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Clinical Profile of Type I and II Respiratory Failure Patients at a Tertiary Care Hospital

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ABSTRACT

Respiratory failure, categorized as Type I (hypoxemic) and Type II (hypercapnic), is a critical condition requiring immediate diagnosis and management. Understanding its clinical profile aids in optimizing care, particularly in tertiary care settings where resources and expertise are concentrated. To study the clinical profile of patients presenting with Type I and Type II respiratory failure at a tertiary care hospital, including demographic characteristics, clinical presentations, underlying etiologies, and outcomes. This prospective observational study was conducted over a period of 12 months in the Intensive Care Unit (ICU) of Department of General Medicine, Government Medical College, Nalgonda, Telangana a tertiary care hospital. A total of 150 patients (Type I: n=80, Type II: n=70) were included based on arterial blood gas (ABG) analysis. Data on demographics, clinical presentation, comorbidities, etiologies, management strategies and outcomes were collected and analyzed using descriptive statistics. Among 150 patients, Type I respiratory failure was predominantly associated with pneumonia (40%), ARDS (25%) and pulmonary embolism (15%), while Type II respiratory failure was more common in COPD exacerbations (50%), obesity hypoventilation syndrome (20%) and neuromuscular disorders (10%). The mean age for Type I was 55±12 years and for Type II was 60±10 years. Mortality was higher in Type I (28%) compared to Type II (18%). Type I respiratory failure is commonly caused by acute parenchyma lung diseases, while Type II is primarily linked to chronic respiratory conditions. Early diagnosis and targeted management improve outcomes.

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Key Words
Respiratory failure, type I, type II, hypoxemia, hypercapnia, clinical profile, tertiary care

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INTRODUCTION

Respiratory failure is a critical condition characterized by the inability of the respiratory system to maintain adequate gas exchange, leading to hypoxia, hypercapnia, or both. It is broadly classified into two types: type I (hypodermic) and type II (hypercapnia) respiratory failure, based on arterial blood gas (ABG) findings. Type I respiratory failure is defined by a partial pressure of oxygen (PaO) <60mmHg with a normal or low partial pressure of carbon dioxide ($PaCO_2$), whereas type II respiratory failure occurs when PaCO exceeds 45mmHg along with a decrease in PaO_2[1]. Understanding the clinical profile of patients presenting with these types of respiratory failure is essential for timely diagnosis, appropriate management and improved outcomes. Type I respiratory failure commonly results from conditions affecting oxygenation, such as acute respiratory distress syndrome (ARDS), pneumonia, pulmonary edema and pulmonary embolism. These disorders impair gas exchange within the alveoli, leading to severe hypoxemia[2]. In contrast, type II respiratory failure is frequently associated with ventilatory failure, which occurs due to hypoventilation caused by neuromuscular diseases, chronic obstructive pulmonary disease (COPD), obesity hypoventilation syndrome and drug overdose[3]. The differing etiologies and pathophysiology of these two types underscore the need for a detailed clinical evaluation to guide therapy. Tertiary care hospitals often serve as referral centers for patients with respiratory failure, offering advanced diagnostic facilities and management strategies. Assessing the clinical profile of patients with type I and type II respiratory failure in such settings provides valuable insights into disease burden, patient demographics, underlying causes and outcomes. Previous studies have emphasized the importance of factors such as age, comorbidities and severity of illness in determining prognosis[4]. However, there remains a paucity of region-specific data in tertiary care settings, particularly in resource-limited healthcare systems, where the burden of respiratory diseases is substantial. In India, respiratory conditions contribute significantly to morbidity and mortality due to the high prevalence of respiratory infections, environmental pollution and a rising burden of chronic respiratory diseases[5]. Therefore, an in-depth evaluation of the clinical profile of respiratory failure patients at tertiary care hospitals can help identify patterns, predict outcomes and inform resource allocation strategies. The current study aims to analyze and compare the clinical profile of type I and type II respiratory failure patients admitted to a tertiary care hospital, highlighting their demographic characteristics, underlying etiologies, clinical presentations and outcomes. This information is crucial for clinicians, policymakers and healthcare systems to optimize patient care and reduce the burden of respiratory failure.

MATERIALS AND METHODS

Study Design: This is a hospital-based, observational, cross-sectional study conducted over a period of 12 months in the Intensive Care Unit (ICU), Department of General Medicine, Government Medical College, Nalgonda, Telangana in a tertiary care hospital.

Study Population: The study included patients admitted with a confirmed diagnosis of type I and type II respiratory failure based on arterial blood gas (ABG) analysis.

Inclusion Criteria:

- Patients aged 18 years and above.
- Patients diagnosed with type I (PaO_2 <60mmHg, $PaCO_2$ normal or low) or type II respiratory failure ($PaCO_2$ > 45mmHg with low PaO_2).
- Patients willing to provide informed consent.

Exclusion Criteria:

- Patients with mixed respiratory failure or other life-threatening comorbidities.
- Patients with incomplete medical records or ABG reports.
- Pediatric patients (<18 years of age).

Sample Size: The sample size was calculated based on previous studies, with an expected prevalence of respiratory failure patients being 10%, a 95% confidence interval and a margin of error of 5%. A total of 150 patients were enrolled.

Data Collection: Data were collected using a structured proforma, including:

- **Demographic Data:** Age, gender, body mass index (BMI) and socioeconomic status.
- **Clinical Presentation:** Symptoms such as breathlessness, altered mental status, cyanosis and cough.
- **Underlying Etiologies:** ARDS, pneumonia, COPD, pulmonary embolism, neuromuscular diseases and others.
- **Investigations:** ABG analysis, chest X-ray and other relevant laboratory and imaging studies.
- **Treatment and Outcomes:** Use of mechanical ventilation (invasive/non-invasive), ICU admission, duration of hospitalization and mortality.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Continuous variables were presented as mean±standard deviation, while categorical variables were expressed as frequencies and percentages.

RESULTS AND DISCUSSIONS

In the study total 150 patients were enrolled after following inclusion and exclusion criteria, among which 80 were type I respiratory failure and 70 were type II respiratory failure and their observation were bellow.

Table 1 : Demographic Distribution Among Respiratory Failure

Parameter	Respiratory Failure	
	Type I (n=80)	Type II (n=70)
Age(Years		
Mean±SD	55.26±12.41	60.68±10.29
Gender		
Male	52 (65%)	48 (68.5%)
Female	28 (35%)	22 (31.5%)

Type II respiratory failure patients were slightly older compared to Type I patients. Male predominance was observed in both groups.

Table 2 : Distribution of Clinical Presentation Among the Patients

Clinical Presentation	Respiratory Failure	
	Type I (n=80)	Type II (n=70)
Breathlessness	75 (94%)	65 (93%)
Cough with sputum	40 (50%)	50 (71%)
Chest pain	30 (38%)	20 (29%)
Altered sensorium	20 (25%)	15 (21%)

Breathlessness was the most common symptom in both groups. Cough with sputum was more frequent in Type II respiratory failure, likely due to COPD exacerbations.

Table 3 : Distribution of Etiologies Among the Patients

Etiologies	Respiratory Failure	
	Type I (n=80)	Type II (n=70)
Pneumonia	32 (40%)	5 (7%)
Acute Respiratory Distress Syndrome (ARDS)	20 (25%)	2 (3%)
Pulmonary embolism	12 (15%)	1 (1.4%)
Chronic Obstructive Pulmonary Disease (COPD)	10 (12%)	35 (50%)
Obesity Hypoventilation Syndrome	0	14 (20%)
Neuromuscular Disorders	0	7 (10%)
Others (e.g., sepsis, trauma)	6 (8%)	6 (8.6%)

Type I respiratory failure was predominantly caused by pneumonia, ARDS and pulmonary embolism. Type II respiratory failure was primarily seen in COPD exacerbations, obesity hypoventilation and neuromuscular disorders.

Table 4 : Distribution of Comorbid Conditions Among the Patients

Comorbid Conditions	Respiratory Failure	
	Type I (n=80)	Type II (n=70)
Hypertension	30 (38%)	25 (36%)
Diabetes mellitus	25 (31%)	20 (29%)
Coronary artery disease	15 (19%)	18 (26%)
Chronic kidney disease	10 (12%)	8 (11%)

Comorbidities like hypertension and diabetes were common in both groups.

Table 5 : Distribution of Comorbid conditions among the patients

Outcome	Respiratory Failure	
	Type I (n=80)	Type II (n=70)
Duration of ICU stay (days)	7.5±2.3	6.8±2.1
Need for mechanical ventilation	50 (62.5%)	40 (57%)
Mortality	11 (10%)	7 (7%)
Discharged	58 (72%)	57 (82%)

Type I respiratory failure patients had longer ICU stays and higher mortality compared to Type II. Mechanical ventilation was frequently required in both groups, slightly higher in Type I cases.

This study aimed to analyze and compare the clinical profile of patients with Type I and Type II respiratory failure at a tertiary care hospital. A total of 150 patients were enrolled, with 80 classified under Type I respiratory failure and 70 under Type II respiratory failure. The present study observed that Type II respiratory failure patients were older (mean age: 60.68±10.29 years) compared to Type I patients (55.26±12.41 years). Similar findings were reported by[6], who noted older age predominance in hypercapnic respiratory failure due to chronic conditions like COPD. The male predominance seen in both groups aligns with studies conducted by[7], which attributed this to higher smoking prevalence among males. Breathlessness was the most common symptom in both groups, present in over 90% of patients. Type II patients had a higher frequency of cough with sputum (71%) compared to Type I (50%), likely due to the chronic nature of conditions such as COPD. A similar trend was noted by[8], who observed that COPD exacerbation patients frequently presented with productive cough due to chronic inflammation and infection. The etiological distribution highlights a clear distinction between the two types of respiratory failure. Type I respiratory failure was predominantly caused by, Pneumonia (40%), ARDS (25%), Pulmonary embolism (15%), In contrast, Type II respiratory failure was primarily associated with, COPD exacerbations (50%), Obesity hypoventilation syndrome (20%), Neuromuscular disorders (10%). These findings are consistent with[9], who reported COPD as the most common etiology of hypercapnic respiratory failure, while pneumonia and ARDS were the leading causes of hypoxemic respiratory failure. Pulmonary embolism, though less common overall, remains an important cause of acute hypoxemia, as previously described in the literature. Comorbidities such as hypertension, diabetes mellitus and coronary artery disease were prevalent in both groups, with slightly higher coronary artery disease in Type II patients (26%). This reflects the chronic nature of conditions like COPD and obesity hypoventilation, which are strongly associated with cardiovascular comorbidities[10]. The mortality rate in Type I respiratory failure (10%) was higher than in Type II (7%). Additionally, ICU stay duration was longer in Type I cases (7.5±2.3 days) compared to Type II (6.8± 2.1 days). These findings align with[11], who reported poorer outcomes and prolonged ICU stays in ARDS and pneumonia-related hypoxemic respiratory failure. The need for mechanical ventilation was also higher in Type I cases, reflecting the severity and acute nature of hypoxemia compared to chronic hypercapnic conditions.

ARDS and Pneumonia in Type I: The significant contribution of ARDS and pneumonia to Type I respiratory failure matches findings by[12], where

mortality and prolonged ICU admissions were higher among ARDS patients due to systemic inflammation and organ dysfunction.

COPD in Type II: The prevalence of COPD exacerbation as a leading cause of Type II respiratory failure correlates well with global studies emphasizing COPD as a major cause of chronic respiratory morbidity. The study underscores the need for early diagnosis and appropriate intervention to reduce mortality and ICU burden, particularly in hypoxemic respiratory failure. Strategies to prevent COPD exacerbations, such as smoking cessation, vaccination and optimized long -term care, are essential for improving Type II outcomes.

CONCLUSION

Type I respiratory failure is primarily caused by acute parenchyma lung diseases, whereas Type II respiratory failure arises from chronic conditions like COPD and obesity hypoventilation. The higher mortality and ICU stay associated with Type I respiratory failure highlight the severity of hypodermic conditions. Early diagnosis and targeted management are key to improving outcomes.

Conflict of Interest: None.

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