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Clinical and Demographic Predictors of Mortality in Patients with Community Acquired Pneumonia

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ABSTRACT:

Background: Community-acquired pneumonia (CAP) is a significant cause of morbidity and mortality worldwide, particularly among elderly individuals and patients with severe clinical presentations. Early identification of predictors of mortality is essential for improving patient outcomes and reducing complications. **Objectives:** To evaluate the clinical and demographic predictors of mortality among patients diagnosed with community-acquired pneumonia. **Materials and Methods:** This hospital-based observational prospective study included 50 patients diagnosed with CAP. Demographic details, lifestyle factors, comorbidities, presenting symptoms, physiological parameters, disease severity scores, complications, ICU admission, and mechanical ventilation requirements were assessed. Statistical analysis was performed using SPSS version 27.0 and GraphPad Prism version 5. A p-value of <0.05 was considered statistically significant. **Results:** The majority of patients belonged to the age group >65 years (54.0%). Male gender showed significantly higher mortality compared to females (41.7% vs 15.4%, p=0.039). Smoking was significantly associated with mortality (p=0.017). Patients with higher CURB-65 scores (3–5) demonstrated markedly increased mortality (83.3%, p<0.001). Significant

physiological predictors of mortality included lower systolic blood pressure (p=0.011), higher respiratory rate (p<0.001), and lower oxygen saturation (p<0.001). Septic shock (p<0.001), MODS (p=0.004), ICU admission (p<0.001), and requirement of mechanical ventilation (p<0.001) were strongly associated with mortality. **Conclusion:** Male gender, smoking, severe disease presentation, hypoxemia, septic shock, MODS, ICU admission, and mechanical ventilation were important predictors of mortality in CAP patients. Early risk stratification and aggressive management may improve survival outcomes.

INTRODUCTION:

Community-acquired pneumonia (CAP) remains one of the leading infectious causes of morbidity and mortality worldwide, particularly among elderly individuals and patients with underlying comorbid conditions. Despite remarkable advances in antimicrobial therapy, vaccination strategies, and critical care management, CAP continues to pose a significant burden on healthcare systems, especially in developing countries. The disease is characterized by an acute infection of the pulmonary parenchyma acquired outside hospital settings and presents with varying degrees of severity ranging from mild respiratory symptoms to life-threatening sepsis and respiratory failure. Mortality associated with CAP is influenced by multiple clinical, demographic, microbiological, and socioeconomic factors, making early risk stratification essential for improving patient outcomes [1].

Globally, CAP affects millions of individuals annually and is associated with high hospitalization rates and substantial healthcare expenditure. In low- and middle-income countries, delayed healthcare access, malnutrition, smoking, poor vaccination coverage, and limited intensive care facilities further contribute to adverse outcomes. The incidence and mortality rates are notably higher among older adults due to age-related decline in immune function and the presence of chronic diseases such as diabetes mellitus, chronic obstructive pulmonary disease (COPD), chronic kidney disease, and cardiovascular disorders [2,3]. Several studies have demonstrated that demographic variables such as advanced age, male gender, and lower socioeconomic status significantly influence the severity and prognosis of CAP [4].

Clinical predictors play a crucial role in determining the risk of mortality in patients with CAP. Symptoms such as severe dyspnea, altered mental status, hypotension, tachypnea, hypoxemia, and the presence of septic shock are commonly associated with poor prognosis. Laboratory abnormalities including leukocytosis, elevated blood urea nitrogen, hyponatremia, acidosis, and elevated inflammatory markers have also been linked to increased mortality risk [5]. Radiological findings such as multilobar involvement and pleural effusion are considered indicators of severe disease and are frequently associated with intensive care admission and higher fatality rates [6].

Various prognostic scoring systems have been developed to identify high-risk patients at an early stage. Tools such as the Pneumonia Severity Index (PSI) and CURB-65 scoring system are widely used in clinical practice for assessing disease severity and guiding hospitalization decisions. However, the predictive accuracy of these scoring systems may vary across different populations due to differences in demographic characteristics, healthcare infrastructure, and prevalence of comorbid conditions [7]. Therefore, understanding locally relevant predictors of mortality remains essential for optimizing treatment strategies and resource allocation.

Microbial etiology also influences clinical outcomes in CAP. Streptococcus pneumoniae remains the most common causative organism worldwide, although atypical pathogens, gram-negative bacteria, and viral infections are increasingly recognized contributors to severe disease [8]. The emergence of multidrug-resistant organisms and inappropriate empirical antibiotic therapy have further complicated disease management and contributed to increased mortality [9].

Identification of clinical and demographic predictors of mortality among patients with CAP is therefore of paramount importance for timely intervention, appropriate triage, and improved survival. Evaluating these predictors can help clinicians recognize high-risk individuals early and initiate aggressive management strategies to reduce complications and mortality. The present study aims to assess the clinical and demographic factors associated with mortality in patients diagnosed with community-acquired pneumonia and to identify significant predictors influencing patient outcomes [10].

The present study aims to evaluate the clinical and demographic predictors of mortality in patients with

community-acquired pneumonia. The objectives are to identify significant risk factors associated with poor outcomes, assess the influence of comorbidities and clinical presentation on mortality, and improve early risk stratification and management strategies in hospitalized patients.

MATERIALS AND METHODS:

Study Design: Hospital-based observational prospective study.
Study Population: Patients diagnosed with community-acquired pneumonia admitted to the Department of General Medicine and associated wards/intensive care units.
Sample Size: A total of 50 patients fulfilling the inclusion criteria were included in the study.
Study Duration: The study was conducted over a period of 12 months.
Study Place: The study was carried out at a tertiary care teaching hospital.

Inclusion Criteria:

1. Patients aged ≥18 years.
2. Patients clinically and radiologically diagnosed with community-acquired pneumonia.
3. Patients admitted within 48 hours of onset of hospitalization.
4. Patients willing to provide informed consent.

Exclusion Criteria:

1. Patients with hospital-acquired or ventilator-associated pneumonia.
2. Patients with active pulmonary tuberculosis.
3. Immunocompromised patients including HIV-positive individuals, chemotherapy recipients, or transplant patients.
4. Patients with incomplete clinical records.
5. Patients unwilling to participate in the study.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS software version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The unpaired t-test was used to compare continuous variables between independent groups, whereas the paired t-test was applied for within-group comparisons. Categorical variables were analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

RESULT:

Table 1: Demographic Characteristics and Clinical Outcome Among Patients with Community Acquired Pneumonia

Variable	Category	Death n (%)	Recovered n (%)	Total n (%)	p-value
Age Group (years)	26–45	2 (25.0%)	6 (75.0%)	8 (16.0%)	0.304
	46–65	2 (13.3%)	13 (86.7%)	15 (30.0%)	
	>65	10 (37.0%)	17 (63.0%)	27 (54.0%)	
Gender	Female	4 (15.4%)	22 (84.6%)	26 (52.0%)	0.039
	Male	10 (41.7%)	14 (58.3%)	24 (48.0%)	
Socioeconomic Status	Low	8 (25.8%)	23 (74.2%)	31 (62.0%)	0.266
	Middle/High	6 (31.6%)	13 (68.4%)	19 (38.0%)	

Table 2: Association of Lifestyle Factors and Comorbidities with Clinical Outcome

Variable	Category	Death n (%)	Recovered n (%)	Total n (%)	p-value
Smoking Status	No	6 (17.6%)	28 (82.4%)	34 (68.0%)	0.017
	Yes	8 (50.0%)	8 (50.0%)	16 (32.0%)	
Alcohol Consumption	No	11 (28.2%)	28 (71.8%)	39 (78.0%)	0.951
	Yes	3 (27.3%)	8 (72.7%)	11 (22.0%)	
Diabetes Mellitus	No	11 (28.9%)	27 (71.1%)	38 (76.0%)	0.791
	Yes	3 (25.0%)	9 (75.0%)	12 (24.0%)	
Hypertension	No	9 (28.1%)	23 (71.9%)	32 (64.0%)	0.979
	Yes	5 (27.8%)	13 (72.2%)	18 (36.0%)	
COPD	No	13 (30.2%)	30 (69.8%)	43 (86.0%)	0.384
	Yes	1 (14.3%)	6 (85.7%)	7 (14.0%)	

Table 3: Association of Presenting Symptoms with Clinical Outcome

Symptom	Category	Death n (%)	Recovered n (%)	Total n (%)	p-value
Fever	No	9 (39.1%)	14 (60.9%)	23 (46.0%)	0.106
	Yes	5 (18.5%)	22 (81.5%)	27 (54.0%)	
Cough	No	9 (45.0%)	11 (55.0%)	20 (40.0%)	0.029
	Yes	5 (16.7%)	25 (83.3%)	30 (60.0%)	
Sputum Production	No	11 (44.0%)	14 (56.0%)	25 (50.0%)	0.012
	Yes	3 (12.0%)	22 (88.0%)	25 (50.0%)	
Dyspnea	No	4 (26.7%)	11 (73.3%)	15 (30.0%)	0.891
	Yes	10 (28.6%)	25 (71.4%)	35 (70.0%)	

Table 4: Comparison of Anthropometric and Physiological Parameters Between Recovered and Death Groups

Variable	Recovered Mean ± SD	Death Mean ± SD	p-value
Age (years)	60.36 ± 14.56	68.43 ± 17.57	0.104
BMI (kg/m²)	23.99 ± 3.01	25.71 ± 2.81	0.072
Pulse Rate (bpm)	97.08 ± 15.61	107.14 ± 21.74	0.074
Systolic BP (mmHg)	124.28 ± 25.27	102.71 ± 27.45	0.011
Respiratory Rate (/min)	20.44 ± 3.15	26.21 ± 5.49	<0.001
SpO_2 (%)	92.39 ± 5.26	81.21 ± 8.24	<0.001

Table 5: Association of Disease Severity and Complications with Clinical Outcome

Variable	Category	Death n (%)	Recovered n (%)	Total n (%)	p-value
CURB-65 Score	0–2	4 (10.5%)	34 (89.5%)	38 (76.0%)	<0.001
	3–5	10 (83.3%)	2 (16.7%)	12 (24.0%)	
ARDS	No	12 (25.5%)	35 (74.5%)	47 (94.0%)	0.124
	Yes	2 (66.7%)	1 (33.3%)	3 (6.0%)	
Respiratory Failure	No	10 (23.8%)	32 (76.2%)	42 (84.0%)	0.131
	Yes	4 (50.0%)	4 (50.0%)	8 (16.0%)	
Septic Shock	No	5 (13.9%)	31 (86.1%)	36 (72.0%)	<0.001
	Yes	9 (64.3%)	5 (35.7%)	14 (28.0%)	
MODS	No	11 (23.4%)	36 (76.6%)	47 (94.0%)	0.004
	Yes	3 (100.0%)	0 (0.0%)	3 (6.0%)	

Table 6: ICU Admission, Mechanical Ventilation, and Logistic Regression Predictors of Mortality

Variable	Category/OR	Death n (%)	Recovered n (%)	p-value
ICU Admission	No	0 (0.0%)	19 (100.0%)	<0.001
	Yes	14 (45.2%)	17 (54.8%)	
Mechanical Ventilation	No	0 (0.0%)	36 (100.0%)	<0.001
	Yes	14 (100.0%)	0 (0.0%)	

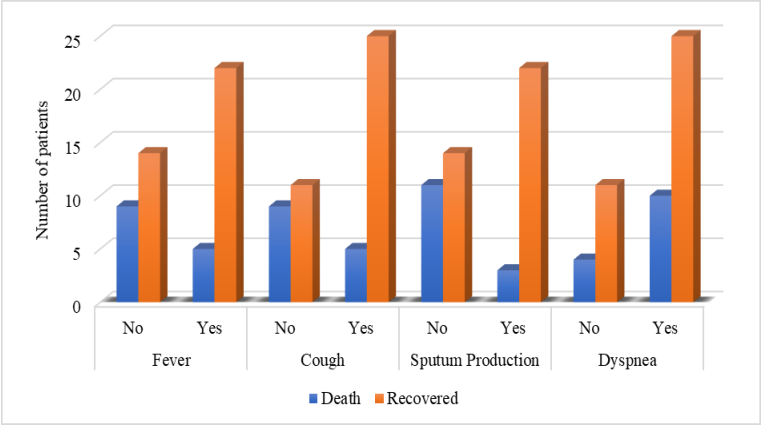

Figure: 1. Association of Lifestyle Factors and Comorbidities with Clinical Outcome

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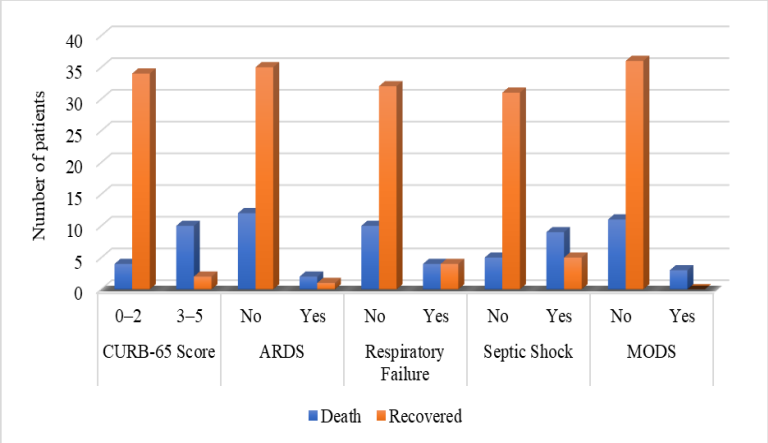

Figure: 2. Association of Disease Severity and Complications with Clinical Outcome

Table 1 demonstrates the demographic characteristics and their association with clinical outcomes among patients with community-acquired pneumonia. Among the 50 study participants, the majority belonged to the age group >65 years, accounting for 27 (54.0%) patients, followed by 46–65 years with 15 (30.0%) patients and 26–45 years with 8 (16.0%) patients. Mortality was highest among patients aged >65 years, where 10 (37.0%) patients died, compared to 2 (13.3%) deaths in the 46–65 years group and 2 (25.0%) deaths in the 26–45 years group. However, the association between age group and outcome was not statistically significant (p=0.304).
Regarding gender distribution, females constituted 26 (52.0%) patients while males accounted for 24 (48.0%). Mortality was significantly higher among males, with 10 (41.7%) deaths compared to only 4 (15.4%) deaths among females. This association between gender and outcome was statistically significant (p=0.039).
In terms of socioeconomic status, 31 (62.0%) patients belonged to the low socioeconomic group and 19 (38.0%) belonged to the middle/high socioeconomic group. Mortality was slightly higher among patients from the middle/high socioeconomic group (31.6%) compared to the low socioeconomic group (25.8%), although this difference was not statistically significant (p=0.266).

Table 2 depicts the association of lifestyle factors and comorbidities with clinical outcomes among patients with community-acquired pneumonia. Smoking was significantly associated with mortality. Among smokers, 8 (50.0%) patients died and 8 (50.0%) recovered, whereas among non-smokers, only 6 (17.6%) patients died and 28 (82.4%) recovered. This association was statistically significant (p=0.017).
Alcohol consumption did not show a significant association with clinical outcome. Among alcohol consumers, 3 (27.3%) patients died while 8 (72.7%) recovered. Similarly, among non-alcohol consumers, 11 (28.2%) deaths and 28 (71.8%) recoveries were observed (p=0.951).
Diabetes mellitus was present in 12 (24.0%) patients, among whom 3 (25.0%) died and 9 (75.0%) recovered. Among non-diabetic patients, 11 (28.9%) deaths and 27 (71.1%) recoveries were noted. The association was not statistically significant (p=0.791).
Hypertension was observed in 18 (36.0%) patients. Mortality among hypertensive patients was 27.8%, which was comparable to 28.1% among non-hypertensive patients, showing no statistically significant difference (p=0.979).
COPD was present in 7 (14.0%) patients, among whom only 1 (14.3%) death was reported, whereas mortality among patients without COPD was 30.2%. However, this difference was not statistically significant (p=0.384).

Table 3 illustrates the association between presenting symptoms and clinical outcomes in patients with community-acquired pneumonia. Fever was present in 27 (54.0%) patients, among whom 5 (18.5%) died and 22 (81.5%) recovered. In contrast, among patients without fever, mortality was higher at 39.1%. However, the association was not statistically significant (p=0.106).
Cough was reported in 30 (60.0%) patients, among whom only 5 (16.7%) died and 25 (83.3%) recovered. Among patients without cough, mortality was considerably higher at 45.0%. This association was statistically significant (p=0.029).
Sputum production was observed in 25 (50.0%) patients. Mortality among patients with sputum production was 12.0%, whereas mortality among patients without sputum production was markedly higher at 44.0%. The difference was statistically significant (p=0.012).
Dyspnea was the most common symptom, present in 35 (70.0%) patients. Mortality among patients with dyspnea

was 28.6%, compared to 26.7% among patients without dyspnea. No statistically significant association was observed (p=0.891).

Table 4 compares anthropometric and physiological parameters between recovered and deceased patients. The mean age was higher among patients who died (68.43 ± 17.57 years) compared to recovered patients (60.36 ± 14.56 years), although the difference was not statistically significant (p=0.104).
The mean BMI was also higher among deceased patients (25.71 ± 2.81 kg/m²) compared to recovered patients (23.99 ± 3.01 kg/m²), but the association was not statistically significant (p=0.072).
Pulse rate was elevated among patients who died (107.14 ± 21.74 bpm) compared to recovered patients (97.08 ± 15.61 bpm), though statistical significance was not achieved (p=0.074).
A statistically significant reduction in systolic blood pressure was observed among deceased patients (102.71 ± 27.45 mmHg) compared to recovered patients (124.28 ± 25.27 mmHg) (p=0.011).
Respiratory rate was significantly higher among patients who died (26.21 ± 5.49/min) than among recovered patients (20.44 ± 3.15/min), demonstrating a highly significant association with mortality (p<0.001).
Similarly, oxygen saturation (SpO_2) was markedly lower among deceased patients (81.21 ± 8.24%) compared to recovered patients (92.39 ± 5.26%), and this difference was highly statistically significant (p<0.001).

Table 5 presents the association between disease severity, complications, and clinical outcomes. Patients with a CURB-65 score of 3–5 had significantly higher mortality, with 10 (83.3%) deaths and only 2 (16.7%) recoveries. In contrast, patients with scores of 0–2 had a mortality rate of only 10.5%. This association was highly significant (p<0.001).
ARDS was observed in 3 (6.0%) patients, among whom 2 (66.7%) died. Although mortality was higher in patients with ARDS compared to those without ARDS (25.5%), the association did not reach statistical significance (p=0.124).
Respiratory failure was present in 8 (16.0%) patients, with a mortality rate of 50.0%, compared to 23.8% mortality among patients without respiratory failure. However, this difference was not statistically significant (p=0.131).
Septic shock showed a strong association with mortality. Among patients with septic shock, 9 (64.3%) died and only 5 (35.7%) recovered, whereas among patients without septic shock, mortality was only 13.9%. This association was highly statistically significant (p<0.001).
MODS was observed in 3 (6.0%) patients, and all affected patients died, resulting in a mortality rate of 100.0%. This association was statistically significant (p=0.004).

Table 6 evaluates ICU admission, mechanical ventilation, and predictors of mortality among patients with community-acquired pneumonia. ICU admission was required in 31 patients, among whom 14 (45.2%) died and 17 (54.8%) recovered. In contrast, none of the patients who were managed without ICU admission died, and all 19 (100.0%) recovered. This association was highly statistically significant (p<0.001).
Mechanical ventilation was required in 14 (28.0%) patients, and all ventilated patients died, resulting in a mortality rate of 100.0%. Conversely, all 36 patients who did not require mechanical ventilation recovered completely. The association between mechanical ventilation and mortality was highly statistically significant (p<0.001).

DISCUSSION:

The present study evaluated the clinical and demographic predictors of mortality among patients with community-acquired pneumonia (CAP). Increasing age was associated with higher mortality, with patients aged more than 65 years showing the highest death rate. Although the association was not statistically significant, the finding is clinically relevant and comparable to the observations of Marrie et al., who reported that elderly patients with CAP had increased mortality due to age-related decline in immune response, delayed presentation, and higher prevalence of comorbidities [11]. Similarly, Kaplan and colleagues demonstrated that advanced age is a major determinant of adverse outcomes and prolonged hospitalization in CAP patients [12].

Gender-wise analysis in the current study revealed significantly higher mortality among males compared to females. This finding is consistent with the study conducted by Falguera et al., who reported that male sex was independently associated with severe pneumonia and increased mortality risk [13]. The higher prevalence of smoking, alcohol use, occupational exposure, and delayed healthcare-seeking behavior among males may explain this observation. Low socioeconomic status was more common in the present study, although no significant association with mortality was found. Similar findings were reported by Jackson et al., who noted that poor socioeconomic conditions contribute to increased disease burden and delayed treatment access but may not

independently predict mortality after hospitalization [14].

Among lifestyle factors, smoking showed a statistically significant association with mortality. Smokers exhibited substantially higher death rates than non-smokers. This finding is supported by Almirall et al., who demonstrated that smoking impairs mucociliary clearance, damages respiratory epithelium, and predisposes individuals to severe lower respiratory tract infections [15]. The present study did not find significant associations between alcohol consumption, diabetes mellitus, hypertension, COPD, and mortality. Comparable findings were observed by Rello et al., who reported that while these comorbidities increase susceptibility to CAP, they may not independently predict mortality unless accompanied by severe systemic complications [16].

Analysis of presenting symptoms revealed that cough and sputum production were significantly associated with better recovery rates, whereas their absence was linked to increased mortality. Patients without productive respiratory symptoms may present late or develop atypical pneumonia with rapid clinical deterioration. Similar observations were made by Buising et al., who reported that atypical clinical presentation is associated with delayed diagnosis and poorer outcomes in elderly CAP patients [17]. Dyspnea was highly prevalent in the present study but did not show a statistically significant association with mortality, which is in agreement with the findings of España et al., where dyspnea was common across both severe and non-severe pneumonia cases [18].

Physiological parameters demonstrated strong associations with mortality. Deceased patients had significantly lower systolic blood pressure, higher respiratory rate, and lower oxygen saturation compared to recovered patients. These findings indicate hemodynamic instability and severe respiratory compromise among non-survivors. Similar results were reported by Charles et al., who identified tachypnea, hypotension, and hypoxemia as independent predictors of severe CAP and mortality [19]. The current study also observed higher pulse rates among deceased patients, reflecting systemic inflammatory response and sepsis-related cardiovascular stress.

Disease severity assessment using the CURB-65 score showed a highly significant association with mortality. Patients with scores between 3 and 5 had markedly higher death rates than those with lower scores. This finding supports the utility of CURB-65 as an effective prognostic tool and correlates well with the work of Aujesky et al., who demonstrated that higher CURB-65 scores strongly predict ICU admission, complications, and mortality in hospitalized CAP patients [20]. Septic shock and multiple organ dysfunction syndrome (MODS) were also significantly associated with mortality in the present study, emphasizing the importance of early recognition and aggressive management of systemic complications. Furthermore, all patients requiring mechanical ventilation died, highlighting the grave prognosis associated with respiratory failure and advanced disease severity in CAP.

CONCLUSION:

Community-acquired pneumonia remains a major cause of morbidity and mortality, particularly among elderly patients and those presenting with severe clinical manifestations. The present study identified several important predictors of mortality, including male gender, smoking, higher CURB-65 score, septic shock, multiple organ dysfunction syndrome (MODS), ICU admission, and requirement of mechanical ventilation. Physiological parameters such as hypotension, tachypnea, and reduced oxygen saturation were also significantly associated with poor outcomes. Although comorbidities like diabetes mellitus, hypertension, and COPD were common among study participants, they did not show a statistically significant association with mortality in the present study. Early recognition of high-risk patients using clinical assessment and severity scoring systems can facilitate timely intervention, appropriate monitoring, and aggressive management. The findings of this study emphasize the importance of prompt diagnosis, risk stratification, and intensive supportive care in reducing mortality and improving clinical outcomes among patients with community-acquired pneumonia.

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