ORIGINAL ARTICLE

A Comparative Study of Confusion, Urea Nitrogen, Respiratory Rate, Blood Pressure, Age ≥ 65 and Pneumonia Severity Index Scoring Systems in Patients with Pneumonia in a Tertiary Care Setting

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Abstract

Background: Pneumonia is one of the major causes of mortality and morbidity globally. The ability to stratify the risk and early intervention is the key to survival and can decrease mortality significantly. Herein, we compare the pneumonia severity index (PSI) and confusion, urea nitrogen, respiratory rate, blood pressure, age ≥ 65 (CURB-65) in terms of predicting mortality, intensive care unit (ICU) admission, and requirement of invasive mechanical ventilation.

Materials and methods: The current study is a 1-year Cohort study conducted from October 2019 to September 2020. Patients hospitalized with community-acquired pneumonia (CAP) were included in the study after fulfilling the eligibility criteria. PSI and CURB-65 scores were calculated at the time of admission and compared. Follow-up of the patients was done for 30 days after admission to observe for mortality.

Results: In total, 70 subjects were admitted to hospital with CAP, with male predominance. Of 70 subjects, 28 (40%) required ICU admission. The overall mortality rate was 15.7%, higher in patients above 65 years of age (33%). PSI class ≥ 4 was more accurate in predicting mortality, and admission into ICU, and PSI class 5 for the requirement of invasive ventilation than CURB-65 score ≥ 2 as calculated from the area under the curve (AUC) for the receiver operator characteristics (ROC) curve drawn for these two scores. The AUC of PSI (0.812) was higher compared to CURB-65 (0.721) in our study, making it a better predictor of mortality. PSI class ≥ 4 had higher sensitivity for predicting ICU admission but CURB-65 score ≥ 2 had higher specificity.

Conclusion: The PSI is more sensitive than CURB-65 in predicting ICU admission and death, with high prognostic capacity. Therefore, it is essential for clinicians to choose the scoring index that is suitable for their local requirements.

Keywords: CURB, mortality, pneumonia, pneumonia severity index, PSI.

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Introduction

Pneumonia is one of the common causes of mortality and morbidity and poses a significant challenge in clinical medicine.[1] It is the fifth leading cause of mortality in our country. The management of pneumonia is made more difficult due to the identification of new pathogens, multidrug resistance, and increased prevalence of immunocompromised hosts.[2,3] Pneumonia is often misdiagnosed, mistreated, and underestimated, despite its significant mortality and morbidity. The incidence is highly influenced by age, with the very young and elderly experiencing a much higher incidence.[2,3]

Pneumonia is an inflammatory process of the pulmonary parenchyma that occurs as a result of an infectious agent. The clinical syndrome of pneumonia includes symptoms such as cough, expectoration, breathlessness, and pleurisy along with fever, sweats, rigors or chills, and/or pulmonary lesions observed on radiographic examination. Loss of appetite, fatigue, and confusion are frequently encountered nonspecific symptoms.[4] Pneumonia historically was classified as community-acquired pneumonia (CAP) and nosocomial pneumonia based on the site of acquisition of the infection. Nosocomial pneumonia encompasses hospital-acquired pneumonia, which is diagnosed 72 hours or later after admission to a healthcare setting, and ventilator-associated pneumonia, which is diagnosed 72 hours after endotracheal intubation.[4]

India has a burden of 4 million cases of pneumonia annually which accounts for 23% of the global burden and 36% of the World Health Organization (WHO) regional burden.[5] Early assessment

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of severity is crucial as it helps in determining the location of care and the level of management.[6] Several predictive score systems were developed which are aimed at optimizing the care and management of CAP. Pneumonia severity index (PSI), the modified American Thoracic Society (mATS) rule, and confusion, urea nitrogen, respiratory rate, blood pressure, age ≥ 65 (CURB-65) score are the three scoring systems commonly used for CAP. Other scores that have been studied include confusion, respiratory rate, blood pressure score, systolic blood pressure, multilobar chest radiography involvement, albumin, respiratory rate, tachycardia, and confusion, oxygen, and arterial pH (SMART-COP) score, national early warning systems (NEWS), systolic blood pressure, respiratory rate, temperature, and age (SWAT-Bp) score, severe CAP score, confusion, oxygen saturation, respiratory rate, blood pressure score, etc.[7,8]

Scoring systems utilized in developed nations are not extensively validated in developing countries, due to differences in population demographics and scarcity of health resources.[9] Prognostic scores for CAP were developed to predict the likelihood of death and to recognize disease severity as early as possible to ensure the delivery of intensive care in a timely manner.[10–12] PSI and CURB-65 are the most studied scoring indices presently. The PSI is complex to use and could overestimate the risk of death in elderly patients with comorbidities while underestimating the need for intensive care unit (ICU) care in younger patients who have not been sick in the past.[13] The CURB-65 is simple to use, but not optimal for patients with multiple comorbidities.[13]

Risk stratification, the ability to individualize the site of care accurately, and early intervention are the keys to survival and can decrease mortality significantly. This study is designed to determine whether PSI and CURB-65 can be used to predict mortality, ICU admission, and length of ICU stay. In addition, can these two scores aid the physician in selecting the appropriate care facility to minimize mortality and enhance patient care is also assessed.

Aims and Objectives

To study PSI and CURB-65 scores in patients hospitalized with pneumonia.

To compare PSI and CURB-65 scores in assessing.

- Mortality.
- Admission into ICU.
- Requirement of mechanical ventilation.

Materials and Methods

The present study is a 1-year observational Cohort study that was conducted from October 2019 to September 2020 in the Department of General Medicine and Pulmonary Medicine, Nizam's Institute of Medical Sciences (NIMS), in Hyderabad. The study was approved by the Institutional Ethics Committee.

Subjects meeting the following criteria were recruited into the study.

Inclusion Criteria

- Subjects of age 18 years or more of either sex.
- Patients diagnosed with pneumonia based on clinical features and radiographic evidence.

Exclusion Criteria

- Patients with alternate diagnoses like bronchogenic carcinoma, and tuberculosis.
- Children (age <18 years), pregnant women, and those not willing to participate.
- Patients with nosocomial or healthcare-associated pneumonia.
- Chronic immunosuppressive conditions like a solid organ transplant, postspelenectomy, neutropenia (absolute neutrophil counts < 1000/mm^3), and those patients on oral steroid treatment, or other immunosuppressive medications.
- Human immunodeficiency virus (HIV)—positive patients.
- Lack of informed consent.

Detailed history, demographic data, and complete physical examination were obtained for all the patients. Relevant blood investigations including blood cultures were obtained immediately after admission before the institution of antibiotic therapy. An electrocardiogram, complete urine examination, sputum for acid-fast bacillus, gram stain, and cultures with sensitivity patterns were obtained. Bronchoscopy with bronchoalveolar lavage, computed tomography chest, H1N1 swab, pleural fluid analysis, and other specific antigen tests were obtained wherever required. All patients were reassessed clinically every 24 hours for the development of any new complications and/or response to treatment.

The PSI and CURB-65 scores were calculated for each patient after obtaining all the variables. The details of the used indices were provided in the supplementary file. Each patient was allotted a class for PSI based on the calculated score. PSI[14] is a two-step system that uses 20 variables and was created to identify low-risk patients and candidates who can be managed on an outpatient basis. Four scoring parameters are used in CURB,[11,15] a modified version of the British Thoracic Society assessment tool—namely, mental confusion, measured blood urea value, respiratory rate, and diastolic blood pressure.

Management of the patients including decision about admission into ICU and initiation of mechanical ventilation is done by the treating physician. He/she will be blinded to the prognostic scores of the individual subjects. All patients were followed for a 30-day period to observe for mortality and other outcomes included in the study.

Sample Size

A sample size of the subjects was calculated based on existing literature, considering the sensitivity of 22.2% and specificity of 98.4% (p = 00034) of CURB-65 class 4 score in predicting the death from CAP.[16] Using this data, a sample size of 70 is required to obtain 90% power for type 1 α-error (0.05) with 95% CI.

Statistical Analysis

All the information and obtained variables were entered into a spreadsheet and analyzed in a statistical software package (IBM, Statistical Packages for the Social Sciences, version 23.0). Descriptive statistics were calculated, that is, mean [standard deviation (SD)] for continuous variables and frequency distribution (percentage) for categorical variables. Sensitivity, specificity, and area under the curve (AUC) were calculated using receiver operator characteristics (ROC) for CURB-65 and PSI with qualitative variables (death, ICU admission, and invasive ventilation) as an outcome. Comparison of continuous variables was done using an unpaired t-test, while the comparison of categorical variables was done using a Chi-squared test. A p-value of <0.05 is considered statistically significant.

Results

A total of 70 patients with CAP were recruited after fulfilling the eligibility criteria. PSI and CURB-65 scores were calculated for all the

patients and studied for comparison. The baseline characteristics of the study population are shown in Table 1.

Age, Gender, and Comorbidity Distribution

The mean age (SD) was 49.65 (14.62) years ranging from 18 to 82 years. A total of 70 patients, 29 (41.4%) were females and 41 (58.6%) were males. There is an increased incidence of pneumonia (66.6%) in males with age ≥ 65 years compared to females (33.3%). The most common underlying illness was diabetes mellitus [*n* = 26 (37.1%)], followed by hypertension in [*n* = 20 (28.6%)].

Outcomes of Study Population

Out of 70 patients in our study population, 11(15.7%) patients died and 59 (84.3%) survived. Among those who expired, five out of 11 patients were aged >65 years, thus mortality was significantly higher in this age group (33.3%) with *p*-value (0.04). In total, there are 28 (40%) admissions into the ICU with or without requiring invasive ventilation. Table 2 shows outcomes and causes of death in the study population.

Table 1: Baseline characteristics and outcome measures of patients with pneumonia (*n* = 70)

Baseline characteristics	*Mean (SD), range or n (%)*
Age (years)	49.65 ± 14.62
Male, *n* (%)	41 (58.6)
Female, *n* (%)	29 (41.4)
Clinical parameters	
Pulse rate	101.54 ± 15.98
Respiratory rate	26.24 ± 5.77
Systolic blood pressure	111 ± 17.54
Oxygen saturation (SpO_2%)	69.54 ± 8.61
Laboratory results	
Sodium (mmol/L)	130.61 ± 5.99
Glucose (mg/dL)	166.89 (72–519)
Arterial pH	7.53 ± 1.23
Blood urea nitrogen (BUN)	26.22 ± 16
Hematocrit	32 ± 3.78
Risk factors: *n* (%)	
Diabetes mellitus	26 (37.2)
Hypertension	20 (28.6)
COPD	4 (5.7)
Coronary heart disease	8 (11.5)
Congestive heart failure	3 (4.3)
Renal disease	5 (7.2)
Chronic liver disease	3 (4.3)
Cerebrovascular disease	2 (2.8)
Smoking	3 (4.3)
Alcoholism	14 (20)
Obstructive sleep apnea	2 (2.8)
Obesity	1 (1.4)
Old tuberculosis	1 (1.4)
Bronchial asthma/allergic airway disease	4 (5.7)
Sickle cell disease	2 (2.8)
(Cholelithiasis, chronic pancreatitis, PAH, hypothyroid, and interstitial lung disease)	1 (1.4)
Outcome measures	
Mortality, *n* (%)	11 (15.7)
ICU admission, *n* (%)	28 (40)
Mechanical ventilation, *n* (%)	10 (14.2)

COPD, chronic obstructive pulmonary disease; ICU, intensive care unit; PAH, pulmonary arterial hypertension; SD, standard deviation

Analysis of Scoring Systems for Mortality Prediction

Analysis of PSI score

In the study, the ICU admission rate was 40%. One patient (11%) had ICU admission in class 1, three patients (30%) had ICU admission in class 2, seven (38.8%) had ICU admission in class 3, eight (40%) had ICU admission in class 4 and nine patients (69.2%) had ICU admission in class 5. The percentage of patients requiring admission to ICU was highest in PSI class 5. Among them, none expired in class 1, one patient expired in class 2 (10%), one expired in class 3 (11%), four expired in class 4 (15%), and five patients expired in class 5 (38.4%). So the mortality rate is 15.7% in the study. In the present study, class 5 had the highest mortality rate (38.4%).

Analysis of CURB-65 Score

In the study population, 20 patients had a CURB-65 score of 0, 22 had a CURB-65 score of 1, 20 had a CURB-65 score of 2, five had a CURB-65 score of 3, two had a CURB-65 score of 4, and one patient had CURB-65 score of 5. Among these score groups, one (5%) patient expired in CURB-65 score 0 group, three (13.6%) expired in the CURB-65 score 1 group, three (15%) expired in CURB-65 score 2 groups, two (40%) expired in CURB-65 score 3 groups, one (50%) expired in CURB-65 score 4 groups, and one (100%) patient expired in CURB-65 score 5 groups. Overall the mortality is highest in the CURB-65 score 5 groups (100%) and least in the CURB-65 score 0 group. Nevertheless, most of the deaths occurred in CURB-65 score 2 and 3 groups.

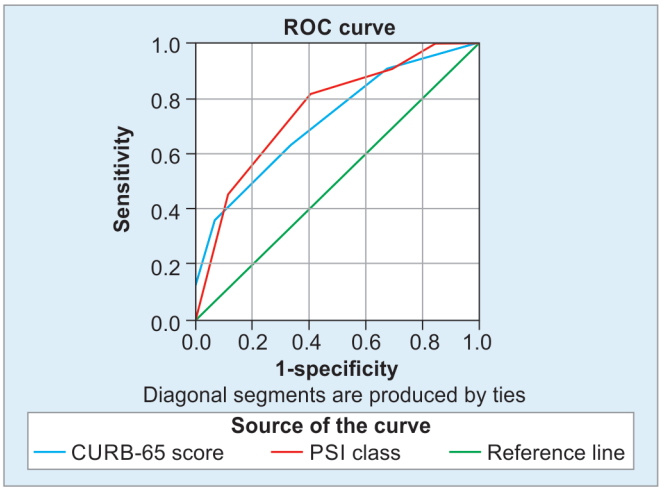
The AUC for PSI risk classes is 0.812. It is significant ($p = 0.001$), thus proving the PSI to be a good predictor of mortality. By the calculation of Youden's index from the ROC curve (at a score of 109.5), it can be inferred that PSI class ≥ 4 has a good predictive value for mortality with 81.8% sensitivity and 80% specificity. The highest specificity was in class 5 (84.7%) (Fig. 1 and Table 3).

The AUC of CURB-65 for predicting mortality is 0.721 which is significant ($p = 0.021$). By the calculation of the Youden index CURB-65 score ≥2 (36.4% sensitivity and 93.2% specificity) has good predictive value for mortality in the present study. The specificity for predicting death is highest in CURB-65 score ≥4 (100%).

Table 2: Outcomes and cause of death in the study population

Outcomes	*Number (%)*
Survived	59 (84.3%)
Expired	11 (15.7%)
ICU admission with/without a ventilator support	28 (40%)
Cause of death	
Septic shock with MODS	8
Severe ARDS	1
Anterolateral wall MI	1
Prolonged invasive ventilation with altered sensorium	1

ARDS, adult respiratory distress syndrome; ICU, intensive care unit; MI, myocardial infarction; MODS, multiple organ dysfunction syndrome



Area under the curve

Test result variable(s)	Area	Std. Error[a]	*p-value*	Asymptotic 95% Confidence interval	
				Lower bound	Upper bound
CURB-65 score	0.721	0.088	0.021	0.549	0.893
PSI class	0.812	0.077	0.007	0.606	0.909

Fig. 1: The ROC curves of different scoring systems in predicting 30-day mortality

Table 3: Sensitivity, specificity, and analysis of scoring systems for predicting 30-day mortality

Risk groups	*Survived*	*Expired, n (%)*	*Sensitivity (%)*	*Specificity (%)*	*Total*	*Positive predictive value*	*Negative predictive value*
PSI class							
Class 1	9	0 (7)	100	18.6	9	18	100
Class 2	9	1 (10)	90	20.3	10	19.6	94.7
Class 3	17	1 (11)	81.8	32.2	18	27.3	94.6
Class 4	17	4 (15)	81.8	79.7	20	41.7	89.7
Class 5	7	5 (38.4)	53.6	84.7	13	–	84.3
Total	59	11 (15)	–	–	70	–	–
CURB-65 scores							
0	19	1 (5)	90.9	32.2	20	20	95
1	19	3 (13.6)	63.6	66.1	22	25.9	90.7
2	17	3 (15)	36.4	93.2	20	50	88.7
3	3	2 (40)	18.2	98.3	5	66.7	86.6
4	1	1 (50)	9.1	100	2	100	85.5
5	0	1 (100)	0	100	1	–	84.3
Total	59	11	–	–	70	–	–

PSI, pneumonia severity index

Analysis of Scoring Systems for Predicting ICU Admission

Analysis of PSI Score

In the study, the ICU admission rate was 40%. One (11%) patient had ICU admission in class 1, three (30%) had ICU admission in class 2, seven (38.8%) had ICU admission in class 3, eight (40%) had ICU admission in class 4, and nine (69.2%) patients had ICU admission in class 5. Patients having PSI class 5 required ICU admission more than other subjects.

Analysis of CURB-65 Score

In the study, out of 28 admissions to ICU, four (20%) patients with score 0 were admitted in ICU, eight (36.3%) with score 1 admitted in ICU, nine (45%) with score 2 admitted in ICU, four (80%) with score 3 admitted in ICU, two (100%) were admitted in ICU with score 4 and one patient (100%) were admitted in ICU with score 5. The percentage of patients requiring ICU admission was highest in CURB-65 score group 4 and score group 5.

The AUC for PSI score is 0.745 and the PSI prediction of ICU admission is significant ($p = 0.001$). By calculation of Youden's index

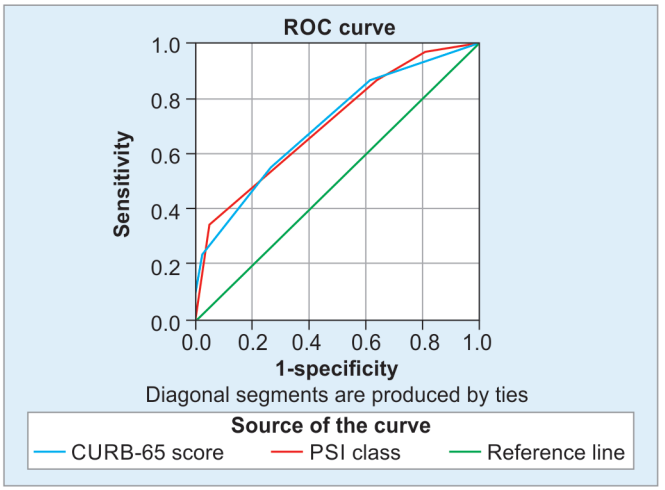
for PSI (PSI score 104), the ability of PSI to predict ICU admission was highest in PSI class ≥ 4 (62.1% sensitivity and 85.4% specificity) (Fig. 2 and Table 4).

The AUC for CURB-65 is 0.706 which was statistically significant in predicting ICU admission. By calculating Youden's index, it was inferred that the CURB-65 score group ≥ 2 has a good ability to predict ICU admission (24.1% sensitivity and 97.6% specificity). The specificity for predicting ICU admission was high in the CURB-65 score group ≥ 2.

Analysis of PSI and CURB-65 Scoring Systems for Predicting Invasive Ventilation

Analysis of PSI Class

In total, 10 patients required invasive ventilation. Among various PSI classes, none of the PSI class 1 or PSI class 2 subjects needed invasive ventilation. On the contrary, one (5.55%) patient in class 3, two (10%) in class 4, and seven (53.8%) patients in class 5 required invasive ventilation. The percentage of patients requiring invasive ventilation was highest in PSI class 5.



Area under the curve

Test result variable(s)	Area	Std. Error[a]	*p-value*	Asymptotic 95% Confidence interval	
				Lower bound	Upper bound
CURB-65 score	0.706	0.063	0.004	0.581	0.830
PSI class	0.745	0.063	0.003	0.585	0.831

Fig. 2: The ROC curves of different scoring systems in predicting ICU admission

Table 4: Sensitivity, specificity, and analysis of scoring systems for predicting ICU admission

Risk groups	*Number of patients in ICU admission, n (%)*	*Total (n)*	*Sensitivity (%)*	*Specificity (%)*	*Positive predictive value*	*Negative predictive value*
PSI class						
Class 1	1 (11)	9	100	7.3	45.9	88.9
Class 2	3 (30)	10	96.6	28	49	78.9
Class 3	7 (38.8)	18	86.2	39	54.5	70.3
Class 4	8 (40)	20	62.1	85.4	83.3	67.2
Class 5	9 (69.2)	13	44.8	92.7		58.6
Total	28 (40)	70	–	–	–	–
CURB-65 scores						
0	4 (20)	20	86.2	39	50	80
1	8 (36.3)	22	55.2	73.2	59.3	69.8
2	9 (45)	20	24.1	97.6	87.5	64.5
3	4 (80)	5	10.3	100	100	61.2
4	2 (100)	2	3.4	100	100	59.4
5	1 (100)	1	0	100		58.6
Total	28	70	–	–	–	–

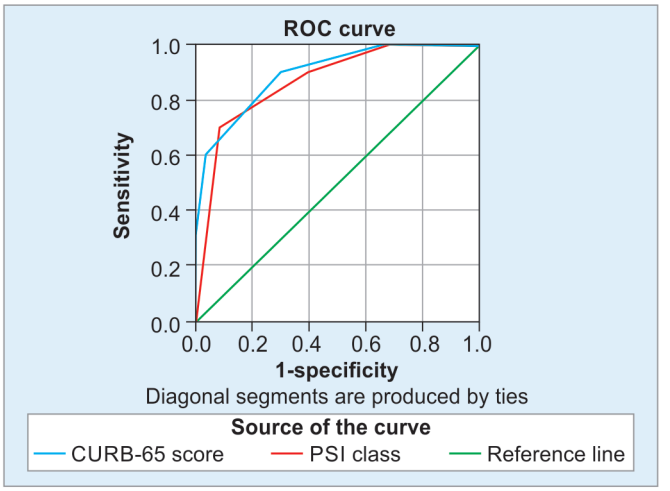
ICU, intensive care unit; PSI, pneumonia severity index

Analysis of CURB-65 Score

In the present study, there were no patients requiring invasive ventilation in the CURB-65 score 0 group. Three patients in the score 2 group, four in the score 3 group, two in the score 4 group, and one each in the CURB-65 score 1 and score 5 groups required invasive mechanical ventilation.

The above Figure 3 shows the predictive value of PSI classes for invasive ventilation with an AUC of 0.91 ($p < 0.01$), which is significant for predicting invasive ventilation. By Youden's index (128 PSI score), it is inferred that PSI class 5 is a good predictor for the requirement of invasive ventilation (sensitivity and specificity of 90%) (Table 5).

The AUC of the CURB-65 score is 0.897, with a *p*-value of 0.000 suggesting that the prediction of invasive ventilation by CURB-65 is statistically significant. By Youden's index, it can be inferred that the CURB-65 score group ≥ 2 is a good predictor of the requirement



Area under the curve

Test result variable(s)	Area	Std. Error[a]	*p-value*	Asymptotic 95% Confidence interval	
				Lower bound	Upper bound
CURB-65 score	0.897	0.053	0.001	0.793	1.00
PSI class	0.910	0.059	0.001	0.753	0.983

Fig. 3: The ROC curves of different scoring systems in predicting invasive ventilation

Table 5: Sensitivity, specificity, and analysis of scoring systems for predicting invasive ventilation

Risk groups	*Number of patients who needed invasive ventilation, n (%)*	*Total (n)*	*Sensitivity (%)*	*Specificity (%)*	*Positive predictive value*	*Negative predictive value*
PSI class						
Class 1	0	9	100	0	16.4	100
Class 2	0	10	100	20	19.6	100
Class 3	1 (5.5)	18	100	33	27.3	97.3
Class 4	2 (10)	20	90	60	58.3	94.8
Class 5	7 (53.8)	13	90	90		85.7
Total	10	70	–	–	–	–
CURB-65 scores						
0	0	20	100	33.3	20	100
1	1 (4.5)	22	90	70	33.3	97.7
2	3 (60)	20	60	96.7	75	93.5
3	4 (80)	5	30	100	100	89.6
4	2 (100)	2	10	100	100	87
5	1 (100)	1	0	100	–	85.7
Total	11	70	–	–	–	–

PSI, pneumonia severity index

of invasive ventilation (60% sensitivity and 96.7% specificity). The specificity of CURB-65 ≥ 2 was high in the prediction of invasive ventilation.

Discussion

In the present study, there was male preponderance and the incidence of pneumonia was higher in males aged >65 years. Diabetes mellitus was the most common comorbid illness. The admission rate into ICU was 40% (28 patients). The overall mortality of CAP was 15.7% and was higher in patients aged ≥ 65 years, which was 33%. Nonsurvivors had low partial pressure of oxygen, higher blood urea nitrogen levels, and higher respiratory rate compared to survivors, which may have prognostic implications.

Sepsis with multiorgan dysfunction was the most common cause of mortality. PSI class ≥ 4 was more accurate in predicting mortality and admission into the ICU. PSI class 5 better predicted the requirement of invasive ventilation than CURB-65 score ≥ 2 as calculated from AUC for the ROC curve. The sensitivity to predict mortality was higher in PSI class ≥ 4 than in CURB-65 score ≥ 2 but specificity was higher for CURB-65 score ≥2. PSI class ≥ 4 had higher sensitivity for predicting ICU admission but specificity of CURB-65 score ≥ 2 was higher. In predicting the requirement of invasive ventilation, PSI class 5 has high sensitivity and specificity (90%), but the specificity of CURB-65 ≥ 2 (96.7%) was higher in this regard.

Our study's mortality rate of 15.7% is comparable to those reported globally.[9,16,17] The ICU admission rate was 40% which was slightly higher when compared to the studies[9,16,18] reported probably due to the smaller sample size in our study. Around 35.7% (10 patients) required invasive ventilation in the present study, which is slightly less when compared to the studies reported worldwide.[16,19,20]

In the study when comparing AUCs, the accuracy of PSI in predicting mortality was slightly higher compared to CURB-65. The sensitivity to predict mortality was higher in PSI class ≥ 4 (81.8%) than in CURB-65 score ≥ 2 (36.4%) but specificity was higher for CURB-65 score ≥ 2 (93.2%). In our study, PSI had a higher AUC (0.812) than CURB-65 (0.721), which made it a more accurate indicator of mortality. Since ours is a tertiary care hospital, many cases admitted had multiple comorbidities, and the severity of the disease was also higher in our cohort. As PSI had scored for associated morbidities, PSI could better predict the mortality thus explaining higher AUCs and sensitivity observed in our study. PSI (AUC = 0.81) and CURB-65 had no significant difference in predicting mortality in CAP as presented in a systematic review and meta-analysis.[21] PSI score was found to have superior prognostic capacity (AUC = 0.857) than CURB-65 (0.744) in predicting mortality in hospitalized subjects admitted with acute exacerbation of chronic obstructive airway disease.[22]

When compared, PSI class ≥ 4 had higher sensitivity (62.1%) for predicting ICU admission but lower specificity (85.4%) than CURB-65 score ≥ 2 (97.6%). The AUC of PSI (0.745) was higher compared to CURB-65 (0.706) making it a better predictor of ICU admission as PSI could cover patients who had comorbidities and their decompensation which led to more severity of pneumonia. Also, the AUC is higher for PSI (0.911) than CURB-65 (0.897) making PSI a better predictor of invasive ventilation.

The main drawback of both scores (PSI and CURB-65) was that they relied more on laboratory investigations for calculations.[23] In countries where resources are scarce, the CURB-65 score can be easily implemented at the bedside, as it is very simple and based mostly on clinical assessment. In contrast, PSI demands a lengthy list of laboratory and clinical parameters. Similar to our study, Shah et al.,[9] reported that PSI has higher sensitivity than CURB-65 in predicting mortality and admission into ICU. However, it was noted that other scores (modified ATS, SMART-COP, and Infectious Diseases Society of America (IDSA)/ATS performed better than PSI and CURB-65 because of their design to evaluate ICU admission instead of mortality.[16,18]

The CURB-65 was more accurate than PSI in predicting mortality and the need for ICU admission in patients with CAP in an Iranian study.[18] Both PSI and CURB-65 have similar predictive efficacy in a systematic review of clinical prediction rules to predict severe CAP in identifying patients requiring ICU admission.[24] A study by Madhu et al.[16] showed that in terms of predicting ICU admission and death, PSI was the most accurate, while CURB-65 was the most specific, which was similar to our study. The prognostic outcomes of scores appear to differ significantly between studies conducted in different healthcare systems because of heterogeneity in study designs. Therefore, clinicians must choose the scoring system that is most suitable for their local needs.[21]

Many newer generation scoring systems have evolved which have superior efficacy in predicting ICU admission, but they have a very low positive predictive value and a high negative predictive value. The use of these scores is more suited to exclude the severity of illness than to determine inpatient management.[16,18,25] Hence, they have to be evaluated in a larger population before implementing them as superior prediction tools in deciding the outcomes.

Our study found some discrepancies in the performance characteristics of PSI and CURB-65 scores. CURB-65 scores > 4 and 5 have high positive predictive value, considering that it is superior in terms of identifying high-risk patients and disease management. The high negative predictive value suggests that PSI may be superior in identifying disease severity. Both PSI and CURB-65 can be complementary predictors of the disease. Though the scores have comparable prognostic performances, it does not establish that patient outcomes can be improved.[21]

Limitations

This study was done only in hospital-admitted patients. The inclusion of outpatients would have enhanced the validity of the results. A larger sample would have been a better representative of the general population. Comparison of other recent scores like SWAT-Bp, SMART-COP, and IDSA/ATS with the PSI and CURB-65 scores would have evaluated the validity of recent proposed scoring systems of pneumonia in tertiary care settings. Other parameters like albumin, creatinine, and pH were not studied in the present study between expired and survived patients, which would have thrown light on whether they could predict mortality in CAP.

Conclusion

To sum up, PSI is a more sensitive tool in predicting ICU admission and mortality, compared to CURB-65. However, specificity was higher for CURB-65 score ≥ 2. In general, both PSI and CURB-65 are interdependent when it comes to predicting mortality and admission to the ICU.

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