A Comparative Study of Serum Procalcitonin, CURB-65, and Pneumonia Severity Index in Predicting Outcomes of Community-Acquired Pneumonia in Elderly Patients

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Abstract- Background: Community-acquired pneumonia (CAP) is a leading cause of morbidity and mortality, particularly among the elderly. Accurate severity assessment is critical for prognosis and treatment. This study compares the efficacy of serum procalcitonin (PCT), CURB-65, and Pneumonia Severity Index (PSI) in predicting outcomes in elderly CAP patients.

Methods: A prospective observational study was conducted at ASRAMS, Eluru, from November 2022 to April 2024, involving 50 patients aged >65 years with CAP. Serum PCT levels, CURB-65, and PSI scores were assessed, and outcomes (cure or death) were analyzed using chi-square tests and Receiver Operating Characteristic (ROC) curves.

Results: The mean age was 72.6±8.28 years, with 66% males. Cough (80%), fever (64%), and breathlessness (52%) were common symptoms. PCT >5 ng/ml was observed in 56% of patients, CURB-65 ≥3 in 64%, and PSI ≥3 in 62%. All three parameters showed significant associations with outcomes ($p<0.001$). ROC analysis revealed AUCs of 0.873 (PCT), 0.901 (CURB-65), and 0.909 (PSI), with sensitivities of 83.35%, 94.4%, and 77.8%, respectively.

Conclusion: Serum PCT, CURB-65, and PSI are effective in predicting CAP outcomes in elderly patients, with comparable predictive power. PCT offers an additional tool for risk stratification, especially in busy clinical settings, and can complement clinical scoring systems.

Keywords: Community-acquired pneumonia, Procalcitonin (PCT), CURB-65, Pneumonia Severity Index (PSI), Elderly, Outcome prediction

INTRODUCTION

Community-acquired pneumonia (CAP) remains a significant global health burden, contributing to 429.2 million illness episodes annually and 94.5 million disability-adjusted life years, with India accounting for 23% of the global burden [1]. In elderly patients (>65 years), CAP is associated with higher morbidity and mortality due to immunosenescence and comorbidities such as diabetes and chronic obstructive pulmonary disease (COPD) [2]. Severity assessment tools like CURB-65 and Pneumonia Severity Index (PSI) are widely used, but their prognostic accuracy is limited [3]. Serum procalcitonin (PCT), a biomarker of bacterial infection, has emerged as a promising indicator for severity and antibiotic guidance in CAP [4].

This study aims to compare the efficacy of serum PCT levels with CURB-65 and PSI in predicting outcomes in elderly CAP patients at a tertiary care center in India. The objectives include assessing the role of PCT

in severity prediction, evaluating CURB-65 and PSI, and comparing their prognostic value.

METHODS

Study Design and Population

A prospective observational study was conducted at the Department of General Medicine, ASRAMS, Eluru, India, from November 2022 to April 2024. The study included 50 consecutive patients aged >65 years admitted with CAP, diagnosed based on acute lower respiratory tract symptoms (cough, breathlessness, pleuritic chest pain), systemic features (fever >37.7°C), focal respiratory signs, and radiological evidence of consolidation [5]. Exclusion criteria were pregnancy, immunosuppressive therapy, and HIV infection.

Data Collection

Detailed clinical histories, physical examinations, and vital parameters were recorded. Severity was assessed using CURB-65 (≥3 indicating severe CAP) and PSI (class ≥IV indicating severe CAP). Serum PCT levels were measured using the BRAHMS PCT KRYPTOR assay (cut-off >5 ng/ml for high levels). Laboratory investigations included complete blood count, renal function tests, electrolytes, chest X-ray, and sputum culture. Outcomes were categorized as cure or death.

Statistical Analysis

Data were analyzed using IBM SPSS version 26 and MS Excel 2023. Chi-square tests assessed associations between PCT, CURB-65, PSI, and outcomes, with $p<0.05$ considered significant. ROC curves determined sensitivity, specificity, and area under the curve (AUC) for each parameter.

Ethical Considerations

The study was approved by the ASRAMS Institutional Ethics Committee. Informed consent was obtained from all participants in their local language, ensuring confidentiality and the right to withdraw.

RESULTS

Demographic and Clinical Profile

The mean age was 72.6±8.28 years, with 66% males and 34% females. The 65-75 age group comprised 78% of patients. Common symptoms included cough (80%), fever (64%), and breathlessness (52%). Comorbidities were prevalent, with diabetes (42%) and COPD (42%) being most frequent. Hypotension was noted in 40% of patients at presentation, and 88% had leucocyte counts >11,000, suggesting bacterial etiology.

Severity Scores and PCT Levels

PCT >5 ng/ml was observed in 56% of patients, CURB-65 ≥3 in 64%, and PSI ≥3 in 62%. Sputum culture was positive in 34% of cases. ICU stays ranged from 1-5 days (48%) to >5 days (36%), with a mortality rate of 36%.

Association with Outcomes

Chi-square analysis showed significant associations between outcomes and PCT ($\chi^2=29.045$, $p<0.001$), CURB-65 ($\chi^2=11.314$, $p=0.007$), and PSI ($\chi^2=8.631$, $p=0.003$). Mean PCT levels were 1.48 ng/dl (CURB-65 <3) vs. 8.94 ng/dl (CURB-65 ≥3) and 1.83 ng/dl (PSI <3) vs. 8.97 ng/dl (PSI ≥3), indicating higher levels with severe disease.

ROC Analysis

ROC curves demonstrated AUCs of 0.873 (PCT, sensitivity 83.35%, specificity 81.2%), 0.901 (CURB-65, sensitivity 94.4%, specificity 75%), and 0.909 (PSI, sensitivity 77.8%, specificity 96.9%), all with $p<0.001$, confirming their predictive efficacy.

DISCUSSION

This study highlights the utility of serum PCT, CURB-65, and PSI in predicting CAP outcomes in elderly patients. The high prevalence of cough, fever, and breathlessness aligns with previous findings [6], while the association of smoking and COPD as risk factors corroborates Nuorti et al. [7]. The elevated leucocyte counts and PCT levels (>5 ng/ml in 56%) suggest a

predominant bacterial etiology, consistent with Choi et al. [8].

PCT's prognostic value was comparable to CURB-65 and PSI, with an AUC of 0.873, supporting its role as a biomarker in CAP severity assessment [9]. The significant correlation between PCT levels and ICU stay or ventilator need ($p<0.001$) aligns with Self et al. [10], emphasizing its utility in guiding intensive care decisions. However, unlike Kim et al. [9], who found a stronger PCT-mortality link in the elderly, our study did not observe a direct mortality correlation, possibly due to the smaller sample size.

The similarity in AUCs (0.873-0.909) suggests that PCT can complement CURB-65 and PSI, offering a rapid, objective measure in emergency settings. Limitations include the small sample size (n=50) and exclusion of patients <65 years, which may limit generalizability. Future multicenter studies with larger cohorts could validate these findings.

CONCLUSION

Serum PCT, CURB-65, and PSI are effective predictors of CAP outcomes in elderly patients, with PCT providing an additional tool for risk stratification. Integrating PCT with clinical scores may enhance prognostic accuracy and guide antibiotic therapy, reducing unnecessary use and improving patient outcomes. Further research with larger, diverse populations is warranted.

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