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Original Research Article

ASSOCIATION OF SERUM PROCALCITONIN AND C-REACTIVE PROTEIN LEVELS WITH CURB-65 CRITERIA IN PROGNOSTICATION OF PATIENTS WITH BACTERIAL PNEUMONIA

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Background and Objectives

Pneumonia is one the most common potentially fatal infectious disease. Bio-markers provide a useful tool in predicting severity, mortality and prognostication of pneumonia. Procalcitonin and CRP can be considered as the primary markers in patients with bacterial pneumonia during infection and estimation of their serum levels in association with CURB-65 criteria can be used to assess the severity of Pneumonia.

Materials and Methods

A total of 142 patients hospitalized in Karnataka Institute of Medical Sciences, Hubli were included in the study. A detailed history, general physical examination and systemic examination of the patients was carried out. Patients were investigated for serum Procalcitonin levels and CRP levels. The severity of pneumonia was assessed by using CURB-65 score and a correlation was established between CURB-65 and S.Procalcitonin and S.CRP levels.

Results

The diagnostic performance of S. Procalcitonin and CRP were comparable with CURB-65 score (DeLong's Test p = 0.639). There was a very strong positive correlation between CURB-65 Score and S. Procalcitonin, which was statistically significant. For every 1 unit increase in CURB-65 Score, the S. Procalcitonin increases by 1.98 units. There was also a very strong positive correlation between CURB-65 Score and S. CRP, which was statistically significant. For every 1 unit increase in CURB-65 Score, the S. CRP increases by 19.85 units.

Conclusion:

Measuring the serum levels of Procalcitonin and CRP could be useful as a strong prognostic factor for the assessment of pneumonia severity and evaluating the patients with bacterial pneumonia. In addition, by considering that PCT and CRP levels quickly rise in pneumonia, they are considered as the primary markers in patients during infection. Using these tests

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can be effective in rapid evaluation and early assessment of pneumonia, and a good alternative to CURB-65 criteria for making clinical decisions regarding the hospitalization of the patients in the ICU ward.

Key Words:

Bacterial pneumonia; CURB 65 Score; Procalcitonin (PCT); C-Reactive protein(CRP)

INTRODUCTION

Pneumonia is an inflammation of the pulmonary parenchyma. It is one of the most common infections occurring in humans.[2,8] The severity of illness can be determined by the CURB-65 criteria, which includes five variables: confusion(C); urea>7mmol/L(U); respiratory rate>= 30/min (R); blood pressure, systolic<90mmHg or diastolic <60mmHg (B); and age >=65 years.[1,2]

A number of substances can serve as markers of severe inflammation. The two most commonly in use are **Procalcitonin** (PCT) and **C-reactive protein** (CRP). Levels of these acute phase reactants increase in presence of an inflammatory response, particularly to bacterial pathogens.[1,3,4]

In the current prospective observational study, we intended to study the utility of procalcitonin and C reactive protein (CRP) levels in comparison with CURB-65 criteria in prognostication of patients with bacterial pneumonia.[5,6]

MATERIALS AND METHODS

The current study is a hospital based Prospective Observational study conducted at Karnataka Institute of Medical Sciences, Hubli. Study was conducted after taking written informed consent from all participants.

INCLUSION CRITERIA:

All patients more than 18 years of age and giving consent and with clinical and radiological features of pneumonia admitted in KIMS Hospital

EXCLUSION CRITERIA:

Patients with severe immune deficiency - HIV, neutropenia, cancer, long-term use of steroids, kidney transplant.

Patients with a confirmed diagnosis of pulmonary tuberculosis and hospitalized patients in 4 weeks before infection.

METHODOLOGY

142 patients presenting with history, characteristic clinical signs and symptoms of pneumonia were taken into the study. A detailed history, general physical examination and systemic examination of the patients was carried out. Data was collected in a pre-requisite proforma. Serum Procalcitonin and

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Serum CRP levels were estimated from blood samples of the patients. Other relevant tests like- Renal function tests, Complete hemogram, Chest Xray, Sputum AFB, Sputum Grams Stain, Sputum C/S and CT Brain were done.

The CURB-65 score was calculated with score of 1 each for the following five variables: Confusion (C); Urea >7 mmol/L (U); Respiratory rate ≥ 30/min (R); Blood pressure, systolic ≤ 90 mmHg or diastolic ≤ 60 mmHg (B); and Age ≥ 65 years .

All the data was entered in excel sheet and appropriate statistical analysis was applied.

STATISTICAL ANALYSIS

The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in Independent groups the unpaired sample t-test was used. For the multivariate analysis the one way ANOVA was used. To assess the relationship between the variables Pearson's Correlation was used. To find the significance in categorical data Chi Square test, Wilcoxon-Mann-Whitney U Test and Fisher's Exact Test were used. In all the above statistical tools the probability value 0.05 is considered as significant level.[7,8,9]

RESULTS

A total of 142 patients were included in the study. The mean Age (Years) in the present study is 62.93 ± 11.46;109 (76.8%) of the participants are male and 33(23.2%) of the participants are female.(Table1)

The predominant symptom was cough with expectoration as presented by 120 (84.5%) of the participants**.** (Table 2)

Table 3 predicts the various characteristics of the patient. In 25.4% of the participants, Strep.pneumoniae was the most common isolated organism in sputum c/s. Bronchopneumonia was the most common chest xray finding(44.4%)

The mean CURB-65 Score was 2.56 ± 1.41.; 46 (32.4%) of the participants had CURB-65: Score 3. Thereby proving that Score 3 had the highest frequency.(Fig 1)

The mean (SD) of S. Procalcitonin (ng/mL) was 3.86 (3.13). There was a very strong positive correlation between CURB-65 Score and S. Procalcitonin (ng/mL), and this correlation was statistically significant. For every 1 unit increase in CURB-65 Score, the S. Procalcitonin (ng/mL) increases by 1.98 units.(Fig 2)

The mean (SD) of S. CRP (mg/L) was 60.20 (31.18). The S. CRP (mg/L) ranged from 5 - 90**.** There was also a very strong positive correlation between CURB-65 Score and S. CRP (mg/L), and this correlation was statistically significant. For every 1 unit increase in CURB-65 Score, the S. CRP

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(mg/L) increases by 19.85 units.(Fig 3)

127 (89.4%) of the participants were discharged whereas 15 (10.6%) of the participants had succumbed to death.(Table 4)

Table 1: Distribution of the Participants in Terms of Age/Gender (n = 142)

Age/Gender	Mean ± SD || Median (IQR) || Min-Max || Frequency (%)
Age (Years)	62.93 ± 11.46 || 65.00 (59.00-69.00) || 28.00 - 85.00
Gender	
Male	109 (76.8%)
Female	33 (23.2%)

Table 2: Summary of Symptoms

Symptoms	Yes	No
Cough With Expectoration	120 (84.5%)	22 (15.5%)
Breathlessness	111 (78.2%)	31 (21.8%)
Fever	103 (72.5%)	39 (27.5%)
Chest Pain	50 (35.2%)	92 (64.8%)
Confusion	17 (12.0%)	125 (88.0%)
Hemoptysis	8 (5.6%)	134 (94.4%)

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Table 3: Summary of Investigations

Investigations	Mean ± SD || Median (IQR) || Min-Max || Frequency (%)
Hemoglobin (g/dL)	12.17 ± 2.02 || 12.45 (11.20-13.10) || 1.03 - 16.10
TLC (/mm3)	12607.99 ± 5481.67 || 12548.00 (8690.00-15680.00) || 2300.00 - 31000.00
Platelet Count (Lac/mm³)	1.75 ± 0.61 || 1.65 (1.13-2.15) || 0.89 - 3.14
Blood Urea (mg/dL)	29.61 ± 12.18 || 26.00 (22.00-36.00) || 10.00 - 69.00
Serum Creatinine (mg/dL)	1.00 ± 0.34 || 0.90 (0.80-1.20) || 0.40 - 2.10
Sputum C/S (Positive)	111 (78.2%)
Organism on Sputum C/S	
Strep. Pneumoniae	36 (25.4%)
No Growth	31 (21.8%)
H.Influenza	17 (12.0%)
Chlamydia	14 (9.9%)
Mycoplasma	13 (9.2%)
Klebsiella	11 (7.7%)
Staph Aureus	11 (7.7%)

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Investigations	Mean ± SD || Median (IQR) || Min-Max || Frequency (%)
Pseudomonas	7 (4.9%)
E.Coli	2 (1.4%)
S. Procalcitonin (ng/mL)	3.86 ± 3.13 || 3.56 (1.54-4.96) || 0.02 - 16.64
S. Procalcitonin	
≤0.5 ng/Ml	18 (12.7%)
>0.5 ng/Ml	124 (87.3%)
S. CRP (mg/L)	60.20 ± 31.18 || 71.00 (26.50-90.00) || 5.00 - 90.00
Chest Xray	
Bronchopneumonia	63 (44.4%)
Lobar Pneumonia	49 (34.5%)
Interstitial Pnemonia	30 (21.1%)

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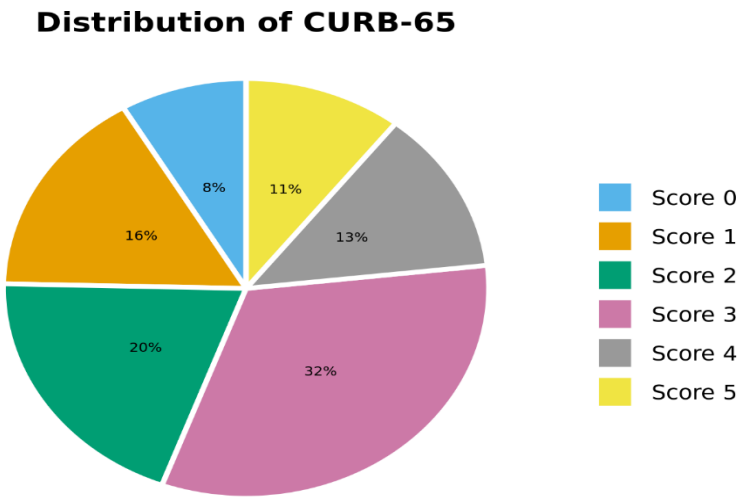
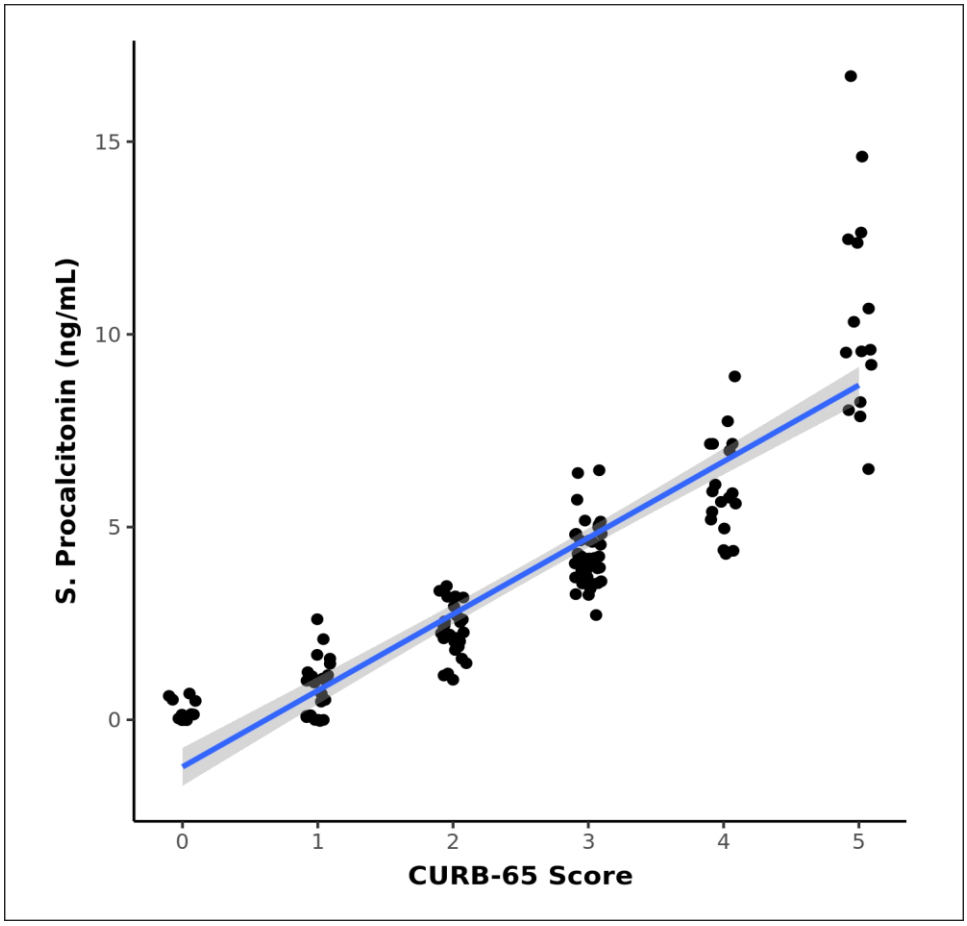


Figure 1: Distribution of CURB-65 score

Figure 2: Association of Serum Procalcitonin with CURB-65 score



The above scatterplot depicts the correlation between CURB-65 Score and S. Procalcitonin (ng/mL). Individual points represent individual cases. The blue trendline represents the general trend of correlation between the two variables. The shaded grey area represents the 95% confidence interval of

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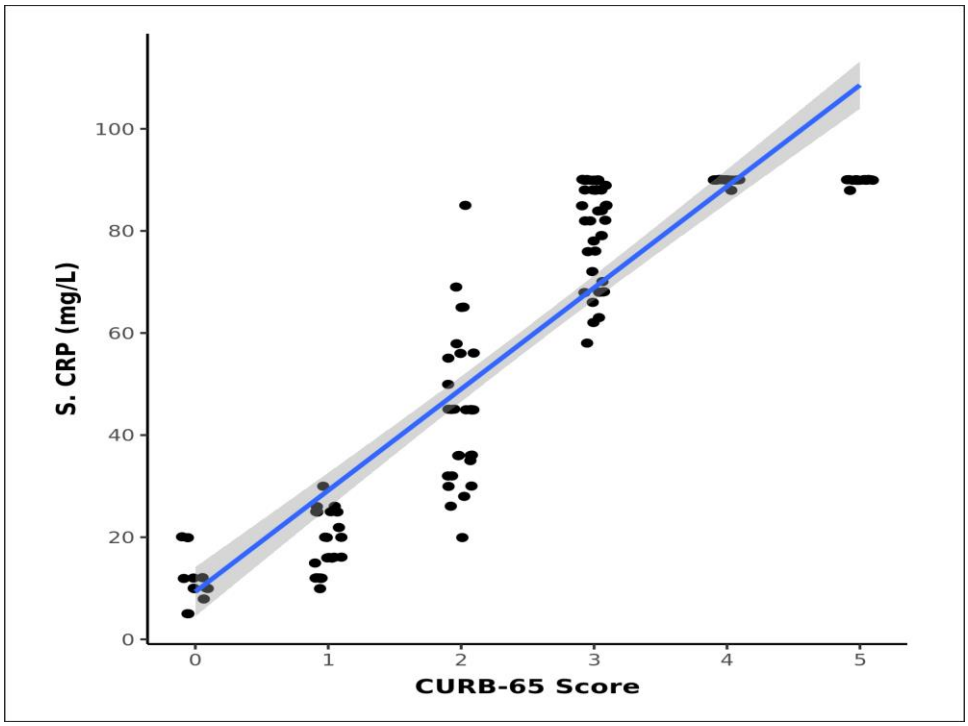
this trendline. There was a very strong positive correlation between CURB-65 Score and S. Procalcitonin (ng/mL), and this correlation was statistically significant (rho = 0.95, p = <0.001).

For every 1 unit increase in CURB-65 Score, the S. Procalcitonin (ng/mL) increases by 1.98 units.

Figure 3: Association of Serum CRP with CURB-65 score



The above scatterplot depicts the correlation between CURB-65 Score and S. CRP (mg/L). Individual points represent individual cases. The blue trendline represents the general trend of correlation between the two variables. The shaded grey area represents the 95% confidence interval of this trendline. There was a very strong positive correlation between CURB-65 Score and S. CRP (mg/L), and this correlation was statistically significant (rho = 0.93, p = <0.001).

For every 1 unit increase in CURB-65 Score, the S. CRP (mg/L) increases by 19.85 units.

Table 4: Distribution of the Participants in Terms of Outcome (n = 142)

Outcome	Frequency	Percentage	95% CI
Discharged	127	89.4%	82.9% - 93.8%
Death	15	10.6%	6.2% - 17.1%

89.4% of the participants had Outcome: Discharged. 10.6% of the participants had Outcome: Death.

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DISCUSSION

According to the findings obtained from the present study, there is a very strong positive correlation between CURB-65 Score and S. Procalcitonin (ng/mL), and this correlation is statistically significant.For every 1 unit increase in CURB-65 Score, the S. Procalcitonin (ng/mL) increases by 1.98 units.

There is also a very strong positive correlation between CURB-65 Score and S. CRP (mg/L), and this correlation is statistically significant.For every 1 unit increase in CURB-65 Score, the S. CRP (mg/L) increases by 19.85 units.

Hence by measuring the serum levels of Procalcitonin and CRP could be useful as a strong prognostic factor for the assessment of pneumonia severity.

In addition, by considering that PCT and CRP levels quickly rise in bacterial infections, they are considered as the primary markers in Bacterial pneumonia patients during infection.

Using these tests can be effective in rapid evaluation and early assessment of bacterial pneumonia, and a good alternative to CURB-65 criteria for making clinical decisions regarding the hospitalization of the patients in the ICU ward.

It should be noted that confusion, blood urea nitrogen, respiratory rate, and blood pressure, which are used for measuring severity of pneumonia, can be influenced by concomitant illness or other medications due to chronic disease, in which case measurement of PCT and CRP can be valuable in evaluating the severity of pneumonia.

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