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Analysis of Mortality-Associated Risk Factors In Patients With Community Acquired Pneumonia: A Retrospective Data From University Hospital

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ABSTRACT

To analyze and determine the mortality-associated risk factors in patients hospitalized due to the Community Acquired Pneumonia (CAP).

The data of patients with CAP were retrieved from hospital's database. The age, gender, smoking status, mortality rate, co-morbidities, laboratory results (WBC, CRP, Procalcitonin, urea, creatinine, lymphocyte, Hb and Htc levels), clinical parameters including respiratory rate, PSI score, CURB-65 score, intensive care unit hospitalization, pO2 levels, fever, blood pressure and presence of pleural effusion were recorded from hospital's patient data system.

In total, 47 cases of CAP were retrospectively evaluated. The mean age of patients were 66.05±14.3 years (range, 35-87). The gender was being 17 females and 30 males. The mortality rate was 9/47 (19.1%). The mean CURB-65 score, WBC and CRP, was 1.2±1.1, 11.67±7.89 and 121.2±52.2, respectively. The non-survivors were found to have statistically significantly decreased level of Sa02, blood pressure level (both systolic and diastolic), lymphocyte count. The survivors were found to have younger age, lower procalcitonin positivity and lower need for invasive mechanical ventilation ($p<0.05$). The logistic regression analysis showed that the mortality-associated risk factors are need for mechanical ventilation, presence of pleural effusion, older age and procalcitonin positivity.

CAP is related with in-hospital mortality and several factors like requirement of invasive ventilation, procalcitonin positivity and older age should be kept in mind for mortality.

Keywords: Pneumonia, mortality, respiratory diseases, CURB-65,

Introduction

Community-acquired pneumonia (CAP) is an important cause of morbidity and mortality worldwide, particularly among the elderly and individuals with comorbid conditions. Despite advancements in antimicrobial drugs and supportive care, CAP remains a major public health problem due to its substantial burden on healthcare systems and its association with poor clinical results (1).

Several risk assessment tools, such as the Pneumonia Severity Index (PSI) and the CURB-65 score, have been developed to predict disease severity and guide clinical decision-making (2). However, mortality rates among hospitalized patients with CAP continue to change, influenced by factors such as age, comorbidities, laboratory parameters, and the need for intensive care support. Determining these mortality-associated risk factors is crucial for improving patient management strategies and optimizing treatment interventions (3).

Furthermore, elucidating the role of inflammatory biomarkers such as procalcitonin and C-reactive protein (CRP) can add valuable prognostic information. These markers have been widely used to assess disease severity and guide antimicrobial therapy decisions (4). However, their precise role in predicting mortality risk remains a subject of ongoing studies.

Additionally, the need for invasive mechanical ventilation and the presence of pleural effusion have been identified as critical indicators of disease severity. Patients requiring intensive respiratory support often experience worse outcomes, highlighting the importance of early and aggressive intervention in high-risk cases (5). By recognizing these key prognostic factors, clinicians can make more informed decisions regarding hospitalization,

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monitoring, and therapeutic approaches to improve patient outcomes.

In this retrospective study, we aimed to analyze the clinical and laboratory parameters associated with in-hospital mortality in CAP patients. By evaluating patient demographics, comorbidities, inflammatory markers, and clinical severity scores, we seek to provide insights into the predictors of adverse outcomes, which may aid in the early identification of high-risk individuals and contribute to better treatment strategies.

Material and Methods

This retrospective study was conducted at a teritary referral center in department of chest diseases. The data of patients hospitalized with a diagnosis of community-acquired pneumonia (CAP) were retrieved from hospital's database and analyzed. The patients who hospitalized for the diagnosis of CAP at our university between date of 01.02.2024 and 01.10.2024 were included in the study. Ethical approval for this study was obtained from the institutional ethical board with the number 2025/03-17. Patient selection was based on hospital records, and demographic characteristics such as age, gender, smoking status, comorbidities, and mortality rates were recorded.

The exclusion criteria were as follows: Patients diagnosed with hospital-acquired pneumonia without radiological confirmation, those with immunosuppressive conditions (including solid organ or bone marrow transplantation or ongoing immunosuppressive therapy), as well as individuals with asthma and active tuberculosis were excluded from the study.

Laboratory parameters including white blood cell count (WBC), C-reactive protein (CRP), procalcitonin, urea, creatinine, lymphocyte count, hemoglobin (Hb), and hematocrit (Htc) levels were analyzed. Additionally, clinical variables such as respiratory rate, PSI score, CURB-65 score, intensive care unit admission, pO2 levels, fever, blood pressure, and the presence of pleural effusion were recorded.

Laboratory parameters were measured at the time of admission and prior to treatment initiation. Peripheral blood samples were collected in calcium-EDTA tubes, and blood counts along with differential analyses were performed using an automated analyzer.

Statistical Analysis: Data were analyzed using The SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY). Continuous variables were presented as mean ± standard deviation, while categorical variables were expressed as percentages. Differences between survivors and non-survivors were assessed using the independent sample t-test or Mann-Whitney U test. Logistic regression analysis was performed to identify mortality-associated risk factors. A p-value of <0.05 was considered statistically significant.

Results

A total of 47 patients diagnosed with community-acquired pneumonia (CAP) were retrospectively analyzed. The mean age of the cohort was 66.05 ± 14.3 years, with a significantly higher mean age in non-survivors compared to survivors (75.08 ± 15.43 vs. 64.06 ± 15.23, $p = 0.003$). Males constituted 63.8% (n = 30) of the study population. The overall mortality rate was 19.1% (n = 9). Table 1 shows the demographic and clinical parameters in the study cohort.

Regarding clinical parameters, non-survivors had significantly lower systolic (101.4 ± 17.2 mmHg vs. 113.4 ± 16.5 mmHg, $p = 0.032$) and diastolic blood pressure levels (60.2 ± 6.84 mmHg vs. 67.4 ± 10.2 mmHg, $p = 0.022$), as well as reduced oxygen saturation (SaO_2) levels (81.2 ± 7.54% vs. 89.4 ± 7.42%, $p = 0.001$). Respiratory rate was also significantly higher in non-survivors (15.87 ± 6.4 vs. 14.31 ± 1.23, $p = 0.013$).

The need for invasive mechanical ventilation (IMV) was markedly higher among non-survivors (66.6% vs. 13.1%, $p = 0.001$). Additionally, pleural effusion was more frequently observed in non-survivors (66.6% vs. 7.8%, $p = 0.002$). Procalcitonin positivity was significantly associated with mortality, with all non-survivors exhibiting elevated procalcitonin levels (100% vs. 23.6%, $p = 0.001$). Furthermore, lymphocyte count was significantly lower in non-survivors compared to survivors (9.87 ± 7.63 vs. 16.2 ± 2.1, $p = 0.015$).

Table 2 shows the univariate regression analysis for the subgroups including survivors and non-survivors. Univariate regression analysis identified age ≥ 65 years (OR: 1.83, 95% CI: 1.651–2.016, $p = 0.001$), procalcitonin positivity (OR: 12.04, 95% CI: 1.850–82.810, $p = 0.024$), need for IMV (OR: 16.03, 95% CI: 1.860–252.320, $p = 0.007$), and presence of pleural effusion (OR: 1.543, 95% CI: 1.210–2.008, $p = 0.001$) as significant mortality-associated risk factors. The CURB-65 score and duration of hospitalization did not show a significant association with mortality ($p > 0.05$).

Table 1: Demographic and Clinical Characteristics of the Patients' Data

Variables	Total (n:47)	Survivors (n:38)	Non-survivors (n:9)	P value
Age, years(mean±SD)	66.05±14.3	64.06±15.23	75.08±15.43	0.003
Gender				
Male, (n/%)	30 (63.8%)	25 (65.7%)	5 (55.5%)	NS
Female, (n/%)	17(36.1%)	13 (34.2%)	4 (44.4%)	
Smoking status				
Yes, (n/%)	32 (68.08%)	26 (68.4%)	6 (66.6%)	NS
Blood pressure level				
Systolic TA (mmHg)	115.6±17.3	113.45±16.5	101.4±17.2	0.032
Diastolic TA (mmHg)	66.45±9.84	67.45±10.2	60.23±6.84	0.022
Co-morbidities				
Diabetes, (n/%)	15 (31.9%)	12 (31.5%)	3 (33.3%)	NS
Hypertension, (n/%)	14 (29.7%)	11 (28.9%)	3 (33.3%)	NS
COPD, (n/%)	15 (31.9%)	11 (28.9%)	4 (44.4%)	NS
Heart disease, (n/%)	5 (10.6%)	4 (10.5%)	1 (11.1%)	NS
SaO_2, (%)	88.21±6.72	89.43±7.42	81.2±7.54	0.001
CURB-65	1.2±1.1	1.03±1	1.45±1.3	NS
Respiratory rate	14.45±2.32	14.3±11.23	15.8±76.4	0.013
IMV, (n/%)	11 (23.4%)	5 (13.1%)	6 (66.6%)	0.001
Hospitalization day	8.67±4.67	8.76±4.53	6 (66.6%)	0.002
Pleural effusion, (n/%)	9 (19.1%)	3 (7.8%)	9 (100%)	0.001
Htc, (%)	40.6±5.23	40.8±6.14	38.6±6.43	NS
WBC,(10^3/μl)	11.67±7.89	11.65±8.76.	11.01±5.65	NS
PLT, (10^3/μl)	265.65±123.1	278.65±112.1	266.23±134.2	NS
CRP, (mg/dL)	121.2±52.2	105.4±65.4	112.2±67.5	NS
Lymphocyte, (10^3/μl)	16.5±11.2	16.2±12.1	9.87±7.63	0.015
Creatinine, (mg/dL)	1.05±0.76	1.04±0.72	1.06±0.65	NS

COPD: Chronic obstructive pulmonary disease, IMV: Invasive mechanic ventilation, P<0.05 shows the statistical significance

Table 2: Univariate Regression Analysis of Mortality-Associated Risk Factors

Variables	Univariate regression OR (95 % CI)	P value
Procalcitonin positivity	12.042 (1.850-82.810)	0.024
IMV	16.030 (1.860-252.320)	0.007
CURB-65(≥1)	1.126 (0.08-24.765)	0.672
Pleural effusion	1.543 (1.210-2.008)	0.001
Age≥65	1.83 (1.651-2.016)	0.001
Hospital stay (≥7 days)	3.21 (0.430-30.210)	0.41
Co-morbidities	18.672 (0.065-6754.123)	0.362

OR: Odds ratio, CI: Confidence interval, IMV: Invasive mechanical ventilation, p<0.05 shows statistical significance

Dıscussıon

Community-acquired pneumonia (CAP) remains a significant cause of morbidity and mortality, particularly among elderly individuals and those with comorbid conditions. In this study, we found that mortality in CAP was associated with older age, the need for invasive mechanical ventilation (IMV), the presence of pleural effusion, and procalcitonin positivity.

Older age is a well-documented risk factor for increased CAP-related mortality. In our cohort, the mean age of non-survivors was significantly higher than that of survivors, a finding consistent with studies reporting that patients aged ≥65 years have an elevated risk of mortality due to diminished immune responses and a higher prevalence of comorbidities (6). The association between age and mortality highlights the need for targeted management strategies in elderly patients, including early intervention and aggressive supportive care.

The need for IMV was another independent predictor of mortality in our study. Non-survivors had significantly higher rates of IMV compared to survivors, reflecting the severity of respiratory failure in these patients. This observation is in line with previous research demonstrating that CAP patients requiring mechanical ventilation have a markedly increased risk of in-hospital mortality (7). The requirement for IMV underscores the importance of early recognition and timely respiratory support in high-risk CAP patients to prevent clinical deterioration.

Another notable finding in our study was the significant association between pleural effusion and mortality. The presence of pleural effusion has been identified as a marker of severe pneumonia and has been correlated with increased ICU admission and prolonged hospital stays. Likewise, Huang CY et al studied the risk factors for progressive CAP in pediatric cohort and reported that pleural effusion at admission is a significant risk factor for progressive disease (8). The mechanisms underlying this association may include delayed antibiotic penetration, increased systemic inflammation, and higher bacterial loads in patients with parapneumonic effusions. Our results emphasize the need for careful monitoring and potential early drainage in patients with CAP and significant pleural effusion.

Procalcitonin positivity was also significantly associated with mortality in our cohort. Elevated procalcitonin levels have been widely used as a biomarker for bacterial infections and sepsis, and their prognostic value in CAP has been extensively studied. In a meta-analysis that evaluated the role of Procalcitonin for mortality in CAP patients reported that an elevated PCT level was associated with an increased risk of mortality (9). High procalcitonin levels are indicative of systemic inflammation and have been linked to increased mortality risk, as confirmed by our findings. The role of procalcitonin in guiding antibiotic therapy and risk stratification remains an important consideration in CAP management.

Our study also examined other parameters, such as CURB-65 scores and inflammatory markers, but did not find a significant correlation with mortality. Although CURB-65 is commonly used for severity assessment in CAP, its predictive value for mortality may be limited in certain populations, as observed in prior studies (10). This suggests that additional biomarkers and clinical parameters may be necessary for a more comprehensive risk stratification approach.

Some limitation of this study should be mentioned. First, it is a retrospective study which may create some data challenges and difficulty in analysis. Second, it is related with the sample size, although it is adequate to reach a scientific analysis, the number of cases should be high to reach a comprehensive statsitical documentation.

In conclusion, our findings indicate that older age, the need for IMV, the presence of pleural effusion, and procalcitonin positivity are significant predictors of mortality in CAP patients. These results underscore the importance of early risk assessment and aggressive management strategies in high-risk individuals. Future studies with larger sample sizes and prospective designs are warranted to validate these findings and further refine CAP risk prediction models.

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