A Comparative Study of CURB-65 and Expanded CURB-65 Scoring Systems in Community Acquired Pneumonia in a Tertiary Care Centre of Patna

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ABSTRACT

BACKGROUND

A variety of organisms cause community-acquired pneumonia, including bacteria, viruses and fungi. Pathogens vary in age and other factors, but the relative importance of each pneumonia as a cause of community-acquired pneumonia remains uncertain because most patients do not undergo thorough testing and because even when tested, specific agents are found in < 50 percent of cases. This study was conducted to evaluate a severity scoring system for community acquired pneumonia and compare it with the standard confusion, urea, respiratory rate, blood pressure and 65 years of age or older (CURB-65) scoring system in a tertiary care centre in Patna Medical College.

METHODS

This hospital based prospective study was conducted among 100 consecutive patients of community-acquired pneumonia (CAP) attending OPD or getting admitted in General Medicine ward of Patna Medical College. The CURB-65 and Expanded CURB-65 scores for these patients were calculated and the accuracy of either in predicting outcomes was statistically analysed, during the period September 2018 - May 2019.

RESULTS

The mean age of CAP patients in our study was 59.09 ± 12.942 years, the most common co-morbidity observed was diabetes mellitus followed by chronic obstructive pulmonary disorders (COPD), cardiovascular disease, chronic liver disease and chronic renal disease. Our study showed that the mortality rate of the study population was 12 % and 30 % patients needed admission in the ICU and 24 % patients needed invasive mechanical ventilation. In the above analysis for 30-day mortality rate, ICU admission rate, and the need for mechanical ventilation among 0 - 2 and 3 - 5 CURB 65 scores, we found no statistically significant difference (P-value = > 0.05).

CONCLUSIONS

The extended CURB-65 score gives priority to both clinical and laboratory parameters and is a more accurate marker for the evaluation of CAP severity and may boost the effectiveness of predicting mortality in CAP patients compared to the current CURB-65 score system.

KEYWORDS

CAP, CURB-65, Expanded CURB-65

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BACKGROUND

Community-acquired pneumonia remains to be an infectious cause of global mortality and morbidity. Common etiological agents of CAP in India are *Klebsiella pneumoniae, Haemophilus influenzae, Streptococcus pneumoniae,* and *Pseudomonas aeruginosa*.[1] Pneumonia is more frequently identified in older and co-morbid patients, such as chronic liver, respiratory, pulmonary and / or renal disorders, metabolic disorders such as diabetes mellitus, chronic alcoholism, malignancies, loss of spleen (asplenia), and immune disorders.

In India, the incidence of CAP is 4 million cases per year with 20 % requiring hospitalisation. The mortality rate for CAP patients in outpatient facilities is 1 % – 5 % and for Intensive Care Units is 25 %.[1,2]

CURB-65, also known as the CURB criteria, is a clinical prediction rule that has been validated for predicting community-acquired pneumonia mortality and infection at any site.[3,4]

CURB-65 is based on the earlier CURB score and is recommended by the British Thoracic Society for the assessment of pneumonia severity.[5,6] CURB-65 was developed in 2002 at the University of Nottingham.

The score is an acronym for each of the risk factors measured. Each risk factor scores one point, for a maximum score of 5:

1. Confusion of new onset (defined as an AMTS of 8 or less)
2. Blood urea nitrogen greater than 7 mmol / l (19 mg / dL)
3. Respiratory rate of 30 breaths per minute or greater
4. Blood pressure (BP) - Systolic BP less than 90 mmHg or diastolic BP less than or equal to 60 mmHg.
5. Age 65 years or older.

Liu et al. developed a new, simpler and more effective scoring system, and named it expanded-CURB-65 that includes:

1. Confusion,
2. Urea > 7 mmol / L,
3. Respiratory rate ⩾ 30 / min,
4. Blood pressure: low systolic (< 90 mmHg) or diastolic (⩽ 60 mmHg),
5. Age ⩾ 65 years,
6. LDH > 230 u / L,
7. Albumin < 3.5 g / dL,
8. Platelet count < 100,000 / cu mm of blood

The determination of the severity and position of treatment decisions for CAP patients is very critical for the protection of patients and for the effective use of resources. Late admission to the intensive care unit (ICU) leads to an increase in the mortality rate among CAP patients.

Multiple scoring systems are in place to predict the severity of this condition. One of the most efficient is the CURB-65.

The expanded CURB-65 score has been formulated to predict severity with further accuracy. In this analysis, we analysed both the scores for the CAP patient and compared their ability to predict the outcome of the patient.

METHODS

This hospital based prospective study was conducted from September 2018 to May 2019 enrolling 100 consecutive patients of CAP attending OPD or patients admitted in General Medicine ward of Patna Medical College. The CURB-65 and expanded CURB-65 scores for these patients were calculated and the accuracy of either in predicting outcomes was statistically analysed.

Inclusion & Exclusion Criteria

Patients willing to take part in the study and satisfying the diagnostic criteria of community acquired pneumonia with age > = 12 years and irrespective of sex were included in the study. Chronically immunosuppressed patients (defined as immunosuppression for solid organ transplantation, post splenectomy, receiving > 10 mg / day of prednisolone or any equivalent steroids for a duration of more than 30 days at a stretch, treatment with other immunosuppressive agents, neutropenic patients with absolute neutrophil count < 1000 / cu mm), patients hospitalised within last 14 days for other disease, patients with chronic cough (> 3 weeks) were excluded from the study

A detailed relevant history, general survey and examination of the respiratory system preceded the diagnostic tests. Special emphasis was given to ascertain the consciousness level for every individual patient included in the study. Routine blood screening included complete blood count including platelet count, serum urea and creatinine estimation and random blood glucose estimation. Additional blood tests included estimation of serum lactate dehydrogenase (LDH) and serum albumin. Imaging included chest radiograph (postero-anterior view).

Statistical Analysis

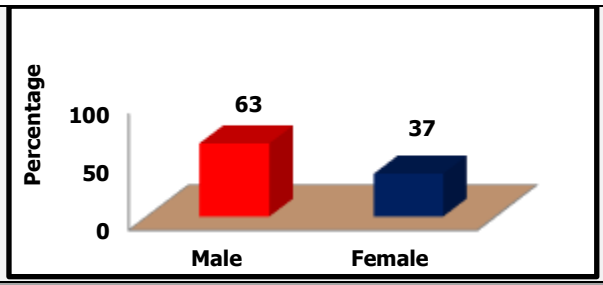
All data was processed and analysed in Microsoft Excel and SPSS platform version 20.0. Descriptive statistical mean and standard deviation for continuous variables and frequency distribution with their percentage for categorical variables have been determined. Sensitivity, precision, positive predictive value (PPV) and negative predictive value (NPV) were calculated for different CURB 65 & Extended CURB-65 grades with qualitative variables (death, ICU entry, mechanical ventilation) as a consequence. Categorical data were expressed as percentages and compared using the chi-square test. P-value of less than 0.05 was considered to be statistically important.

RESULTS

The mean age of CAP patients enrolled in our study was 59.09 ± 12.942 years.

Age in Years	No. of Cases	Percentage
< 30 years	06	12
31 – 40 years	09	18
41 – 50 years	18	36
51 – 60 years	12	24
> 60 years	05	10
Total	**50**	**100**

Table 1. Age Distribution



Graph 1. Sex Distribution among CAP Patients Enrolled in the Study

Sex distribution of CAP patients (N = 100) of our study is mentioned in Table 1. The above table shows a male predominance in our study as we had 63 % male and 37 % female patients with a male to female ratio of 1.70:1.

Comorbidities (N = 56)	No. of Patients	Percentage
Chronic renal disease	05	05
COPD	12	12
Chronic liver disease	05	05
Cardiovascular co-morbidities	19	19
Diabetes mellitus	16	16
Without comorbidity	44	44
Total	**100**	**100**

Table 2. Distribution CAP Patients According to Comorbidities (N = 100)

The most common comorbidity we found among CAP patients was diabetes mellitus accounting for 16 % patients, followed by COPD consisting 12 % patients, and cardiovascular co-morbidity accounting for 19 % patients. The least common co-morbidities were chronic liver disease and chronic renal disease accounting for 5 % each. 44 % patients presented without any co-morbidity.

Findings	No of Patients	Percentage
Confusion	16	16
Respiratory rate ≥ 30 / min	62	62
Systolic blood pressure < 90	37	37
Diastolic blood pressure < 60	37	37
LDH > 230 U / L	45	45
Platelet count < 100 x 10^3 / cumm	23	23
Albumin < 3.5 gm / dl	33	33
Urea > 7 mmol / L	05	05
Creatinine > 1.5 mg / dl	05	05
Glucose > 200 mg / dl	16	16

Table 3. Physical & Laboratory Findings of CAP Patients (N = 100)

Findings of physical examination and laboratory investigation are mentioned in Table 3. Respiratory rate ≥ 30 / min was the commonest finding observed in 62 % patients, followed by LDH level > 230 U / L observed in 45 % patients, SBP < 90 and DBP < 60 accounted for 37 % patients each, albumin level < 3.5 mg / dl observed in 33 % patients, platelet count < 100 x 10^3 / cu.mm was observed in 23 % patients. Urea level < 7 mmol / L and confusion were the least common findings observed in 5 % and 16 % patients respectively.

Outcome	No of Patients	Percentage
30 day mortality (death)	12	12
ICU admission	30	30
Need for invasive mechanical ventilation	24	24
Survived	34	34

Table 4. Outcome of Patients (N = 34)

Among 100 CAP patients included in our study 34 % patients survived, 30 % patients needed an admission in ICU and 24 % patients needed invasive mechanical ventilation. The mortality rate of our study was 12 %. The above data is tabulated in Table 4.

CURB-65 Score	Total Patients		30-Day Mortality		ICU Admission		Invasive Mechanical Ventilation	
	No	%	No	%	No	%	No	%
0 – 2	58	58	4	6.89	14	24.1	12	20.6
3 – 5	42	42	8	19.0	16	38.1	12	28.6
P-Value			0.06		0.09		0.24	

Table 5. 30-Day Mortality Rate, ICU Admission, Mechanical Ventilation in Subgroups CURB-65 (N = 100)

30-day mortality rate, ICU, mechanical ventilation in subgroups CURB-65 is mentioned in Table 5. The above table shows, 0 - 2 CURB-65 score was observed in 58 % patients among them 14 (24.1 %) had an ICU admission, 12 (20.6 %) needed an invasive mechanical ventilation and mortality rate was 6.89 % (4). 3 - 5 CURB-65 score was observed in 42 % patients among them 12 (28.6 %) needed an invasive mechanical ventilation, 16 (38.1 %) patients had an ICU admission and the mortality rate was 19 %. Above analysis for 30-day mortality rate, ICU, mechanical ventilation among 0 - 2 and 3 - 5 CURB 65 score we found no statistical significance (P-value = > 0.05).

Expanded CURB-65 Score	Total Patients		30-Day Mortality		ICU Admission		Invasive Mechanical Ventilation	
	No	%	No	%	No	%	No	%
0 – 4	67	67	2	2.98	16	23.8	10	14.9
5 – 8	33	33	10	30.0	14	42.4	14	42.4
P-value			0.001		0.002		0.001	

Table 6. 30-Day Mortality Rate, ICU, Mechanical Ventilation in Subgroups Expanded CURB-65: (N = 100)

30-day mortality rate, ICU, mechanical ventilation in subgroups of Expanded CURB-65 is mentioned in Table 6. The above table shows 0 - 4 Expanded CURB-65 score was observed in 67 % patients among them 16 (23.8 %) had an ICU admission, 10 (14.9 %) needed an invasive mechanical ventilation and mortality rate was 2.98 % (2). 5 - 8 Expanded CURB-65 score was observed in 33 % patients among them 14 (42.4 %) needed an invasive mechanical ventilation, 14 (48.5 %) patients had an ICU admission and the mortality rate was 30.0 %. Above analysis for 30-day mortality rate, ICU, mechanical ventilation among 0 - 4 and 5 - 8 Expanded CURB 65 score, we found statistical significance (P-value = < 0.05).

Scoring System	Thresh Old	P Value	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
CURB-65	> 3	0.003	66.67	87.10	88.8	66.6	76.1
Expanded CURB-65	> 4	< 0.002	83.33	90.48	83.3	90.4	87.8

Table 7. Accuracy of Different Scoring Systems in Predicting 30 Day Mortality (N = 100)

Above analysis for the accuracy in predicting 30 - day mortality of two different modalities i.e. Curb 65 and Expanded CURB 65 we found statistical significant difference in both groups (P-value = < 0.05). The specificity and sensitivity rate of CURB-65 (threshold > 3) scoring in predicting 30-day mortality was 87.10 % and 66.67 % respectively with a PPV and NPV value of 88.8 % and 66.6 % respectively. The specificity and sensitivity rate of Expanded CURB-65 (threshold > 4) scoring in predicting 30-day mortality was 90.48 % and 83.33 % respectively with a PPV and NPV value of 83.3 % and 90.4 % respectively. The accuracy rate of CURB-65 and expanded CURB-65 scoring in prediction of 30-day mortality was 76.1 % and 87.8 % respectively. The above mentioned data is tabulated in Table 7.

DISCUSSION

The mean age of our study was 59.09 ± 12.942 years. There was a male predominance in our study with male to female ratio of 1.7:1. Similar findings were observed in a study conducted by S.M. Shehata et al. (2017)[7] where the mean age of the study population was 59.17 ± 14.04. They also found male predominance in their study; male female ratio was 1.68:1.

The most common co-morbidity we found among CAP patients was diabetes mellitus accounting for 16 % patients, followed by COPD consisting 12 % patients, cardiovascular co-morbidity accounting for 19 % patients. The least common co-morbidities were chronic liver disease and chronic renal disease accounting for 5 % each. 44 % patients presented without any co-morbidity.

A study by S.M. Shehata et al. (2017)[7] showed similar findings in their study where diabetes mellitus was the commonest morbidity as well. Diabetes mellitus was the most common co-morbid condition seen in 37.7 % patients of the study group in a study by B G Saroja (2018).[8]

In our study the mortality rate was 12 %, ICU admission was needed in 30 % patients and invasive mechanical ventilation was needed in 24 % patients. Our results were in accordance with Irfan et al. (2009)[9] who found that the overall mortality in their study population was 11 %. On the other hand, Zhang et al. (2016)[10] found that the overall 30 -day mortality rate was 15.7 %, ICU admission rate was 5.8 % and the median length of hospital stay was four days. Also, Liu et al. (2016)[11]

Study by S.M. Shehata et al. (2017)[7] demonstrated that the Expanded CURB-65 score gave the most sensitive prediction of mortality (75 %) with the highest NPV (95.9 %). The expanded CURB-65 scoring system was the best predictor of 30-day mortality in CAP patients as it had the largest area under the curve-AUC (0.793) P-value < 0.0001). These results were comparable with Liu et al. (2016) [11] study in which the overall sensitivity and specificity of expanded CURB-65 were superior (AUC = 0.826) to other score systems, of which the AUCs were 0.801, 0.756 for PSI and CURB-65 respectively in predicting the 30-day mortality.

The above table shows 0 - 4 Expanded CURB-65 score was observed in 67 % patients among them 16 (23.8 %) had an ICU admission, 10 (14.9 %) needed an invasive mechanical ventilation and mortality rate was 2.98 %.[2] 5 - 8 Expanded CURB-65 score was observed in 33 % patients among them 14 (42.4 %) needed an invasive mechanical ventilation, 14 (48.5 %) patients had an ICU admission and the mortality rate was 30.0 %. In above analysis for 30-day mortality rate, ICU admission and need for mechanical ventilation among 0 - 4 and 5 - 8 Expanded CURB 65 score we found statistical significance (P-value < 0.05).

The specificity and sensitivity rate of CURB-65 (threshold > 3) scoring in predicting 30-day mortality was 87.10 % and 66.67 % respectively with a PPV and NPV value of 88.8 % and 66.6 % respectively. The specificity and sensitivity rate of Expanded CURB-65 (threshold > 4) scoring in predicting 30-day mortality was 90.48 % and 83.33 % respectively with a PPV and NPV value of 83.3 % and 90.4 % respectively. The accuracy rate of Curb 65 and Expanded CURB 65 scoring in prediction of 30-day mortality was 76.1 % and 87.8 % respectively.

The specificity and sensitivity rate of CURB-65 (threshold > 3) scoring in predicting ICU admission was 77.78 % and 66.67 % respectively with a PPV and NPV value of 80.0 % and 63.64 % respectively. The specificity and sensitivity rate of expanded CURB-65 (threshold > 4) scoring in predicting ICU admission was 86.67 % and 77.78 % respectively with a PPV and NPV value of 87.50 % and 76.4 % respectively. The accuracy rate of CURB-65 and Expanded CURB 65 scoring in prediction of ICU admission were 71.43 % and 81.8 % respectively.

The sensitivity of the Expanded CURB-65 score for prediction of invasive mechanical ventilation was better than the other two scores. AUC of expanded CURB-65 score was 0.588 (P-value 0.0459), which was significantly higher than PSI (AUC 0.561) and CURB-65 score (AUC 0.521) in a study by S.M. Shehata et al. (2017) [7] But, these low sensitivity and very small AUC poorly predict the need for invasive mechanical ventilation in CAP patients. Chalmers et al. (2008)[12] reported that CURB 65 had high specificity but low sensitivity (89.6 % and 54.5 %) in predicting the requirement for mechanical ventilation and / or inotropic support. These scores should be used only in conjunction with a formal clinical assessment.

CONCLUSIONS

Both extended CURB-65 and CURB-65 complement each other in predicting mortality, ICU admission, and the need for intrusive mechanical ventilation. Expanded CURB-65 was more sensitive in predicting both the ICU admission and the mortality rate. The extended CURB-65 score gives priority to both clinical and laboratory parameters and is a more accurate marker for the evaluation of CAP severity and may boost the effectiveness of predicting mortality in CAP patients compared to the current CURB-65 score system. More realistic triaging would potentially lead to sufficient prompt action for optimum usage of hospital services.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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