E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.02.420

Research Article

Effectiveness of Non-Invasive Ventilation in Preventing Intubation in Acute Respiratory Failure

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Received: 14.05.2026, Revised: 12.07.2026, Accepted: 19.07.2026

ABSTRACT

Objective: The purpose of this study was to assess the Outcomes Associated with Non-Invasive Ventilation (NIV) in the prevention of invasive mechanical ventilation in patients with severe respiratory distress.

Methods: This was an analytical cross-sectional study conducted at the Pulmonology Departments of Doctors Hospital and Farooq Hospital, Lahore. Overall, 160 Patients meeting the diagnostic criteria for acute respiratory failure were included in the study. With acute respiratory failure were included in the study using consecutive sampling. Patients were managed with NIV and monitored for outcomes including the need for intubation. Clinical parameters, comorbidities, and response to NIV were recorded. Statistical analysis was performed using SPSS software version 27, A p-value of <0.05 was considered statistically significant.

Results: Out of 160 patients, 104 (65%) showed successful response to NIV, while 56 (35%) required intubation. Patients with successful NIV had significantly higher PaO_2 and SpO_2 levels and lower respiratory rates compared to those who failed NIV ($p<0.001$). Severe hypoxemia, delayed initiation of NIV, and presence of comorbidities were significantly associated with NIV failure.

Conclusion: NIV is a valuable supportive modality that reduces the need for intubation in acute respiratory failure in reducing the need for intubation in acute respiratory failure, particularly when initiated early and applied to appropriately selected patients.

Keywords: Non-Invasive Ventilation, Acute Respiratory Failure, Intubation, Mechanical Ventilation, Respiratory Support.

INTRODUCTION

Disruption normal respiratory function, termed Acute Respiratory Failure (ARF), is a severe clinical condition associated with insufficient gas exchange, which causes hypoxemia and hypercapnia or both and is a major cause of admission to critical care units worldwide across the world [1,2].It is linked to a considerable disease burden and survival outcomes, especially in patients with underlying cardiopulmonary diseases, like COPD, pneumonia, and heart failure [3]. The growing burden of ARF emphasizes the need to implement timely and effective management to avoid the further development of the disease and enhance patient outcomes. Conventionally the overall management of severe cases of ARF has been through invasive mechanical ventilation by endotracheal intubation.

However, invasive ventilation is associated with several complications including complications like ventilator-associated infections, injury to the airway, and sedation-related side effects and extended hospital stay all of which can lead to higher health care expenditures and death rates [4,5]. The limitations have led to a greater concern over other less invasive interventions such as a non-invasive approach to assisted ventilation(NIV) that can potentially provide some useful respiratory support without creating the numerous complications

Non-invasive ventilation provides pressure-assisted ventilation via a mask interface thus preventing airway instrumentation and retaining natural defense mechanisms. Past research has shown that NIV enhances oxygenation, eases work of breathing as well as intubation requirements; especially among

individuals diagnosed with COPD attacks and cardiogenic fluid accumulation in the lungs commonly known as pulmonary edema [6-9]. Nevertheless, NIV does not always work, and its failurecan postpone the required intubation which can adversely affect the results [10,11].
Thus, it is important to determine the factors that relate to the success and failure of NIV to streamline clinical decision-making. This paper will analyze the efficacy of NIV in the prevention of intubation in individuals presenting with acute respiratory failure as well as predictors of its success and failure.

METHODOLOGY

The study is an analytical cross-sectional study that was performed in the Department of Pulmonology of Doctors Hospital and Farooq Hospital, Lahore in a period of six months. Consecutive non-probability sampling was used to enroll 160 patients with acute respiratory failure. The inclusion criteria included patients who had acute respiratory failure and who were not on ventilatory support and have clinical and laboratory evidence that they had acute respiratory failure.
The patients who were no them dynamically stable had impaired consciousness, facial trauma, or urgent need for intubation were excluded. All the patients were induced to NIV through standard procedures. Clinical measurements such as respiratory rate, oxygen saturation, arterial blood gases, and comorbidity weretaken. Patients werefollowed to assess treatment response and classify to NIV success (no intubation was needed) and NIV failure.
The SPSS version 27 was used in data analysis. Continuous variables were put in the form of means and SD and categorical variables in the form of frequencies and percentages. Chi-square and independent t-test were used. A p-value below 0.05 was used to indicate statistical significance

RESULTS

The differences were statistically significant, indicating better oxygenation in the NIV success group.
One hundred and sixty patients who had acute respiratory failure were included. The average age of participants was 58.4±14. 2years.The study population was 61.3 percent males. COPD (45%), pneumonia (30%), and cardiogenic pulmonary edema (25%), were the most prevalent underlying conditions.
Out of 160patients, 104(65%) showed successful response to NIV to NIV successfully and 56 (35) to intubation.

Table1: Comparison of Clinical Parameters

Variable	NIVSuccess (N=104)	NIVFailure (N=56)	P-Value
Pao_2(Mmhg)	72.4 ±8.2	58.6 ±7.5	<0.001
RespiratoryRate	22.3 ±3.5	29.1 ±4.2	<0.001
Spo_2 (%)	93.6 ±2.4	86.2 ±3.1	<0.001

Table2: Distribution of Outcomes

Outcome	Frequency (%)
NIVSuccess	104 (65%)
NIVFailure	56 (35%)
Total	160

Table3: Factors Associated with NIV Failure

Variable	Odds Ratio	95% CI	P-Value
Severe Hypoxemia	3.12	1.75–5.56	<0.001
DelayedNIV	2.48	1.34–4.59	0.003
Comorbidities	1.89	1.05–3.42	0.032

Severe hypoxemia and delayed NIV initiation were strong predictors of NIV failure.

DISCUSSION

This study has shown that NIV serves as an approach to prevent intubation in a significant percentage of patients experiencing acute respiratory failure, with an overall success rate of65%. This is in line with the past research reports of success rates of between 60 and 75 percent, which supports the use of NIV as a first-line therapying the right patient when used appropriately [6–9].
The fact that NIV can help enhance the process of gas exchange and decrease the amount of respiratory effort is important because it helps stabilize patients without exposing them to the

dangers of invasive ventilation. The fact that the oxygenation parameters and respiratory rate were significantly improved in patients who responded to NIV indicates that NIV has physiological advantages (reduced breathing work and increase alveolar ventilation) [13,14]. These results are consistent with prior research which has shown that NIV has not only better short-term clinical outcomes brutal so lessens mortality and length of hospital stay [15].

Timely NIV plays a crucial role in the achievement of these outcomes as timely intervention may lead to further deterioration of the respiratory system. Severe hypoxemia, slow initiation of NIV and comorbidities were also identified to be significant predictors of NIV failure in this study. These findings are consistent with the existing literature which points to the fact that advanced respiratory compromise patients are less likely to respond Tonon invasive support, and they are likely to be prone to early intubation [10,16].

Moreover, comorbidities may decrease physiological reserve and have an adverse effect on treatment outcomes [18,19]. Therefore, patients must be carefully selected and closely observed to offer a timely increase in care. And the clinical guidelines are oriented at the early re-assessment and an immediate transition to the invasive ventilation in case of necessity to prevent a bad outcome [20].

Limitations

The study had several limitations including a limited sample size and data collection from only two healthcare institutions, which may restrict the generalizability of the results. Furthermore, the cross-sectional design limited the ability to establish causal relationships and long-term clinical outcomes of patients receiving NIV were not evaluated.

CONCLUSION

Non-invasive ventilation has shown a good safety and efficacy profile in the management of acute respiratory failure and it has significantly reduced the use of intubation. Early initiation and appropriate patient selection areessential in achieving the best outcomes. Integration of NIV into the clinical practice can enhance patient prognosis and minimize complications of invasive ventilation.

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