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Original Article

Internal Medicine Section

Predictors of Outcome in Patients with Dyspnoea of Pulmonary Origin admitted to a Respiratory Intensive Care Unit: A Prospective Observational Study from Eastern India

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ABSTRACT

Introduction: Dyspnoea is one of the most common presenting complaints in the Respiratory Intensive Care Unit (RICU). It reflects a wide spectrum of underlying pulmonary conditions with varying severity and outcomes. Early identification of clinical and laboratory predictors can aid in risk stratification and management planning in critically ill patients.

Aim: To evaluate the demographic and clinical profiles, initial Arterial Blood Gas (ABG) findings, and factors associated with short-term outcomes in patients with pulmonary-origin dyspnoea admitted to the RICU.

Materials and Methods: A prospective observational study with follow-up until ICU discharge was conducted in the RICU of the College of Medicine and Sagore Dutta Hospital, Kolkata, West Bengal, India from December 2023 to 2024. A total of 76 patients presenting with dyspnoea of pulmonary origin were enrolled. Demographic parameters, presenting symptoms, primary diagnosis, microbiological findings, co-morbidities, neurological status, initial ABG parameters, oxygen or ventilatory support, and outcomes were recorded. Patients with non pulmonary causes of dyspnoea were excluded. Data were analysed using Statistical Package for the Social Sciences (SPSS) statistical software (Version 26.0), employing appropriate statistical methods. A p-value <0.05 was considered as statistically significant.

Results: Of the 76 patients included, 67.1% were male, with a mean age of 59.5±11.74 years. Hypertension and diabetes mellitus were the most common co-morbidities, and obstructive airway disease was the predominant diagnosis (55.3%). Non survivors were significantly older (p-value=0.041) and more likely to have altered sensorium {Richmond Agitation Sedation Scale (RASS) < +1; p-value <0.0001}, *Acinetobacter baumannii* infection (p-value <0.0001), metabolic and mixed acidosis (p-value <0.0001), initial arterial pH ≤7.20 (p-value=0.044), septic shock (p-value <0.0001), Acute Respiratory Distress Syndrome (ARDS) (p-value=0.001), ventilator-associated pneumonia (p-value=0.001), and massive haemoptysis (p-value=0.008). The requirement for Invasive Mechanical Ventilation (IMV) was the strongest predictor of mortality (p-value <0.0001). On bivariate logistic regression analysis, age {Odds Ratio (OR) 1.07, p-value=0.007), RASS < +1 (OR 7.29, p-value <0.0001}, *Acinetobacter baumannii* infection (OR 30.00, p-value=0.002), metabolic acidosis (OR 7.13, p-value <0.0001), and mechanical ventilation (OR 304.5, p-value <0.0001) were significantly associated with mortality. On multivariate analysis, metabolic acidosis (OR 6.67, p-value=0.005), mechanical ventilation (OR 68.47, p-value <0.0001), and RICU stay <6 days or >12 days (OR 1.18, p-value=0.015) independently predicted poor outcomes.

Conclusion: Older age, lower RASS scores, gram-negative infection, severe acidosis, and the need for invasive mechanical ventilation were associated with increased mortality. Early identification of these adverse prognostic markers and timely intervention may improve outcomes in RICU patients presenting with dyspnoea of pulmonary origin.

Keywords: Acid-base disorders, Mechanical ventilation, Respiratory failure, Sepsis

INTRODUCTION

Dyspnoea is defined as "a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity" [1]. It is a multidimensional symptom encompassing sensory, affective, and cognitive components, shaped by physiological, psychological, and environmental factors [2]. The RICU is a specialised setting for managing patients with acute or chronic respiratory failure, often requiring Non Invasive Ventilation (NIV) or Invasive Mechanical Ventilation (IMV) [3]. ABG analysis remains a cornerstone in the evaluation of acute dyspnoea, providing insights into oxygenation {Partial pressure of oxygen in arterial blood (PaO_2)}, ventilation {Partial pressure of carbon dioxide in arterial blood ($PaCO_2$)}, acid-base status (pH), and metabolic disturbances. Current guidelines recommend ABG analysis in patients presenting with acute dyspnoea of uncertain aetiology, particularly when hypoxaemia, hypercapnia, or metabolic derangements are suspected [4,5]. Outcomes in RICUs depend on age, co-morbidities, severity of illness, timeliness of intervention, and complications such as multiorgan dysfunction. Globally, ICUs account for 30-40% of hospital mortality, with respiratory failure contributing to 25-35% of deaths [6]. In resource-limited settings, delays in ABG analysis, lack of NIV equipment, and inadequate staffing exacerbate poor outcomes, with mortality rates exceeding 50% in some cohorts [7]. While predictors of mortality have been extensively studied in general ICUs [8,9], data specific to RICUs and to patients presenting exclusively with pulmonary-origin dyspnoea in India remain sparse [10-12].

The present study aimed to evaluate demographic and clinical characteristics, initial ABG parameters, and early complications associated with short-term outcomes among patients with pulmonary-origin dyspnoea admitted to a RICU in Eastern India.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted from December 2023 to 2024 in the RICU of the College of Medicine and Sagore Dutta Hospital, a tertiary care centre in Eastern India. After obtaining approval from the Institutional Ethics Committee (Approval No. CMSDH/IEC/54/05-2023) and securing both verbal and written informed consent.

Inclusion criteria: Adult patients admitted to the RICU with dyspnoea of pulmonary origin during the study period were included in the study.

Exclusion criteria: Patients with dyspnoea of non pulmonary or mixed pulmonary and non pulmonary aetiology (based on history, clinical examination, and investigations), those who did not consent to ABG sampling, and patients who Left the hospital Against Medical Advice (LAMA) before enrolment were excluded from the study.

Sample size and sampling technique: All eligible patients admitted on three randomly selected days each week, determined using computer-generated randomisation, were enrolled. As no prior prevalence data were available, the minimum sample size was estimated based on hospital admission records and a 12-month study duration, resulting in a final sample of at least 75 patients.

Study Procedure

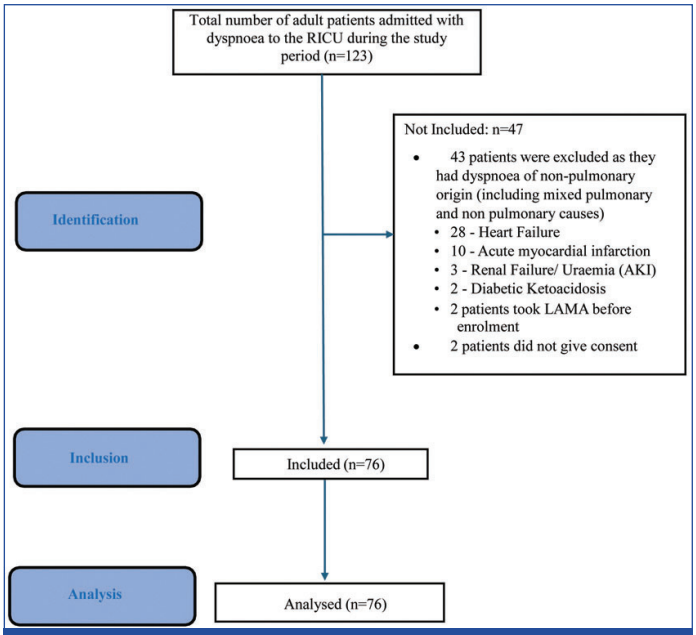
Demographic details (age and sex) and clinical profiles were recorded. Clinical evaluation included dyspnoea , dyspnoea severity was assessed using the modified Medical Research Council (mMRC) scale, ranging from Grade 0 (breathlessness only on strenuous exercise) to Grade 4 (too breathless to leave the house or experiencing breathlessness during activities such as dressing) [13]. associated symptoms, Richmond Agitation-Sedation Scale (RASS) was used to assess agitation and sedation levels, ranging from +4 (combative) to -5 (unarousable) [14]. microbiological evaluation of sputum, bronchoalveolar lavage, or endotracheal aspirates, primary diagnosis, co-morbidities (hypertension, diabetes mellitus, hypothyroidism, chronic liver disease, and chronic kidney disease), and complications during admission.

The ABG analysis on admission, performed using the epoc Blood Analyser (Siemens), included measurements of pH, PaO_2, $PaCO_2$, HCO_3-, type of respiratory failure, and acid–base disturbances. Treatment-related parameters included the initial mode of respiratory support (oxygen therapy, non invasive ventilation, or invasive mechanical ventilation), duration of invasive ventilation, total RICU stay, and the need for reintubation. Outcomes were documented as discharge or death.

A total of 123 patients were screened for eligibility during the study period, of whom 76 were finally included in the analysis. The detailed recruitment flowchart of the study is presented in [Table/Fig-1].

STATISTICAL ANALYSIS

The collected data were processed and coded through manual sorting and entered into SPSS statistical software (IBM Corp., Version 26.0, Armonk, NY, USA). Appropriate tables, charts, and diagrams were generated from the available data. Data normality was assessed using the Shapiro–Wilk test. Categorical variables were expressed as percentages, while continuous variables were presented as mean±Standard Deviation (SD) or median with Interquartile Range (IQR), as appropriate. Chi-square test or Fisher's exact test was used for bivariate analysis to assess the association between various variables and adverse outcomes. Multivariate logistic regression analysis was performed to identify factors independently associated with mortality. A p-value <0.05 was considered as statistically significant.



[Table/Fig-1]: STROBE flow chart: strengthening the reporting of observational studies in epidemiology.
RICU: Respiratory intensive care unit; AKI: Acute kidney injury; LAMA: Leave against medical advice

RESULTS

The majority of participants were male (51, 67%), while 25 (33%) were female. The mean age of the study population was 59.50±11.74 years. Of the participants, 43 (56.6%) were aged 46-65 years, 23 (30.3%) were older than 65 years, and 10 (13.1%) were between 18 and 45 years of age. Baseline characteristics are summarised in [Table/Fig-2].

Advancing age showed a significant association with hypertension (p-value=0.020), metabolic acidosis on ABG analysis (p-value=0.020), Gram-negative infections (p-value=0.001), need for mechanical ventilation (p-value=0.040), septic shock (p-value=0.002), ARDS

Variable	N (%)		
Advancing age	Age > 45 years (n=66)	Age <=45 years (n=10)	p-value
Hypertension	28 (42.4)	2 (20.0)	0.020*
Type 2 respiratory failure	47 (71.2)	4 (40.0)	0.060
Metabolic acidosis (ABG)	25 (37.9)	1 (10.0)	0.020*
Gram-negative infections	31 (46.9)	1 (10.0)	0.001*
Need for mechanical ventilation	29 (43.9)	1 (10.0)	0.040*
Septic shock	15 (22.7)	1 (10.0)	0.002*
ARDS	6 (9.1)	0	0.002*
Mortality	28 (42.4)	2 (20.0)	0.006*
Outcome			
Discharged	46 (60.5)		-
Died	30 (39.5)		
Presenting symptoms			
Dyspnoea (mMRC Grade IV)	76 (100.0)		-
Cough	76 (100.0)		
Expectoration	70 (92.1)		
Fever	28 (36.8)		
Chest pain	12 (15.8)		
Haemoptysis	7 (9.2)		
Initial RASS score			
+1	51 (67.1)		-
-1	11 (13.2)		

Co-morbidities		
Any	57 (75.0)	-
Single	40 (52.6)	
Multiple	17 (22.4)	
Hypertension	30 (39.5)	
Diabetes mellitus	30 (39.5)	
Chronic kidney disease	4 (5.3)	
Hypertension by gender		
Male (n=51)	24 (47.1)	0.020*
Female (n=25)	6 (24.0)	

[Table/Fig-2]: Overview of baseline characteristics of patients (n=76).
*: p<0.05, RASS: Richmond agitation sedation scale; ABG: Arterial blood gas; mMRC: Modified medical research council; ARDS: Acute respiratory distress syndrome

(p-value=0.002), and mortality (p-value=0.006). Overall, 46 patients (60.5%) were discharged, while 30 (39.5%) died during hospital stay. All patients presented with dyspnoea of mMRC Grade IV. Other common presenting symptoms included cough (76, 100%), expectoration (70, 92.1%), fever (28, 36.8%), chest pain (12, 15.8%), and haemoptysis (7, 9.2%). Most patients had an initial RASS score of +1 (51, 67.1%), followed by -1 (11, 13.2%). Co-morbidities were present in 57 (75%) of the study cohort, with 40 patients (52.6%) having a single comorbidity and 17 (22.4%) having multiple co-morbidities. Hypertension and diabetes mellitus (30, 39.5%) were the most common comorbid conditions. Hypertension was significantly more prevalent among men than women {24 (47.1%) vs. 6 (24.0%), p=0.020} [Table/Fig-2].

Baseline characteristics stratified by outcome are presented in [Table/Fig-3].

Mortality was significantly higher among older patients, particularly those aged >65 years and those older than 45 years overall. Deaths

Category	Parameters (n (%))	Dis-charge (n=46)	Death (n=30)	Overall (n=76)	p-value
Demographics	Age >45 years	37 (80.4)	29 (96.7)	66 (86.8)	0.041*
	Age groups (years)				
	18-45	8 (17.4)	2 (6.7)	10 (13.1)	0.009*
	46-65	30 (65.2)	13 (43.3)	43 (56.6)	
	>65	8 (17.4)	15 (50.0)	23 (30.3)	
	Male sex	32 (69.6)	19 (63.3)	51 (67.1)	0.572
Co-morbidities	Hypertension	18 (39.1)	12 (40.0)	30 (39.5)	0.940
	Diabetes mellitus	15 (32.6)	15 (50.0)	30 (39.5)	0.129
	Chronic kidney disease	1 (2.2)	3 (10.0)	4 (5.3)	0.167
Underlying respiratory disease	Obstructive airway disease	26 (56.5)	16 (53.3)	42 (55.3)	0.355
	Diffuse parenchymal lung disease	7 (15.2)	4 (13.3)	11 (14.5)	0.482
	Others (ABPA, TB, CA lung, etc.,)	13 (28.3)	10 (33.3)	23 (30.2)	0.571
Neurological status	RASS ≥ +1	38 (82.6)	13 (43.3)	51 (67.1)	<0.0001*
Microbiology	*Acinetobacter baumannii*	1 (2.2)	12 (40.0)	13 (17.1)	<0.0001*
Acid-base disorders	Respiratory acidosis	33 (71.7)	19 (63.3)	52 (68.4)	0.441
	Metabolic acidosis	8 (17.4)	18 (60.0)	26 (34.2)	<0.0001*
	Mixed acidosis	7 (15.2)	12 (40.0)	19 (25.0)	<0.0001*
	Initial pH ≤7.20	2 (4.4)	8 (26.7)	10 (13.2)	0.044*
Respiratory failure	Type 1	13 (28.3)	12 (40.0)	25 (32.9)	0.291
	Type 2	33 (71.7)	18 (60.0)	51 (67.1)	0.325

[Table/Fig-3]: Baseline characteristics of patients based on their outcome (Discharge/ Death) (n=76).
*: p<0.05, ABPA: Allergic broncho-pulmonary aspergillosis; TB: Tuberculosis; CA: Carcinoma; RASS: Richmond agitation sedation scale

were strongly associated with neurological status, *Acinetobacter baumannii* infection, severe acid-base disturbances (metabolic or mixed acidosis), and an initial arterial pH ≤7.20. Gender, co-morbidities, underlying respiratory disease, and type of respiratory failure were not significantly associated with outcome.

Diagnosis

Among the 76 cases of dyspnoea due to pulmonary diseases, acute exacerbation of obstructive airway disease (42, 55.3%) was the most common primary diagnosis, followed by diffuse parenchymal lung disease (11, 14.5%) and pneumonia (7, 9.2%). Other diagnoses included allergic bronchopulmonary aspergillosis (5, 6.5%), pulmonary tuberculosis (3, 4%), lung carcinoma (3, 4%), pleural effusion (2, 2.6%), diffuse alveolar haemorrhage (2, 2.6%), and pulmonary alveolar proteinosis (1, 1.3%).

Microbiological Fauna

Microorganisms were isolated in 36 patients (47.5%). Among these, Gram-negative bacteria predominated (32, 88.8%). *Acinetobacter baumannii* was the most common isolate (13, 36.1%), followed by *Pseudomonas aeruginosa* (10, 27.8%), *Klebsiella pneumoniae* (6, 16.7%), and *Enterobacter cloacae* (3, 8.3%). Other organisms identified included *Mycobacterium tuberculosis* (3, 8.3%) and *Pneumocystis jirovecii* (1, 2.8%).

Acinetobacter baumannii infection was strongly associated with fatal outcomes, being present in 40% (n=12) of deaths compared to only 2.2% (n=1) of discharged patients (p-value <0.0001) [Table/Fig-3].

Initial ABG Analysis

On admission, the mean arterial pH was 7.32±0.14, mean $PaCO_2$ was 59.80±21.64 mmHg, and mean PaO_2 was 69.86 ± 29.69 mmHg. The majority of patients exhibited acidosis (63.2%), hypoxaemia (76.6%), and hypercapnia (69.7%). Respiratory acidosis was the most common acid–base disturbance, followed by mixed acidosis and respiratory alkalosis. Overall, 51 patients (67.1%) presented with type 2 respiratory failure.

Respiratory acidosis was significantly more common in males than females (84% vs. 36%, p=0.005). Metabolic and mixed acidosis were significantly more frequent among patients who died (60.0% and 40.0%, respectively) compared to those who survived (17.4% and 15.2%; p<0.0001 for both). An initial arterial pH ≤7.20 was also predictive of mortality (p-value=0.044). Although respiratory acidosis was the most prevalent abnormality overall (68.4%), it did not differ significantly between outcome groups [Table/Fig-3].

Complications and interventions: The frequency of complications and interventions among study participants is summarised in [Table/Fig-4]. Most patients developed complications during their hospital course. The most common complications were septic shock (21.1%), lower respiratory tract infection (15.8%), ventilator-associated pneumonia (14.5%), pneumothorax (7.9%), ARDS (7.9%), and haemoptysis (6.5%).

Septic shock (50.0% vs. 2.2%, p<0.0001), ARDS (16.7% vs. 2.2%, p=0.001), ventilator-associated pneumonia (30.0% vs. 4.4%, p=0.001), and massive haemoptysis (13.3% vs. 2.2%, p=0.008) were significantly more frequent among patients who died. Conversely, the absence of any complication was strongly associated with survival (p-value <0.0001).

Category	Parameters (n (%)	Discharge (n=46)	Death (n =30)	Overall (n=76)	p-value
Complications	Septic shock	1 (2.2)	15 (50.0)	16 (21.1)	<0.0001*
	LRTI	3 (6.5)	9 (30.0)	12 (15.8)	0.001*
	ARDS	1 (2.2)	5 (16.7)	6 (7.9)	0.001*
	Pneumothorax	3 (6.5)	3 (10.0)	6 (7.9)	0.680
	VAP (n=30)	2 (4.4)	9 (30.0)	11 (14.5)	0.001*
	Massive haemoptysis	1 (2.2)	4 (13.3)	5 (6.5)	0.008*
	No complication	24 (52.2)	1 (3.3)	25 (32.9)	<0.001*
Interventions	Need for mechanical ventilation	4 (8.7)	26 (86.7)	30 (39.5)	<0.001*
	Need for reintubation (n=30)	1 (2.2)	4 (13.3)	5 (6.6)	<0.001*
Outcome related	RICU stay <6 or >12 days	3 (6.5)	19 (63.3)	22 (28.9)	<0.001*

[Table/Fig-4]: Complications, interventions, and secondary outcomes grouped by discharge/death status in all study participants (n=76).
*: p<0.05, LRTI: Lower respiratory tract infection; ARDS: Acute respiratory distress syndrome; RICU: Respiratory intensive care unit; VAP: Ventilator-associated pneumonia

Duration of RICU Stay and Need for Respiratory Support

The median duration of RICU stay was 8 days (IQR: 6-12), with most patients (54, 71.1%) staying between 5 and 14 days. The most common initial mode of respiratory support was BiPAP (44, 57.9%), followed by NRBM (24, 31.6%) and invasive mechanical ventilation (IMV) (8, 10.5%). Overall, BiPAP was required in 63 patients (82.9%), while 30 (39.5%) required mechanical ventilation at some point during their RICU stay. Reintubation was necessary in 5 patients (13.3%) who required mechanical ventilation. The median duration of mechanical ventilation was 6 days (IQR: 3-12), with the majority (21, 70%) receiving invasive ventilation for 2-12 days.

The need for mechanical ventilation was the most powerful clinical discriminator, being required in 26 non survivors (86.7%) compared to only 4 patients (8.7%) who were discharged (p-value <0.0001). Reintubation was also significantly more frequent among non survivors (p-value=0.001). Mortality was higher in patients with either very short (<6 days) or prolonged (>12 days) RICU stays (p-value <0.001).

Analysis of Outcome

Patient outcomes and the types of respiratory support at discharge are summarised in [Table/Fig-5]. Of the 76 patients, 46 (60.5%) had a favourable outcome (discharged), while 30 (39.5%) had an unfavourable outcome (death). Among patients with favourable outcomes, 39.2% were discharged on Long-Term Oxygen Therapy (LTOT), 17.4% with home BiPAP, and 21.7% required both LTOT and home BiPAP. A further 21.7% were discharged without any respiratory support.

Results of logistic regression analysis are presented in [Table/Fig-6] and illustrated via a forest plot in [Table/Fig-7].

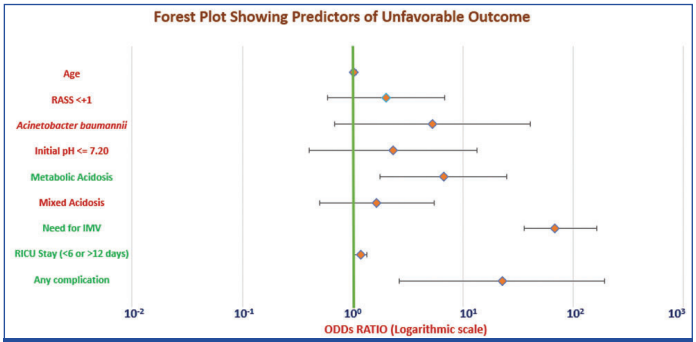
In bivariate logistic regression analysis, older age (p-value=0.007), RASS < +1 (p-value <0.0001), *Acinetobacter baumannii* infection (p-value=0.002), initial pH ≤7.20 (p-value=0.013), metabolic acidosis (p-value <0.0001), mixed acidosis (p-value <0.0001), need for mechanical ventilation (p-value <0.0001), RICU stay <6 or >12 days (p-value <0.0001), and presence of any complication (p-value=0.001) were all associated with increased odds of mortality.

Outcome category	n (%)
Favourable outcome (Discharged)	46 (60.5)
Unfavourable outcome (Death)	30 (39.5)
Among those discharged (n=46)	
Discharged on LTOT	18 (39.2)
Discharged with home BiPAP	8 (17.4)
Discharged with both LTOT and home BiPAP	10 (21.7)
Discharged without any respiratory support	10 (21.7)

[Table/Fig-5]: Outcomes and type of respiratory support at discharge (n=46).
LTOT: Long-term oxygen therapy, BiPAP: Bilevel positive airway pressure

Variables	Bivariate OR (95% CI)	p-value	Multivariate OR (95% CI)	p-value
Age	1.071 (1.019-1.125)	0.007*	1.028 (0.971-1.088)	0.326
Male sex	1.352 (0.500-3.500)	0.572	–	–
RASS <+1	7.286 (2.472-21.477)	<0.0001*	2.014 (0.593-6.837)	0.259
Acinetobacter baumannii	30.000 (3.630-247.932)	0.002*	5.282 (0.682-40.916)	0.112
Initial pH ≤7.20	8.000 (1.565-40.905)	0.013*	2.334 (0.402-13.544)	0.341
Metabolic acidosis	7.125 (2.479-20.480)	<0.0001*	6.673 (1.767-25.201)	0.005*
Mixed acidosis	3.714 (1.253-11.010)	<0.0001*	1.658 (0.501-5.484)	0.408
Need for mechanical ventilation	304.500 (32.358-2865.475)	<0.0001*	68.472 (36.206-164.682)	<0.0001*
RICU stay <6 or >12 days	18.306 (5.696-58.835)	<0.0001*	1.180 (1.032-1.348)	0.015*
Any complication	31.636 (3.969-252.150)	0.001*	22.686 (2.653-194.012)	0.004*

[Table/Fig-6]: Predictors of unfavourable outcome using logistic regression analysis (n=76).
*: p<0.05, OR: Odds ratio; RASS: Richmond agitation sedation scale; ARDS: Acute respiratory distress syndrome; RICU: Respiratory intensive care unit



[Table/Fig-7]: Forest plot (using logarithmic scale on x-axis) showing predictors of unfavourable outcome (death) among patients with dyspnoea of pulmonary origin. The significant predictors have been labeled in green font in the y-axis.
RASS: Richmond agitation sedation scale; IMV: Invasive mechanical ventilation; RICU: Respiratory intensive care unit

When these significant variables were entered into the multivariate logistic regression model, four retained independent statistical significance. Metabolic acidosis independently predicted adverse outcomes (adjusted OR 6.67, 95% CI 1.77-25.20; p-value=0.005). The need for mechanical ventilation was the strongest predictor (adjusted OR 68.47, 95% CI 36.21-164.68; p-value <0.0001). Additionally, RICU stay <6 or >12 days (adjusted OR 1.18, 95% CI 1.03-1.35; p-value=0.015) and the presence of any complication (adjusted OR 22.69, 95% CI 2.65-194.01; p-value=0.004) remained associated with poor prognosis.

Other variables that were significant in bivariate analysis-age, low RASS score, *Acinetobacter* infection, initial low pH, and mixed acidosis-lost significance after adjustment for confounders [Table/Fig-6].

DISCUSSION

In this cohort, the mean age was 59.50±11.74 years, with a predominance of males (67%). This reflects global patterns in respiratory critical care, where middle-aged to elderly men are more frequently affected by chronic lung diseases such as COPD and occupational respiratory disorders [15]. More than half of the patients

(56.6%) were between 46 and 65 years of age, highlighting the burden of chronic respiratory illness among economically active individuals. This is particularly relevant in low-resource settings, where prolonged exposure to biomass fuel and tobacco use is common [16].

Cough and expectoration were the most frequent presenting symptoms, consistent with chronic airway inflammation typical of obstructive lung diseases such as COPD and bronchiectasis [17]. In contrast, relatively few patients had haemoptysis or chest pain, suggesting that acute vascular events, such as pulmonary embolism, were less common, and exacerbations of pre-existing chronic disease were the primary drivers of dyspnoea [18].

Among co-morbidities, hypertension and diabetes mellitus were each present in 39.5% of cases, reflecting the common overlap of metabolic and respiratory disorders [19]. Interestingly, unlike earlier studies demonstrating an association between diabetes and adverse outcomes such as prolonged ventilation or higher mortality in ARDS [20-22], present study found no significant correlation between overall comorbidity burden and outcomes. This may be attributable to the predominance of obstructive airway disease rather than acute inflammatory pathologies.

Gram-negative bacteria accounted for the majority of pathogens isolated, with *Acinetobacter baumannii* and *Pseudomonas aeruginosa* being the most common. This finding highlights the high burden of hospital-acquired infections in RICUs, particularly where infection control practices may be suboptimal [23]. Detection of *Mycobacterium tuberculosis* and *Pneumocystis jirovecii* among critically ill patients further underlines the need for broad diagnostic coverage in regions where tuberculosis and HIV remain endemic [24,25]. Importantly, *Acinetobacter baumannii* was significantly associated with mortality (p-value <0.0001), consistent with previous evidence that multidrug-resistant organisms in ventilator-associated pneumonia are linked to higher death rates [26].

The most frequent diagnoses were acute exacerbation of obstructive airway diseases, diffuse parenchymal lung disease, and pneumonia. ABG analysis revealed a mean pH of 7.32±0.14, mean $PaCO_2$ of 59.80±21.64 mmHg, and mean PaO_2 of 69.86±29.69 mmHg, indicating that type 2 respiratory failure was predominant. Respiratory and mixed acidosis were common findings. Notably, metabolic and mixed acidosis were strongly associated with poor outcomes (p-value <0.0001), corroborating evidence that acidosis is a strong predictor of mortality [27]. In contrast, isolated parameters such as pH, $PaCO_2$, or PaO_2 alone were not significantly associated with outcome, suggesting that patterns of derangement, particularly mixed acidosis, may better reflect multiorgan dysfunction as seen in sepsis-induced respiratory failure [28,29].

BiPAP was the most frequently employed initial mode of support and was used overall in 82.9% of patients, consistent with its established role in managing hypercapnic respiratory failure. However, 30 patients (39.5%) required IMV, and 5 of these (6.6%) required reintubation. Mortality was significantly higher among patients receiving IMV (p-value <0.001), consistent with global data reporting 40-60% mortality rates in mechanically ventilated COPD patients [30-32].

Logistic regression analysis: The logistic regression analysis in this study identified several clinical and laboratory parameters significantly associated with mortality among patients admitted to the RICU with dyspnoea of pulmonary origin. In bivariate analysis, older age, altered neurological status, *Acinetobacter baumannii* infection, severe acid-base disturbances, the need for IMV, abnormal RICU stay duration, and the presence of complications were all significantly linked with unfavourable outcomes. These findings underscore that mortality in this patient group is strongly influenced by disease severity, underlying physiological derangements, and secondary complications acquired during critical care.

However, on multivariate analysis, only metabolic acidosis, requirement for mechanical ventilation, RICU stay <6 or >12 days, and the presence of any complication (including septic shock, Lower Respiratory Tract Infection (LRTI), ARDS, pneumothorax, Ventilator-Associated Pneumonia (VAP), or haemoptysis) remained independent predictors. Metabolic acidosis reflects underlying tissue hypoxia and multiorgan dysfunction, both of which are established contributors to poor outcomes in critical illness. The strong association of mechanical ventilation with mortality likely reflects the severity of respiratory failure and the burden of co-morbidities necessitating ventilatory support. The biphasic effect of RICU stay (<6 or >12 days) may indicate early mortality among severely ill patients and late complications among those with prolonged ICU courses.

Variables such as age, *Acinetobacter baumannii* infection, and initial pH, although significant in bivariate analysis, lost significance after adjustment, suggesting that their effects were mediated through the severity of metabolic acidosis and the need for ventilatory support. Similar patterns have been observed in prior Indian and international RICU cohorts, emphasising that physiological derangements at admission and the need for organ support remain the most reliable predictors of outcome.

Overall, the regression findings highlight that while individual clinical parameters—such as older age, neurological impairment, infection with *Acinetobacter*, metabolic acidosis, and the need for invasive ventilation—strongly correlate with mortality, outcomes in RICU patients are multifactorial. Mortality risk likely arises from cumulative physiological insult rather than a single determinant, emphasising the need for early, comprehensive management targeting both primary disease and secondary complications. These findings are consistent with prior studies demonstrating that low pH, need for IMV, and septic complications are strong predictors of poor outcomes [33,34].

In contrast with some reports, PaO_2, $PaCO_2$, or type of respiratory failure were not significantly associated with mortality, possibly due to the predominance of hypercapnic cases. Similarly, the lack of association between co-morbidities and outcomes may reflect the small sample size and underrepresentation of specific subgroups [35,36]. Overall, these findings underscore the importance of early recognition of respiratory failure, timely ventilation, and prevention of complications to improve RICU outcomes.

Limitation(s)

This study had several limitations. First, the sample size was small, with only 76 patients included, which limits the generalisability of the findings; larger, multicentric cohorts are required to draw stronger conclusions. Second, as a single-centre study, the results may reflect local practices and may not be representative of other healthcare settings. Third, patients with mixed respiratory and non respiratory causes of dyspnoea were excluded, despite such overlap being common in ICU populations. Fourth, outcomes were assessed only during the ICU stay, without long-term follow-up for post-discharge morbidity, mortality, functional status, or quality of life. Finally, treatment heterogeneity across different underlying respiratory diseases may have introduced variability in management, making direct comparisons more difficult.

CONCLUSION(S)

This study highlights the demographic and clinical profile of patients with dyspnoea of pulmonary origin in a RICU. Middle-aged men predominated, with obstructive airway disease as the most common diagnosis and a mortality rate of 39.5%. Hypertension and diabetes were frequent but did not predict outcomes. Gram-negative pathogens, especially *Acinetobacter baumannii* and *Pseudomonas aeruginosa*, were predominant. Metabolic and mixed acidosis and the need for invasive ventilation independently predicted mortality, along with altered sensorium, abnormal RICU stay duration, and septic complications. Early recognition, aggressive management, and strict infection control are essential to improve outcomes in respiratory critical care.

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