

ORIGINAL RESEARCH

A comparative study of characteristics and outcome of patients with acute respiratory failure and acute or chronic respiratory failure requiring mechanical ventilation**Dr. Prachi Verma¹, Dr. Jitendra Jalutharia², Dr. Pasumarthi Kamesh Chandra³**¹Associate Professor, Department of Anaesthesiology and Critical Care, Mahatma Gandhi Medical College and Hospital, Jaipur (Rajasthan), India.²Assistant Professor, Department of Respiratory Medicine, Mahatma Gandhi Medical College & Hospital, Jaipur, (Rajasthan), India.³MD DA FCCCM, Senior Consultant, Department of Anaesthesiology and Critical Care, Queens NRI Hospital, Visakhapatnam, Andhra Pradesh, India.**Corresponding Author:Dr. Prachi Verma,****doctorprachi.verma@gmail.com**Received: 20th May, 2024Accepted: 11th June, 2024**Abstract:**

Background: Acute respiratory failure (ARF) and acute on chronic respiratory failure (ACRF) are significant medical conditions often necessitating mechanical ventilation. This study aims to compare the characteristics and outcomes of patients with ARF and ACRF requiring mechanical ventilation to identify potential differences and inform clinical practice.

Materials and Methods: A retrospective cohort study was conducted in a tertiary care hospital from December 2021 to December 2023. A total of 200 patients requiring mechanical ventilation were included, with 100 diagnosed with ARF and 100 with ACRF. Patient data, including demographic characteristics, comorbidities, duration of mechanical ventilation, length of ICU stay, and mortality rates, were collected and analyzed using statistical software. Comparative analyses were performed using t-tests for continuous variables and chi-square tests for categorical variables.

Results: The mean age of patients with ARF was 65 ± 12 years, while for ACRF patients, it was 68 ± 10 years ($p=0.045$). Males constituted 60% of the ARF group and 55% of the ACRF group ($p=0.385$). The average duration of mechanical ventilation was significantly shorter for ARF patients (7 ± 2 days) compared to ACRF patients (10 ± 3 days) ($p<0.001$). The length of ICU stay was also shorter for ARF patients (10 ± 4 days) compared to ACRF patients (15 ± 5 days) ($p<0.001$). Mortality rates were higher in the ACRF group (45%) compared to the ARF group (30%) ($p=0.028$).

Conclusion: Patients with ACRF have worse outcomes compared to those with ARF, including longer duration of mechanical ventilation, extended ICU stays, and higher mortality rates. These findings underscore the need for targeted management strategies and early interventions for ACRF patients to improve clinical outcomes.

Keywords: Acute respiratory failure, acute on chronic respiratory failure, mechanical ventilation, ICU stay, mortality, comparative study.

Introduction:

Acute respiratory failure (ARF) and acute on chronic respiratory failure (ACRF) are critical conditions that frequently necessitate mechanical ventilation in the intensive care unit (ICU). ARF is characterized by a rapid onset of respiratory dysfunction, leading to inadequate oxygenation or ventilation, while ACRF involves an acute exacerbation of chronic respiratory conditions such as chronic obstructive pulmonary disease (COPD) or interstitial lung disease (1). Mechanical ventilation is a lifesaving intervention for these patients, but the associated outcomes can vary significantly based on the underlying respiratory failure type (2).

Several studies have explored the characteristics and outcomes of patients with ARF and ACRF, highlighting the differences in clinical presentation and prognosis. For instance, patients with ACRF often have a more prolonged ICU stay and higher mortality rates compared to those with ARF (3,4). These differences may be attributed to the underlying chronic respiratory conditions and the patients' overall health status, which can complicate the management of acute exacerbations (5). Furthermore, understanding these variations is crucial for developing targeted treatment strategies and improving patient outcomes.

Despite the importance of this issue, there is limited comparative data on the characteristics and outcomes of patients with ARF and ACRF requiring mechanical ventilation. This study aims to fill this gap by systematically comparing these two patient populations in terms of demographic characteristics, comorbidities, duration of mechanical ventilation, length of ICU stay, and mortality rates. By identifying key differences, we hope to inform clinical practice and guide the development of more effective management protocols for these critically ill patients.

Materials and Methods:

Study Design and Setting:

This retrospective cohort study was conducted at a tertiary care hospital from December 2021 to December 2023. The study protocol was approved by the institutional review board, and the requirement for informed consent was waived due to the retrospective nature of the study.

Patient Population:

A total of 200 patients who required mechanical ventilation during the study period were included. Patients were divided into two groups based on their diagnosis: 100 patients with acute respiratory failure (ARF) and 100 patients with acute on chronic respiratory failure (ACRF). Patients were eligible for inclusion if they were aged 18 years or older and required invasive mechanical ventilation. Exclusion criteria included patients with do-not-resuscitate (DNR) orders and those who received non-invasive ventilation only.

Data Collection:

Data were collected from electronic medical records. Variables collected included demographic characteristics (age, sex), comorbidities (e.g., hypertension, diabetes, chronic

obstructive pulmonary disease), clinical parameters at ICU admission (e.g., PaO₂/FiO₂ ratio, arterial blood gases), and outcomes. Specific outcomes of interest included the duration of mechanical ventilation, length of ICU stay, and mortality rates.

Statistical Analysis:

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the demographic and clinical characteristics of the patients. Continuous variables were expressed as mean \pm standard deviation (SD) and compared using Student's t-test. Categorical variables were presented as frequencies and percentages and compared using the chi-square test or Fisher's exact test as appropriate. A p-value of <0.05 was considered statistically significant.

Results:

Patient Demographics and Clinical Characteristics:

A total of 200 patients were included in the study, with 100 patients in the ARF group and 100 patients in the ACRF group. The demographic and clinical characteristics of the patients are summarized in Table 1.

Characteristic	ARF (n=100)	ACRF (n=100)	p-value
Age, mean \pm SD (years)	65 \pm 12	68 \pm 10	0.045
Male, n (%)	60 (60%)	55 (55%)	0.385
Hypertension, n (%)	45 (45%)	50 (50%)	0.521
Diabetes, n (%)	30 (30%)	35 (35%)	0.501
COPD, n (%)	0 (0%)	80 (80%)	<0.001
PaO ₂ /FiO ₂ ratio, mean \pm SD	150 \pm 30	120 \pm 25	<0.001

Duration of Mechanical Ventilation and ICU Stay:

The duration of mechanical ventilation and length of ICU stay for both groups are presented in Table 2.

Outcome	ARF (n=100)	ACRF (n=100)	p-value
Duration of mechanical ventilation, mean \pm SD (days)	7 \pm 2	10 \pm 3	<0.001
Length of ICU stay, mean \pm SD (days)	10 \pm 4	15 \pm 5	<0.001

Mortality Rates:

The mortality rates in the ARF and ACRF groups are shown in Table 3.

Outcome	ARF (n=100)	ACRF (n=100)	p-value
Mortality, n (%)	30 (30%)	45 (45%)	0.028

Patients with ACRF had a significantly longer duration of mechanical ventilation and ICU stay compared to those with ARF ($p<0.001$ for both). Additionally, the mortality rate was higher in

the ACRF group (45%) compared to the ARF group (30%) ($p=0.028$). These findings highlight the greater severity and poorer prognosis associated with ACRF in comparison to ARF.

Discussion:

This study provides a comparative analysis of patients with acute respiratory failure (ARF) and acute on chronic respiratory failure (ACRF) requiring mechanical ventilation, highlighting significant differences in clinical outcomes. The findings indicate that patients with ACRF have a longer duration of mechanical ventilation, extended ICU stays, and higher mortality rates compared to those with ARF. These results underscore the greater complexity and severity of managing ACRF patients in the ICU setting.

The mean age of patients with ACRF was slightly higher than that of ARF patients, which may partly explain the worse outcomes observed in the ACRF group (1). Age is a known risk factor for increased mortality and prolonged ICU stays in critically ill patients (2). Additionally, the higher prevalence of comorbid conditions such as COPD in the ACRF group likely contributes to the poorer prognosis (3). The presence of chronic respiratory diseases imposes an additional burden on the patients' respiratory system, making recovery from acute exacerbations more challenging.

The significantly longer duration of mechanical ventilation and ICU stay in ACRF patients is consistent with previous studies that have reported similar findings (4,5). Prolonged mechanical ventilation increases the risk of complications such as ventilator-associated pneumonia, which can further complicate the clinical course and increase mortality (6). The need for extended ICU care also reflects the greater severity of illness in ACRF patients, who may require more intensive and prolonged treatment to achieve stabilization.

Mortality rates were notably higher in the ACRF group compared to the ARF group. This finding aligns with existing literature that suggests a higher risk of death in patients with chronic respiratory conditions experiencing acute exacerbations (7,8). The chronic underlying pathology in ACRF patients predisposes them to poorer outcomes, as their baseline respiratory function is already compromised.

The study has several limitations that should be acknowledged. The retrospective design may introduce selection bias, and the findings may not be generalizable to all ICU settings. Additionally, the study did not account for other potential confounding factors such as the severity of the acute episode, variations in treatment protocols, and the presence of other comorbid conditions. Future prospective studies are needed to validate these findings and explore interventions that could improve outcomes for ACRF patients.

Conclusion

In conclusion, this study highlights the significant differences in outcomes between patients with ARF and ACRF requiring mechanical ventilation. The findings emphasize the need for tailored management strategies for ACRF patients to address their higher risk of prolonged mechanical ventilation, extended ICU stays, and increased mortality. Optimizing care for these patients could potentially improve clinical outcomes and reduce the burden on healthcare resources.

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