Original Article

Using of Noninvasive Ventilation for Iraqi Patients with Acute Respiratory Distress Syndrome (ARDS) Instead of Intubation

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Abstract

Aim of the Study: Using noninvasive ventilation, clinical data and outcomes of noninvasive ventilation in patients related to acute respiratory distress syndrome. **Study Limitation**: The Patients admitted to the trust are detected disease applying PCR tests from nasally and oral swabs for the period (10 January 2021 and 20- May-2022). Clinical data collecting on whole positive patients, including age, gender, co-illnesses, and residency in care homes besides the clinical management. **Materials and Methods:** In this trial, patients with acute respiratory distress syndrome are given noninvasive ventilation while wearing an orinasal mask. People with acute respiratory distress syndrome are clinically followed up by serial arterial blood gas analysis. This research evaluated the effectiveness of noninvasive ventilation at the time of using it, time spent in the hospital mortality and intensive care unit, and the improvement in clinical and blood gas markers. Noninvasive ventilation's success is measured by its ability to avoid endotracheal intubation. The ethical consideration **samples** chosen by participation are voluntary. People are given a choice and the ability to opt-out at any time, even if they've already agreed to take part in this study. **Results:** The study included 100 persons and 20 people who required intubated ventilation were excluded, bringing the study total number to 80 persons; there is a significant difference in levels of oxygen saturation (SpO_2, PaO_2/FIO_2 ratio, and repertory rate) (p value< 0.05) in patients with acute respiratory distress syndrome with NIV, during the maintenance days, especially between the first day and 5th day. **Conclusions:** The current study found that using non-invasive ventilation instead of intubation is possible, and more studies can be conducted on this topic.

Keywords: Acute Respiratory Distress Syndrome, Noninvasive Ventilation, Mechanical Ventilation.

Introduction

Noninvasive ventilation (NIV) is mechanical ventilation administered without the use of an invasive artificial airway (tracheostomy tube or endotracheal tube).[1] NIV may be provided using positive or negative pressure procedures. With the former, air is drawn into the lungs directly by applying positive pressure to the airway; with the latter, air is drawn into the lungs by using negative pressure to the belly and thorax. Since Noninvasive Positive Pressure Ventilation (NPPV) is the noninvasive approach most frequently employed to sustain acute patients.[2] The range of disorders that can be successfully treated with NPPV, the settings in which it is used, and the goals that can be attained have all increased significantly during the past 20 years in all parts of the world.[3] Acute respiratory distress syndrome (ARDS) is a clinical condition marked by severe hypoxia, widespread pulmonary opacities, and sudden respiratory failure without overt cardiac dysfunction.[4] ARDS is classified as severe (PaO_2/FiO_2 ratio & 100 mmHg), moderate (PaO_2/FiO_2 ratio >100 & 200 mmHg), and mild (PaO_2/FiO_2 ratio > 200 & 300 mmHg) depending on the degree of hypoxemia. Mortality reaches 27% in mild ARDS and 45% in severe ARDS as ARDS severity increases.[5] Depending on the underlying an etiology, ARDS is further divided into pulmonary and extra-pulmonary categories.[6] In addition to treating the underlying cause, ARDS care includes correcting hypoxemia through additional oxygen or positive pressure

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breathing.[7] Acute respiratory distress syndrome (ARDS) is a devastating complication of severe sepsis, from which patients have high mortality. Endotracheal intubation is one invasive approach to administer positive pressure breathing. The gold standard of care for treating ARDS is invasive mechanical ventilation, which has been shown to lower mortality.[8] The incidence average of ventilator-associated pneumonia, volutrauma, barotrauma, and other consequences are however linked to invasive ventilation. These issues may be avoided by using noninvasive ventilation (NIV).[9] The therapy of acute respiratory failure, mainly caused by acute cardiogenic pulmonary edema and acute exacerbations of chronic obstructive pulmonary disease, benefits significantly from NIV.[10] NIV increases oxygenation in hypoxemic respiratory failure, lessens dyspnea, relieves respiratory muscle strain, and may help patients avoid invasive mechanical ventilation.[11] Data on the function of noninvasive ventilation from the underdeveloped world is scarce. [12] This study predicted that people with ARDS might benefit from using NIV rather than intubation. The study aims to evaluate using noninvasive ventilation in acute respiratory distress syndrome instead of intubation.

Patients and Methods

Study Design, Setting, and Time

The interventional study was conducted in the ICU of the Anesthesia Department of Baghdad Teaching Hospital, Medical City Complex, Baghdad, Iraq, during a period of two months from (March to May 2020). The ethical consideration samples chosen by participation are voluntary. People are given a choice and the ability to opt-out at any time, even if they've already agreed to take part in this study.

Study Population and Sample Size

The study included 100 adult patients aged between (20-95) years diagnosed by doctors with ARDS since they are in addition to being infected with other diseases, including diabetes, hypertension, heart or kidney diseases, etc. Clinicians select Patients for continuous positive airway pressure (CPAP) devices due to the unit protocol at the time. Machines of CPAP are ResMed Air sensing equipment designed for delivering CPAP as air-used pumps in machines of CPAP. Oxygen is given at (10–15 L / min) via the face masks through a port in the face masks. This provides an estimate of 50%–70% fractional inspiring oxygen differing due to the oxygen flowing and pressure of CPAP.[13] The Caregiver's skills and their experiences extent in using of NIV are essential to this technique's success. Consequently, as the caretakers' skills improve, they might be capable of successfully treating very sick patients. Besides, the protocols usage as guiding usage might develop appropriate patient selection. Clinical data collecting on whole-positive patients includes age, gender, co-illnesses, and residency in care homes, besides clinical management. Vital signs are taken from the patient's entry for a period of two weeks. These signs are temperature, pulse rate, respiratory rate (RR), blood pressure, and the percentage of arterial oxygen saturation (SPO_2), the saturation that can be taken through the blood, and that is through the arterial blood gas (ABG) test.

Protocol

NIV is administered to study patients using Servoi universal, Maquet, and Getinge ICU ventilators in order to get a clinical response in the relief form from dyspnea, Starting NIV settings, CPAP, Usual settings are 5, 7.5 or 10 cmH20, BiPAP,The aim is to commence BiPAP at settings of 12cmH2O/4cmH2O (IPAP of 12, EPAP of 4) and escalate the IPAP: Start EPAP at 4 or 5 cmH2O Start IPAP at 10 cmH2O titrated rapidly in 2-5 cm increments at a rate of approximately 5cmH2O each 10 minutes with a usual pressure target of 20cms H2O or until a therapeutic response is achieved or patient tolerability has been reached.

Setting changes should be guided by serial ABGs and the respiratory or ICU teams should be involved to help guide this. a RR < 30 breaths/minute, a tidal volume of 6-8 ml/kg of ideal body weight, or a maximum IPAP of 20 cm of H_2O, NIV started with 6-8 cm of H_2O as an initial inspiratory positive airway pressure (IPAP). This IPAP was then gradually raised by two cm in order to reach a SpO_2 92% or a maximum EPAP of 10 cm of H_2O; EPAP started at 3–4 cm of H_2O and was finally raised by one cm of H_2O. Only for the purpose of consuming food and to clear oral secretions during the first 24 hrs. of NIV is the interconnection disconnected. The off-NIV duration then gradually extended based on the response. If patients are capable of maintaining SpO_2 92% on FiO_2 of 30% and an RR of 30 breaths/min, they are weaned off NIV. Dyspnea getting worse, hypoxemia getting worse or not getting better, Low oxygen tension in the arterial blood (PaO2) is due to the inability of the lungs to properly oxygenate the blood. Causes include hypoventilation, impaired alveolar diffusion, and pulmonary shunting. It is due to pump failure (heart is unable to pump enough blood, and therefore oxygen delivery is impaired).

RR staying above 35 breaths/minute, respiratory acidosis demonstrated, circulatory shock appearing, or altered sensorium, all considered signs of NIV failure, and the patient is then eligible for endotracheal intubation; yet, the ICU doctor retained sole authority over whether to intubate. The reasons for NIV failure are most often related to the inability to improve oxygenation capacity, inability to reduce dyspnea, mask discomfort, agitation, anxiety, hemodynamic instability, and progression of ARF

Statistical Analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS) version 26 at a p-value of and a p-value

Data presented as mean, standard deviation and ranges. Paired T-test is used to compare the continuous variables on admission and during maintenance days. A level of p-value less than 0.05 is considered significant.

Results

The patient's condition is monitored, and the treatment protocol started 15 days after the patient entered the intensive care unit, where the CPAP device is relied on for treatment. The results are as follows: this study results similar to the mortality of ARDS, reaching 27% in mild ARDS and 45% in severe ARDS as ARDS severity increases.[5] The Ratio of success of NIV is 80% from the study samples. scoring scale (HACOR score) consisted of Heart rate (beats/minute), acidosis (assessed by pH), consciousness (assessed by Glasgow coma score), oxygenation, and respiratory rate. A higher score indicates a higher risk for NIV failure. Patients with updated HACOR scores of ≤ 7, 7.5–10.5, 11–14, and > 14, respectively, were classified as having a low, moderate, high, and very high probability of NIV failure. This updated score provides a reference for clinical staff in decision-making.

There is a significant difference when comparing the oxygen saturation (SpO_2) in patients with acute respiratory distress syndrome and during the maintenance days, as shown in Table (1) and Figure 1. Table (2) and Figure 2 compared the (PaO_2/FiO_2) ratio in patients with acute respiratory distress syndrome and during the maintenance days. Table (3) and Figure 3 displayed a significant difference when comparing the respiratory rate in patients with acute respiratory distress syndrome and during the maintenance days.

Table 1: Means of SpO_2 During the Study Days.

	Mean ± SD						*p* Value
Days	**1**	**3**	**6**	**9**	**12**	**15**	
SPO_2	90.05±5.794 A	89.14±4.56 a	88.73±5.873 a	91.55±6.006 ab	93.41±3.85 B	95.45±2.405 B	**<0.0001****

NS: Non-significant, ** p < 0.01. Different letters (a,b,c,d) significantly differ among raw groups.

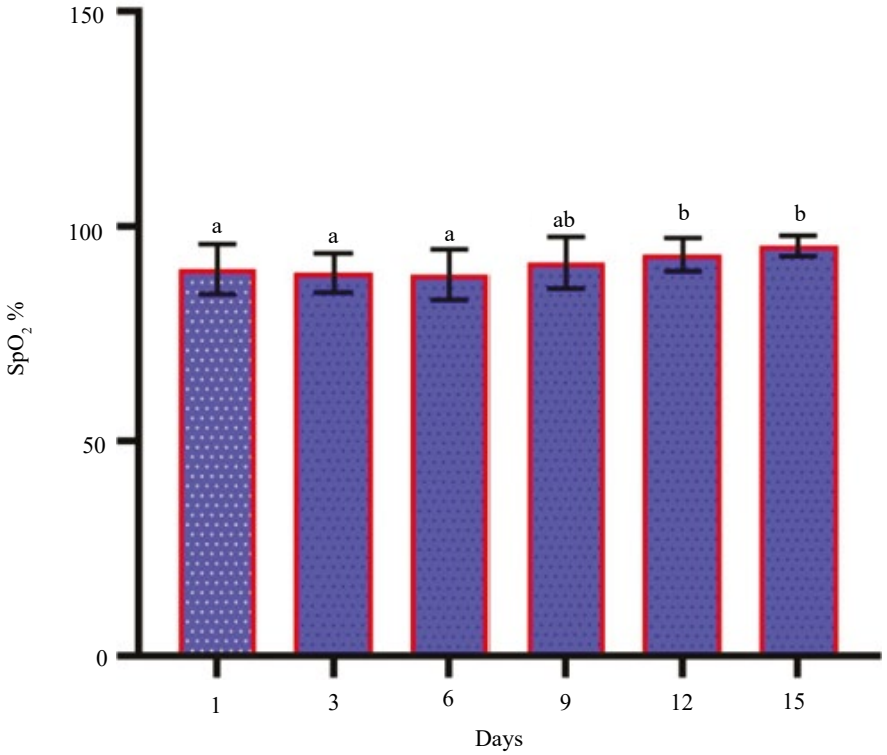

Figure 1: SpO_2 During the Study Days.

Table 2: Means of PaO_2/FiO_2 Ratio During the Study Days.

	Mean ± SD						*p* Value
Days	**1**	**3**	**6**	**9**	**12**	**15**	
PF	460.9±194.2 A	439.8±202.1 a	373.1±211.2 a	196.4±131.0 B	171.4±65.4 B	187.3±73.45 b	**<0.0001****

NS: Non-significant, ** p < 0.01. Different letters (a,b,c,d) significantly differ among raw groups.

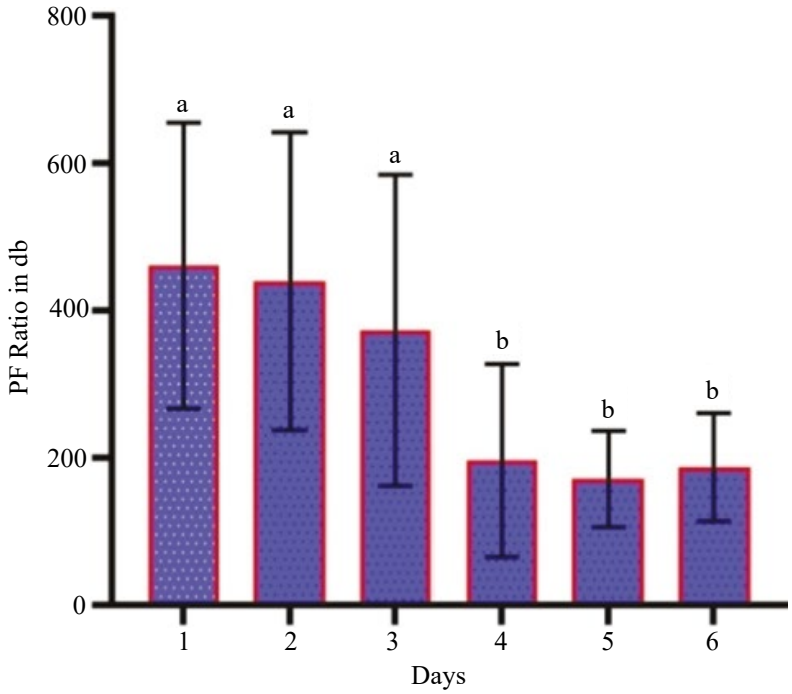

Figure 2: PaO_2/FiO_2 Ratio During the Study Days.

Table 3: Means of Repertory Rate During the Study Days.

	Mean ± SD						*p* Value
Days	**1**	**3**	**6**	**9**	**12**	**15**	
RR	35.05±8.931 A	35.18±7.519 a	34.41±7.353 a	33.45±7.507 a	31.09±8.518 ab	26.27±7.33 B	**0.0015****

NS: Non-significant, ** $p < 0.01$. Different letters (a,b,c,d) significantly differ among raw groups.

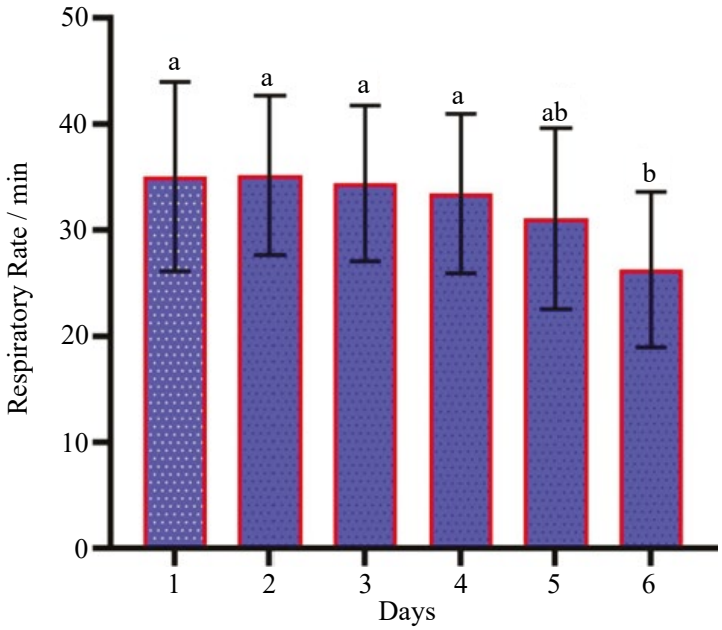

Figure 3: Repertory Rate During the Study Days.

Also, in this study, all patients are analyzed and noticed that the mean of SPO_2 is significantly increased after 15 days during the maintenance days (95.45 versus 90.05%, P= 0.001), while means of PaO_2/FiO_2 Ratio and RR are significantly decreased after the same duration (187.3 versus 460.9, P= 0.001, and 26.27 versus 35.05 breath/mint., P= 0.001 respectively) as shown in Table (4).

Table 4: Comparison in Certain Clinical Parameters During the Maintenance Days.

Variable	Time			P – Value
	Day 1 Mean ± SD	Day 6 Mean ± SD	Day 15 Mean ± SD	
SPO_2 (%)	90.05 ± 5.8	88.73 ± 5.873	-	**0.142**
	90.05 ± 5.8	-	95.45 ± 2.4	**0.001***
PaO_2/FiO_2 Ratio	460.9 ± 194.2	373.1 ± 211.2	-	**0.001***
	460.9 ± 194.2	-	187.3 ± 73.5	**0.001***
RR	35.05 ± 8.9	34.41 ± 7.4	-	**0.418**
	35.05 ± 8.9	-	26.27 ± 7.3	**0.001***

* Refer to p value <0.05 and p value <0.001 the value is significant.

Discussion

It is clear that there is a significant difference when comparing the oxygen saturation (SpO_2, PaO_2/FIO_2 ratio, and repertory rate) in ARDS patients and during the maintenance days, especially between the first day and the 15th day.

These results are consistent with noninvasive ventilation studies that are published; however, there haven't been many reports of data on transcutaneous CO_2 or oxygen saturation. However, SpO_2 monitoring is not used other than measurements of arterial blood gas tensions in the early phases of treatment. Multiple studies have demonstrated that oxygen levels improve quickly with and on this basis of monitoring of SpO_2.[14] So, monitoring SpO_2 is very helpful throughout the first 24 hours of treatment. SpO_2 should ideally be monitored continuously with the goal of maintaining saturation above 85% and additional oxygen as needed.[15] After starting noninvasive ventilation, SpO_2 should be regularly checked for at least 24 hours, and more oxygen should be given to keep saturation between 85% and 90%.[16] Also, given that the recommendations for using noninvasive ventilation in ARDS imply that its usage be restricted to moderate ARDS,[17] the finding of using noninvasive ventilation is similar throughout the ARDS severity groups is unexpected. Although noninvasive ventilation has a success rate of 78% in mild ARDS, this fell to 58% in intermediate ARDS and 53% in severe ARDS, in line with prior research.[18] Although immunosuppression/neoplastic disease patients as a subgroup have been demonstrated to benefit from noninvasive ventilation,[19] the presence of these diseases was not linked to higher noninvasive ventilation usage in our patients. Noninvasive ventilation use seems to be linked to several additional variables, including congestive heart failure, prior chronic obstructive pulmonary, and chronic renal failure disease. Although the Berlin definition explicitly accepts that patients using noninvasive ventilation can meet the criteria for an ARDS diagnosis, it is less apparent how the severity of ARDS should be assessed in these individuals, while some authors included noninvasive ventilation patients in the PaO_2/FIO_2 severity bands,[20] others believed that patients have PaO_2/FIO_2 levels less than 200 mmHg could not be divided using the Berlin criterion and therefore removed from the analysis.[21] The study findings corroborate the classification of noninvasive ventilation patients into severe, moderate, and mild groups using bands of PaO_2/FIO_2: patients with deteriorating ARDS categories had worse outcomes and required longer, more aggressive ventilator support.

The very high rate of delayed detection in ARDS patients is an interesting indication that doctors identified ARDS much more frequently in patients who failed noninvasive ventilation. In all ARDS categories, PEEP is lower in noninvasive ventilation patients (with a median value of 7 cm H_2O), and FiO_2 is more frequently used to treat hypoxemia. This conclusion is clinically significant since patients with moderate to severe ARDS are shown to fare better when more significant amounts of PEEP are used.[22]

This study's findings further draw attention to the negative impacts of control lack over respiratory drive, even if the use of lower PEEP may be considered intrinsic to the use of noninvasive ventilation due to restrictions in raising airway pressure due to higher respiratory rates and tidal volumes, noninvasive ventilation patients having higher minute ventilation. Moreover, tidal volumes exceeding 6-8 ml/kg of ideal body weight that is advised for lung-protective ventilation due to the fact that they are only measured in a portion of noninvasive ventilation; these statistics should be used with caution.

For the purpose of determining the treatment response early on, before other physiological measurements are collected, monitoring the heart and breathing rates is crucial.[23] Usually, breathlessness improvement is seen within (1–2) h and is accompanied usually by improvement in the neurological state.[24]

Conclusions

Through the current study, it is found the possibility of using non-invasive ventilation instead of intubation has been found, and needing more studies can be conducted on this topic.

The recommendation: Provide internal and external magazines, manual booklet, leaflets or training courses to the health care professionals working in the intensive care unit to enhance their care regarding noninvasive mechanical ventilation for preventing complications

such as infection and minimize the patient's exposition to endotracheal tube, besides organizing educational programs every six months for health care professional for promoting their knowledge and practices related with care of noninvasive ventilation in patients with acute respiratory distress syndrome, further studies on large sample of patients for better generalization, besides applying methods upon evidence base practice. The study included 100 persons and 20 people who required intubated ventilation were excluded, bringing the study total number to 80 persons; there is a significant difference in levels of oxygen saturation The first are surely cases on 10 January 2021 and 20- May 2022.

The clinical benefit of research is using NIV instead of intubation.

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