and SaO2 with NPPV may be explained by an increase in the concentration of inspired oxygen under positive pressure as well as improved breathing via perfusion matching. Alveolar ventilation that is enhanced leads to a rise in PaCO2 and pH, which in turn leads to an improvement in hypoventilation. The improvement of minute ventilation and the alleviation of hypercapnia that results from a rise in inspiratory pressure is achieved by the increase in tidal volume and the decrease in respiratory rate. These findings provide insight on the efficacy of non-invasive ventilation techniques in the treatment of acute respiratory failure. These techniques are able to rapidly improve gas exchange and clinical outcomes, hence reducing the need for invasive mechanical breathing and the associated complications.

CONCLUSION

The use of non-invasive positive pressure ventilation (NPPV) is a method that has the potential to be both safe and successful in the management of acute respiratory failure, particularly in patients who have AECOPD. Compared to standard oxygen therapy, non-pressurized pulmonary ventilation (NPPV) results in a number of advantages, including improved vital signs (heart rate and respiratory rate), gas exchange (PaO2, PaCO2, pH, and SaO2), a reduced need for endotracheal intubation, and shorter stays in the critical care unit. When the NPPV treatment is started at an earlier stage, rapid clinical and physiological benefits are seen. This is most likely due to the fact that there is less effort placed on the muscles that are responsible for inhalation, an increase in tidal volume, and improved ventilation-perfusion matching. On the

basis of these findings, non-invasive positive pressure ventilation (NPPV) need to be regarded as the first therapy for acute respiratory failure. This is because it lowers the risk of complications connected to invasive breathing and improves the patient's prognosis.

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