RESEARCH PAPER

Evaluation of the Severe Community Acquired Pneumonia (SCAP) Score in Predicting Severity and Clinical Outcomes in Patients with Community-Acquired Pneumonia

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ABSTRACT

Background: Community-acquired pneumonia (CAP) remains a major cause of morbidity and mortality worldwide. Accurate early assessment of disease severity is essential to guide clinical management and optimize resource allocation. Traditional tools such as CURB-65 and the Pneumonia Severity Index (PSI) have limitations in predicting intensive care unit (ICU) requirements and mortality. The Severe Community-Acquired Pneumonia (SCAP) score, incorporating physiological, laboratory, and radiological parameters, has shown superior predictive accuracy internationally, though Indian data remain limited.

Objectives: To evaluate the effectiveness of the SCAP score in predicting severe clinical outcomes including ICU admission, need for mechanical ventilation, vasopressor use, and in-hospital mortality among patients with community-acquired pneumonia, and to compare its performance with the CURB-65 score.

Methods: This prospective observational study was conducted in the Department of General Medicine in a Tertiary Care Hospital at Puducherry, India, over three months. Sixty-six adults with radiologically confirmed CAP were enrolled. SCAP and CURB-65 scores were calculated within 24 hours of admission. Outcomes measured included ICU admission, ventilatory support, vasopressor use, and mortality. Statistical analyses included Chi-square tests, receiver operating characteristic (ROC) curve analysis, and logistic regression.

Results: The mean SCAP score was 13.9 ± 5.4, while the mean CURB-65 score was 2.1 ± 1.0. Twenty-two patients (33.3%) required ICU care, 18 (27.3%) required mechanical ventilation, and 12 (18.2%) died. Higher SCAP scores were significantly associated with severe outcomes ($p < 0.001$). ROC analysis showed superior predictive performance for SCAP (AUC 0.91 for mortality) compared with CURB-65 (AUC 0.76). SCAP ≥20, acidosis (pH <7.30), and multilobar infiltrates were independent predictors of poor outcomes.

Conclusion: The SCAP score is a reliable and superior tool for early identification of severe CAP compared with CURB-65. Its integration into clinical practice could enhance triage accuracy, guide ICU referral, and improve patient outcomes, particularly in resource-limited settings.

Keywords: Community-acquired pneumonia, SCAP score, CURB-65, severity assessment, intensive care, mortality prediction

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INTRODUCTION

Community-acquired pneumonia (CAP) remains a leading cause of morbidity and mortality worldwide, particularly among adults and the elderly. According to the World Health Organization (2023), lower respiratory tract infections rank as the fourth leading cause of death globally, underscoring the persistent burden of this disease despite advances in antimicrobial therapy and supportive care [1]. CAP accounts for substantial hospital admissions and healthcare costs, especially in low- and middle-income countries where diagnostic and critical care resources are limited.

Early identification of patients at risk of developing severe disease is critical for optimizing management strategies, including timely intensive care unit (ICU) referral, mechanical ventilation, and vasopressor support. Several scoring systems have been developed to assess pneumonia severity and guide clinical decisions [2]. Among the most widely used are the Pneumonia Severity Index (PSI) and CURB-65, both of which incorporate clinical and laboratory parameters to stratify risk.

The conventional tools do, however, have significant drawbacks. Despite being thorough, the PSI requires a lot of variables and may underestimate severity in younger individuals. The CURB-65 score, on the other hand, is quick and easy to use, but its sensitivity in predicting the requirement for extensive respiratory or vasopressor support is low [3]. As a result, different models that more precisely forecast critical illness are being investigated.

The Severe Community-Acquired Pneumonia (SCAP) score, proposed by España et al., integrates physiological, radiological, and laboratory variables that are closely associated with severe outcomes such as shock and respiratory failure [4]. Multiple international studies have validated its superior performance compared with CURB-65 and PSI. For instance, the SCAP score demonstrated better predictive accuracy for mechanical ventilation and vasopressor requirement than CURB-65 [5, 6]. Similarly, SCAP effectively predicted early ICU transfer in

patients with multilobar pneumonia [7]. A meta-analysis involving over 15,000 patients further confirmed that SCAP and SMART-COP achieved the highest area under the curve (AUC) for predicting intensive respiratory or vasopressor support [8].

Recent evidence from Asia and Latin America has reinforced the prognostic utility of the SCAP score across diverse healthcare settings [9]. High SCAP scores were significantly correlated with hyperlactatemia, renal dysfunction, and in-hospital mortality [10]. Moreover, studies from resource-limited environments demonstrated that SCAP accurately predicted both ICU admission and short-term mortality [11].

Despite these findings, there remains a paucity of data from India and other South Asian populations, where differences in pathogen spectrum, antimicrobial resistance patterns, and healthcare-seeking behaviour could affect score performance. Therefore, it is crucial to validate the SCAP score in Indian patients in order to ascertain its suitability and dependability in regional clinical practice.

This study aims to evaluate the effectiveness of the SCAP scoring system in predicting severe outcomes including ICU admission, mechanical ventilation, vasopressor use, and mortality among Indian patients with community-acquired pneumonia. By comparing the SCAP score with CURB-65, the study seeks to identify a more accurate, resource-appropriate tool for early risk stratification and clinical decision-making.

MATERIALS AND METHODS

Study Design and Setting: A prospective observational study conducted in the Department of General Medicine in a tertiary care centre at Puducherry over a period of three months after obtaining approval from the Institutional Ethics Committee (IEC) (Approval No. IEC/SVMCH/2025/MDGM/014) and the Scientific Research Committee (SRC).

Study Population: All adult patients admitted with a clinical and radiological diagnosis of community-acquired pneumonia (CAP) were screened for eligibility. CAP was defined as the presence of a new pulmonary infiltrate on chest imaging with one or more clinical symptoms such as fever, cough, or breathlessness, and onset occurring outside the hospital or within 48 hours of admission.

Inclusion Criteria: Adults aged 18 years and above, clinical features suggestive of pneumonia (fever, cough and breathlessness), radiological confirmation of pneumonia on chest X-ray, onset of illness in the community or within 48 hours of hospitalization and written informed consent obtained.

Exclusion Criteria: Hospital-acquired or ventilator-associated pneumonia, immunocompromised states such as HIV infection, post-transplantation, or chemotherapy, active pulmonary tuberculosis or lung malignancy, patients already intubated before evaluation and pregnant women.

Sample Size Determination: The sample size was calculated based on previous studies that demonstrated a sensitivity of approximately 88% for the SCAP score in predicting in-hospital mortality among patients with community-acquired pneumonia. Using a 95% confidence interval and an allowable error of 15%, the required number of outcome-positive cases was 18. Considering an expected mortality prevalence of 30% and a 10% dropout rate, the final sample size was determined to be 66 patients.

Data Collection Procedure: Eligible patients were enrolled consecutively after obtaining informed consent. A detailed clinical evaluation was performed at admission, including demographic data (age, sex, occupation, address), presenting complaints, comorbidities, prior antibiotic use, and personal habits such as smoking and alcohol consumption. A thorough physical examination was done, including temperature, pulse rate, blood pressure, respiratory rate, oxygen saturation, and mental status using the Glasgow Coma Scale. All data were entered into Microsoft Excel 2010 and analyzed using SPSS version 23.0. Patients were assigned coded study identification numbers, and no personal identifiers were used in the analysis.

Investigations: All investigations were performed within 24 hours of admission as part of standard care. These included complete blood count, renal function tests, electrolytes, arterial blood gas analysis, liver function tests if indicated, and chest X-ray. Sputum and blood cultures were obtained when clinically warranted.

Severity Scoring: Within the first 24 hours of admission, both SCAP and CURB-65 scores were calculated for each patient. The SCAP score proposed by España et al. (2006) includes physiological, laboratory, and radiological parameters such as arterial pH, systolic blood pressure, respiratory rate, confusion, blood urea, oxygen saturation or PaO_2, multilobar infiltrates, and age [4]. The CURB-65 score proposed by Lim et al. (2003) includes confusion, urea >7 mmol/L, respiratory rate ≥30/min, low blood pressure, and age ≥65 years. Patients were categorized into low, intermediate, or high-risk groups based on their SCAP scores (0–9, 10–19, and ≥20 respectively) [3].

Primary Outcomes

- Intensive Care Unit (ICU) admission
- Requirement for mechanical ventilation (invasive or non-invasive)
- Vasopressor use
- In-hospital mortality

Secondary Outcomes

- Duration of hospital and ICU stay
- Development of complications such as shock, acute respiratory distress syndrome (ARDS), and acute kidney injury (AKI)

STATISTICAL ANALYSIS

Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Comparisons between categorical variables were made using the Chi-square or Fisher's exact test, and between continuous variables using the student's t-test or Mann–Whitney U test, depending on distribution.

Predictive accuracy of SCAP and CURB-65 scores was evaluated using receiver operating characteristic (ROC) curve analysis and comparison of area under the curve (AUC). Logistic regression analysis was used to identify independent predictors of severe outcomes. A p-value less than 0.05 was considered statistically significant.

RESULTS

The results of the study were represented in tables 1-4 and figure 1&2.

Baseline Characteristics

Sixty-six patients with community-acquired pneumonia were enrolled. The mean age was 56.8 ± 14.7 years, and 40 patients (60.6%) were male. Fever (87.9%), cough (84.8%), and dyspnea (77.3%) were the most frequent symptoms. Comorbidities were present in 65.2% of participants, with diabetes mellitus (31.8%) and hypertension (27.3%) being the most common. Chronic obstructive pulmonary disease was documented in 16.7% of patients. The mean duration of symptoms before admission was 4.2 ± 1.8 days.

Radiological and Laboratory Findings

Multilobar infiltrates were observed in 22 patients (33.3%), and pleural effusion in 10 (15.2%). The mean oxygen saturation on admission was 89.6 ± 6.8%. Arterial pH averaged 7.38 ± 0.08, with acidosis (pH <7.30) noted in 14 patients (21.2%). The mean serum urea level was 34.6 ± 12.4 mg/dL.

SCAP and CURB-65 Scores

The mean SCAP score was 13.9 ± 5.4. Based on risk stratification, 19 patients (28.8%) were in the low-risk group (0–9), 26 (39.4%) in the intermediate group (10–19), and 21 (31.8%)

in the high-risk group (≥20). The mean CURB-65 score was 2.1 ± 1.0; 22 patients (33.3%) were categorized as low risk (0–1), 24 (36.4%) as moderate risk (2), and 20 (30.3%) as high risk (3–5).

Clinical Outcomes

ICU admission was required in 22 patients (33.3%), mechanical ventilation in 18 (27.3%), and vasopressor support in 14 (21.2%). Twelve patients (18.2%) died during hospitalization. The mean hospital stay was 8.6 ± 3.7 days, and the mean ICU stay among critically ill patients was 5.2 ± 2.8 days.

Association Between SCAP Score and Outcomes

Higher SCAP scores were significantly associated with adverse outcomes. Patients in the high-risk category (≥20) had higher rates of ICU admission (81.0%), need for mechanical ventilation (71.4%), vasopressor use (47.6%), and mortality (42.9%) compared with those in the low-risk category (all $p < 0.001$). The association between CURB-65 and severe outcomes was less robust, particularly for vasopressor requirement ($p = 0.06$).

Predictive Performance of SCAP and CURB-65

Receiver operating characteristic (ROC) curve analysis demonstrated that the SCAP score had superior predictive accuracy compared with CURB-65. For ICU admission, the area under the curve (AUC) for SCAP was 0.90 (95% CI, 0.82–0.97) versus 0.78 (95% CI, 0.67–0.89) for CURB-65. For the requirement of mechanical ventilation, AUC values were 0.89 (95% CI, 0.80–0.96) and 0.74 (95% CI, 0.62–0.86), respectively. For in-hospital mortality, SCAP yielded an AUC of 0.91 (95% CI, 0.83–0.98), significantly higher than that of CURB-65 (AUC, 0.76; 95% CI, 0.64–0.88; $p < 0.01$).

Multivariate Analysis

Logistic regression identified SCAP score ≥20 (adjusted OR, 6.8; 95% CI, 2.7–17.3; $p < 0.001$), arterial pH <7.30 (adjusted OR, 4.5; 95% CI, 1.6–12.5; $p = 0.005$), and multilobar infiltrates (adjusted OR, 3.9; 95% CI, 1.4–10.6; $p = 0.008$) as independent predictors of severe outcomes. CURB-65 ≥3 showed a marginal association with mortality (OR, 2.1; 95% CI, 0.9–5.2; $p = 0.08$).

DISCUSSION

The Severe Community-Acquired Pneumonia (SCAP) score outperformed the CURB-65 score in predicting severe outcomes, such as ICU admission, mechanical ventilation, vasopressor requirement, and in-hospital mortality, in this prospective observational study of 66 patients with community-acquired pneumonia. Despite improvements in antibiotic and supportive therapy, the total in-hospital mortality rate of 18.2% found in this study is similar to previously published data from international cohorts, indicating the on-going burden of severe CAP.

The findings indicate the SCAP score's prognostic significance in determining illness severity. ICU hospitalization (81.0%), mechanical ventilation (71.4%), and death (42.9%) were also significantly greater among patients with SCAP scores ≥20. The results reported by earlier studies showed that SCAP outperformed both CURB-65 and the Pneumonia Severity Index (PSI) in identifying patients requiring intensive care and predicting short-term mortality [5,12,10]. Receiver operating characteristic analysis also showed excellent discriminatory performance (AUC 0.91 for mortality).

The SCAP score incorporates key physiological parameters—such as acidosis, hypoxemia, hypotension, and multilobar infiltrates—that directly reflect respiratory and hemodynamic compromise. These parameters are closely linked to the pathophysiology of severe pneumonia, thereby enhancing the clinical relevance of SCAP in early identification of patients likely to deteriorate. In contrast, CURB-65 relies on fewer and more generalized variables, which may limit its ability to detect early respiratory failure or circulatory collapse. Similar observations were made by Memon et al. (2022) and Mehmood et al. (2025), who reported higher sensitivity and specificity for SCAP and SMART-COP in predicting the need for intensive respiratory or vasopressor support [8,13].

Significantly, this work contributes regional evidence from an Indian population, where SCAP validation data is still scarce. Score performance may be impacted by variations in patient demographics, pathogen prevalence, and healthcare-seeking behavior. The high predictive accuracy of SCAP in this context indicates that it can be used in a variety of clinical settings, such as hospitals with limited resources where quick risk assessment is crucial for effective triage and management. Early detection of high-risk patients enables prompt ventilator and vasopressor assistance, optimal ICU usage, and better results.

The study's strengths include its prospective design, standardized scoring within 24 hours of admission, and comprehensive outcome assessment. However, certain limitations must be acknowledged. The single-center nature and modest sample size may limit generalizability, and microbiological confirmation was not uniformly available. Additionally, long-term outcomes beyond hospitalization were not assessed. Nevertheless, the results are consistent with global evidence supporting SCAP as a robust tool for assessing the severity of community-acquired pneumonia.

CONCLUSION

The Severe Community-Acquired Pneumonia (SCAP) score demonstrated superior predictive accuracy compared with the CURB-65 score in assessing disease severity and clinical outcomes among patients with community-acquired pneumonia. A SCAP score ≥20 was strongly associated with ICU admission, need for mechanical ventilation, vasopressor use, and in-hospital mortality, confirming its reliability as an early prognostic tool. Given its inclusion of key physiological and radiological parameters, SCAP provides a more comprehensive assessment of illness severity. Validation in this Indian cohort supports its applicability in diverse healthcare settings, suggesting that routine use of the SCAP score can facilitate timely triage, optimize critical care resource utilization, and potentially improve patient outcomes.

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TABLES AND FIGURES

Table 1. Baseline Demographic and Clinical Characteristics of the Study Population (n = 66)

Variable	Mean ± SD / n (%)
Age (years)	56.8 ± 14.7
Sex (Male)	40 (60.6%)
Fever	58 (87.9%)
Cough	56 (84.8%)
Breathlessness	51 (77.3%)
Chest pain	20 (30.3%)
Comorbidities (any)	43 (65.2%)
Diabetes mellitus	21 (31.8%)
Hypertension	18 (27.3%)
COPD	11 (16.7%)
Duration of symptoms (days)	4.2 ± 1.8
Oxygen saturation on admission (%)	89.6 ± 6.8
Arterial pH	7.38 ± 0.08
Acidosis (pH < 7.30)	14 (21.2%)
Multilobar infiltrates on X-ray	22 (33.3%)
Pleural effusion	10 (15.2%)

Table 2. Distribution of SCAP and CURB-65 Scores

Scoring System	Mean ± SD	Low Risk	Intermediate Risk	High Risk
SCAP	13.9 ± 5.4	19 (28.8%)	26 (39.4%)	21 (31.8%)
CURB-65	2.1 ± 1.0	22 (33.3%)	24 (36.4%)	20 (30.3%)

Table 3. Association between SCAP Risk Category and Clinical Outcomes

Outcome	Low Risk (0–9)	Intermediate (10–19)	High Risk (≥20)	p-value
ICU admission	2 (10.5%)	8 (30.8%)	12 (81.0%)	<0.001
Mechanical ventilation	1 (5.3%)	5 (19.2%)	12 (71.4%)	<0.001
Vasopressor use	1 (5.3%)	3 (11.5%)	10 (47.6%)	<0.001
In-hospital mortality	0 (0%)	3 (11.5%)	9 (42.9%)	<0.001

Table 4. Comparison of Predictive Accuracy between SCAP and CURB-65 Scores

Outcome	SCAP AUC (95% CI)	CURB-65 AUC (95% CI)	p-value
ICU admission	0.90 (0.82–0.97)	0.78 (0.67–0.89)	0.01
Mechanical ventilation	0.89 (0.80–0.96)	0.74 (0.62–0.86)	0.01
Vasopressor use	0.88 (0.79–0.95)	0.73 (0.60–0.85)	0.01
In-hospital mortality	0.91 (0.83–0.98)	0.76 (0.64–0.88)	<0.01

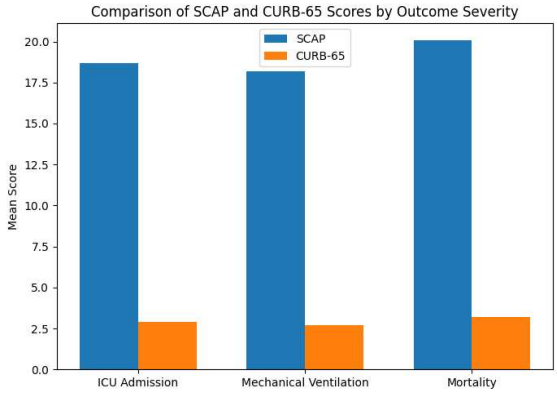

Figure 1: Comparison of SCAP and CURB-65 Scores by Outcome Severity

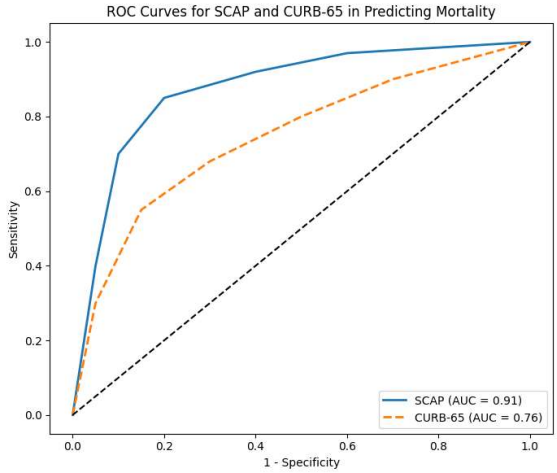

Figure 2: Receiver Operating Characteristic (ROC) Curves for SCAP and CURB-65 in Predicting Mortality