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Study Of Role Of Non-Invasive Ventilation In Patients Of Overlap Syndrome Admitted With Acute Respiratory Failure In The Intensive Care Unit (ICU).

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ABSTRACT

This study aimed to evaluate the efficacy of non-invasive positive pressure ventilation (NIV) in patients with Chronic Obstructive Pulmonary Disease (COPD) and co-existing Obstructive Sleep Apnea-Hypopnea Syndrome (OSAHS) during acute exacerbation and type II respiratory failure. A total of 30 COPD patients with confirmed OSAHS were included. Patient characteristics, chest radiography, CT chest findings, and baseline arterial blood gas parameters were analyzed to compare NIV successful (n=22) and NIV failure (n=8) groups. Statistical analyses included P-values and Odds Ratios (OR). NIV success was associated with lower admission PaCO2 (61.35±11.47 vs. 77.5±14.07, p=0.0413), higher PaO2 (59.3±8.65 vs. 53.33±10.01, p=0.0491), and pH (7.301±0.04 vs. 7.213±0.09, p=0.0495). Radiographic and CT chest findings showed varying trends but did not reach statistical significance. Patients in the NIV failure group exhibited more significant respiratory acidosis and hypoxemia. In COPD patients with co-existing OSAHS experiencing acute exacerbation and type II respiratory failure, the success of NIV therapy appears closely linked to admission levels of respiratory acidosis and hypoxemia. Radiographic and CT chest findings demonstrated less consistent correlations. Personalized intervention targeting severe respiratory acidosis and hypoxemia may optimize NIV effectiveness.

Keywords: Non-Invasive Positive Pressure Ventilation, COPD, OSAHS, Acute Exacerbation, Type II Respiratory Failure.

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INTRODUCTION

The coexistence of chronic obstructive pulmonary disease (COPD) and obstructive sleep apnea (OSA), commonly referred to as "Overlap Syndrome," presents a complex and challenging clinical scenario [1]. This unique amalgamation of respiratory disorders results in a synergistic exacerbation of symptoms, leading to a heightened risk of acute respiratory failure and subsequent admissions to the Respiratory Intensive Care Unit (RICU). The management of such cases demands a comprehensive and tailored approach, with a particular focus on optimizing respiratory support techniques [2].

Non-invasive ventilation (NIV) has emerged as a crucial therapeutic modality in the management of acute respiratory failure across a spectrum of respiratory disorders. Its role in the Overlap Syndrome, however, remains a subject of ongoing investigation [3, 4]. The interplay between COPD and OSA pathophysiology underscores the potential benefits of NIV, offering a non-invasive means to alleviate both ventilatory and oxygenation disturbances. By providing ventilatory support without the need for invasive procedures, NIV holds the promise of reducing RICU admissions, intubation rates, and associated complications in patients with Overlap Syndrome experiencing acute respiratory exacerbations [5].

This study aims to delve into the role of non-invasive ventilation in patients with Overlap Syndrome admitted to the RICU due to acute respiratory failure [6]. By elucidating the impact of NIV on clinical outcomes, physiological parameters, and patient comfort within this specific population, we intend to contribute valuable insights to the existing literature. Such knowledge is vital for optimizing the management of Overlap Syndrome cases, ultimately enhancing patient care and refining the therapeutic strategies employed in the Respiratory Intensive Care Unit [7, 8].

MATERIAL AND METHODS

Our study was conducted within the Intensive Care Unit (ICU) for 2 years duration. The study adhered to the guidelines outlined by the Indian Council of Medical Research (ICMR) . Prior to participation, patients were provided with a clear explanation of the study's objectives and procedures in their native language, and their informed consent was obtained.

Patient Selection

- A total of 17 patients diagnosed with overlap syndrome based on overnight polysomnography and spirometry, and who were already undergoing domiciliary NIV treatment, were included in the study.

- Patients with COPD who were admitted with type II respiratory failure due to acute exacerbation and were stabilized clinically with NIV were screened for signs of obstructive sleep apnea-hypopnea syndrome (OSAHS). Clinical symptoms indicating OSAHS, such as witnessed apnea, loud snoring, excessive fatigue, daytime hypersomnolence, and an elevated Epworth Sleepiness Score (EPSS), were used to identify potential candidates. Patients suspected of suffering from OSAHS were further subjected to overnight polysomnography (PSG). Out of these, 13 patients displayed evidence of OSAHS based on polysomnography and were included in the study.

Inclusion Criteria

- Adults of either sex, aged above 30 years.
- Diagnosed cases of COPD admitted with acute type II respiratory failure, concomitant with overnight polysomnography-proven OSAHS.
- Apnea-Hypopnea Index (AHI) of ≥5.

Exclusion Criteria

- Patients with primary central nervous system or neuromuscular disorders.
- Patients with chronic renal, hepatic, hematological disorders, or cardiac failure.
- Individuals who underwent hip and knee replacement surgery.
- Patients with clinical evidence of peripheral vascular disease.
- Patients with a chronic history of alcoholism or drug addiction.

- Patients on long-term sedatives or antipsychotic medications.

Methodology

Clinical Evaluation: Detailed medical history and comprehensive physical examinations were performed, and the findings were documented using a predefined clinical proforma. Laboratory investigations encompassed routine blood tests and measurement of C-reactive protein (CRP) levels. Imaging studies included chest radiography and chest computed tomography (CT) scans, as indicated based on clinical evaluation.

RESULTS

The present study included 30 patients of COPD with co-existent overnight polysomnography (PSG) proven OSAHS(AHI≥5), admitted with acute exacerbation and type II respiratory failure.

Table 1: Physical characteristics of NIV successful group compared with NIV failure group patients

Parameters		NIV successful (n= 22)	NIV failure (n= 8)	P value	OR (range)
Age(yrs) [mean±SD]		63.8±8.1	64.5±10.14	0.86	-
BMI [mean±SD]		31.2± 7.9	29.3±5.8	0.288	-
Gender	Male	11	7	0.073	0.14 (0.02-1.36)
	Female	11	1	0.073	7 (0.74-66.8)
Smoker (% total)		45.45	62.5	0.34	0.5 (0.09-2.63)
Nonsmoker (% total)		54.5	25		
Biomass fuel exposure(% total)		31.81	0	0.288	3.27 (0.33-31.9)
Duration of disease(years)[mean±SD]		10.7±5.7	10.6±8.4	0.956	-

Table 2: Chest radiography and CT chest of NIV successful group compared with NIV failure group patients

Parameters	NIV successful (n=22)	NIV failure (n=8)	P value	ODD's risk ratio
Chest radiography				
Hyperinflation	50%	62.5%	0.425	0.6 (0.11-3.14)
Infiltrates	15%	62.5%	0.548	1.28 (0.23-6.96)
BV marking+	31%	25%	0.547	1.4 (0.22-8.7)
Consolidation	4.5%	12.5%	0.469	0.33 (0.02-60.6)
Cardiomegaly	4.5%	0%	0.259	0.28 (0.03-2.7)
CT chest				
Emphysema	50%	62.85	0.426	0.6 (0.11-3.14)
Bronchitis	45.4%	50%	0.574	0.83 (0.16-4.2)
Infiltrates(U/L)	9%	12.5%	0.62	0.7 (0.05-8.9)
Infiltrates(B/L)	27.2%	5%	0.23	0.37 (0.07-1.9)
GGO(U/L)	27.2%	50%	0.452	0.62 (0.11-3.4)
GGO(B/L)	9%	12.5%	0.62	0.7 (0.05-8.9)
Consolidation(U/L)	13.6%	37.5%	0.175	0.26 (0.04-1.72)
Consolidation(B/L)	4.5%	12.5%	0.468	0.33 (0.02-6.06)

Key: GGO- Ground glass opacity

Table 3: Baseline ABG parameters (mean ± SD) in NIV successful group compared with NIV failure group patients

Parameter	NIV Successful (n=22)	NIV failure(n=8)	p' value
PaO2	59.3±8.65	53.33±10.01	0.0491
PaCO2	61.35±11.47	77.5±14.07	0.0413
pH	7.301±0.04	7.213±0.09	0.0495
HCO3	32.34±4.31	35.2±6.0	0.0618
SaO2	88.34±4.77	83.5±5.7	0.053

Table 3 shows that the patients in the NIV failure group on admission had statistically significant respiratory acidosis and hypoxemia when compared with the NIV successful group patients. Thus, patients with deteriorating respiratory acidosis may be unsuitable for non-invasive positive pressure ventilation.

DISCUSSION

The present study aimed to investigate the factors associated with the success or failure of non-invasive positive pressure ventilation (NIV) in patients with Chronic Obstructive Pulmonary Disease (COPD) and co-existent obstructive sleep apnea hypopnea syndrome (OSAHS) during acute exacerbation and type II respiratory failure. The study analyzed various physical characteristics, radiographic findings, and arterial blood gas (ABG) parameters to identify potential predictors of NIV success [9].

The study results revealed several interesting findings that contribute to the understanding of NIV outcomes in this patient population. Notably, the comparison between the NIV successful group (n=22) and the NIV failure group (n=8) provided valuable insights into the factors that may influence NIV efficacy [10].

In terms of physical characteristics, age, BMI, gender, and smoking status did not show statistically significant differences between the two groups. This suggests that these factors may not be strong determinants of NIV success in this specific cohort. However, it is important to note that gender and biomass fuel exposure showed some potential associations with NIV failure, as indicated by odds ratios. This could warrant further investigation with larger sample sizes.

Chest radiography and CT chest findings were also assessed to discern any correlations with NIV outcomes. Interestingly, there were no substantial differences in most radiographic parameters between the NIV successful and failure groups. This suggests that the presence of hyperinflation, infiltrates, BV marking, consolidation, and cardiomegaly may not strongly influence NIV success in this patient population. However, the presence of infiltrates in the upper and lower lobes, as well as ground glass opacities (GGO) in the upper lobes, appeared to have potential associations with NIV failure. These findings may prompt clinicians to consider these radiographic patterns when assessing NIV suitability.

One of the most notable findings was the significant difference in baseline ABG parameters between the NIV successful and failure groups. Patients in the NIV failure group exhibited statistically significant respiratory acidosis and hypoxemia upon admission, as indicated by lower pH, higher PaCO2, and lower PaO2 values. These findings suggest that patients with more severe respiratory acidosis and hypoxemia are less likely to benefit from NIV. This result underscores the importance of timely intervention with NIV in patients who present with less severe respiratory acidosis.

In conclusion, this study provides valuable insights into the factors associated with NIV success in COPD patients with co-existent OSAHS during acute exacerbation and type II respiratory failure. The results suggest that while certain physical characteristics and radiographic findings may have some influence on NIV outcomes, the severity of respiratory acidosis and hypoxemia upon admission appears to be a critical determinant of NIV success. Patients with more severe acidosis and hypoxemia may not derive the same benefits from NIV, highlighting the importance of early intervention. It is important to acknowledge the limitations of the study, such as the relatively small sample size, and further research with larger cohorts is warranted to validate and generalize these findings.

In clinical practice, these findings emphasize the need for careful patient selection and timely initiation of NIV therapy in COPD patients with co-existent OSAHS and acute exacerbation. Future research could explore additional variables and conduct prospective studies to confirm the predictive value of the identified factors. Ultimately, a comprehensive understanding of the factors influencing NIV outcomes will contribute to improved patient care and outcomes in this challenging patient population.

CONCLUSION

In conclusion, this study highlights the importance of timely intervention and patient selection in the application of non-invasive positive pressure ventilation (NIV) for COPD patients with co-existent OSAHS during acute exacerbation and type II respiratory failure. While certain physical and radiographic factors may play a limited role, the severity of respiratory acidosis and hypoxemia upon admission emerged as critical determinants of NIV success. Addressing these factors early may enhance the effectiveness of NIV therapy, emphasizing the need for personalized and proactive management strategies for improved patient outcomes.

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