# Correlation between Serum Lactate and CURB-65 Score in Community Acquired Pneumonia

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**ABSTRACT**

**BACKGROUND**

Community acquired pneumonia is a common and potentially serious illness throughout the world. Although diagnosis is often clinical, it can be confirmed by radiology and sputum analysis. An easily available prognostic marker is of high relevance. Various studies suggest that serum lactate can be used as a marker to assess the severity of disease instead of tedious scores like CURB-65 and PSI. we wanted to study the correlation between serum lactate level and CURB-65 score in predicting the prognosis of CAP.

**METHODS**

This is a cross-sectional observational study conducted among 100 patients admitted with CAP. A thorough history taking and clinical examination was conducted in patients admitted with symptoms of CAP. Admission CURB-65 score obtained. Serum lactate levels at 0, 12$^{th}$, 24$^{th}$ and 48$^{th}$ hour were recorded. The clinical course, relevant investigations, complications and outcome of each cases has been studied. The correlation between serum lactate and CURB-65 score was obtained.

**RESULTS**

The mean serum lactate was 4.68 with a standard deviation of 2.65. Statistical analysis revealed a significant correlation of serum lactate with CURB-65 score and PSI. The mean lactate levels in 27 non-survivors was 7.85 which was associated with a high CURB-65 score, which demonstrates its strong mortality predictive value.

**CONCLUSIONS**

Serum lactate which can be obtained as a part of routine blood gas analysis can be considered as a simple, cheap and easily available prognostic marker in community acquired pneumonia.

**KEYWORDS**

Community Acquired Pneumonia, Serum Lactate, CURB-65, PSI

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## BACKGROUND

Pneumonia is the infection of pulmonary parenchyma.[1] Community acquired pneumonia is a common and potentially serious illness worldwide. Despite being the cause of significant morbidity and mortality, pneumonia is often misdiagnosed and underestimated. It affects all age groups and major cause of death in children under five and extremes of age. An important reason for failure of treatment is the failure to assess the severity of pneumonia and to decide on outpatient or inpatient treatment. Pneumonia is the leading cause of sepsis, [2] which can progress to severe sepsis, septic shock and death. Pneumonia independently predicts 28-day in-hospital mortality in septic patients admitted to the intensive care unit.

The biomarkers have been intensively studied in CAP, [3] not only for the correct diagnosis but also with respect to diagnosing its microbiological aetiology, severity, prognosis and treatment. Since CAP is an infectious disease, commonly used laboratory values include total WBC count, CRP, procalcitonin and cardiovascular biomarkers pro- arginine vasopressin and pro-atrial natriuretic peptide (proANP).[4] In patients with severe pneumonia there is effective reduction in tissue perfusion and increases anaerobic metabolism. Blood lactic acid is a product of anaerobic metabolism of glucose and can directly reflect tissue hypoperfusion and hypoxia condition. Lactic acidosis is an important index of shock, hypoxia and oxygen metabolism, and quantitative detection and monitoring of the lactic acid levels in patients with severe pneumonia is an important indicator with significant value for assessment of the disease.[5]

In critically ill patients, high blood lactate levels develop from a combination of inadequate oxygen delivery secondary to hypoperfusion, impaired cellular oxygen utilization resulting from mitochondrial damage, and decreased hepatic clearance of lactate.[6] Even minor rise in lactate concentrations to >1.5 mEq/l is associated with higher mortality rates.[7] The British Thoracic Society recommended a system using Confusion, Urea, Respiratory rate, and Blood pressure plus age ≥ 65 years (CURB-65) for assessing severity and aiding management of CAP.[8] The CURB-65 score has a major advantage in its simplicity. However, with blood urea nitrogen, it includes a variable which is not readily available in all primary centres.[9] a simple and easily accessible marker for severity prediction of CAP is of high relevance. This study is intended to correlate the serum lactate levels with CURB-65 in the prognosis of CAP.

We wanted to study the correlation between serum lactate levels and CURB-65 score in community acquired pneumonia.

## METHODS

The study was carried out in SSIMS & RC, Davangere over a period of 1 year from January 2018 to January 2019. It was designated as a cross sectional study. 100 patients with community acquired pneumonia meeting the inclusion criteria were included. Ethical permission for the study was obtained from the Institutional Ethical Review Board (IERB).

### Inclusion Criteria

1. Patients with community acquired pneumonia.
2. Patients with age more than 18 years.

### Exclusion Criteria

1. Hospital acquired pneumonia.
2. Patients with cardiac failure.
3. Patients with liver diseases
4. Patients with renal disease

### Methods of Data Collection

Approval from the Institutional ethics committee review board was obtained. A detailed proforma was filled up for each patient, which included age, sex, IP number, detailed history, past and personal history. A detailed clinical examination was done on community acquired pneumonia cases getting admitted in SSIMS & RC. For all these cases routine blood investigations, serum lactate levels, CXR was obtained. Serial monitoring of serum lactate levels at admission, 12$^{th}$ hour, 24 hour and 48 hour was done.

### Statistical Analysis

Categorical variables were expressed as frequency & percentages. To test the association of variables Chi square test was used. Continuous variables were expressed as mean ± standard deviation. To assess mean difference between groups unpaired t test was performed. Within the group comparison was done with Paired t test. To know the relation between variables Person's Correlation was done. The value of P <0.05 was considered statistically significant. Statistical Package for the Social Sciences (SPSS) version 22 (IBM) for windows was used for analyses.

## RESULTS

| Gender | Frequency | Percent |
|---|---|---|
| Male | 54 | 54.0 |
| Female | 46 | 46.0 |
| Total | 100 | 100.0 |

***Table 1. Gender Distribution***

| Age | Frequency | Percent |
|---|---|---|
| ≤ 30 | 6 | 6.0 |
| 31-40 | 11 | 11.0 |
| 41-50 | 13 | 13.0 |
| 51-60 | 16 | 16.0 |
| 61-70 | 22 | 22.0 |
| 71-80 | 20 | 20.0 |
| > 80 | 12 | 12.0 |
| Total | 100 | 100.0 |

***Table 2. Age Distribution***

| Smoking | Frequency | Percent |
|---|---|---|
| Yes | 21 | 21.0 |
| No | 79 | 79.0 |
| Total | 100 | 100.0 |

***Table 3. Smoking History***

| BP | Frequency | Percent |
|---|---|---|
| Recordable | 84 | 84.0 |
| Not recordable | 16 | 16.0 |
| Total | 100 | 100.0 |

***Table 4. Admission Blood Pressure***

| | PR / HR | RR | $SpO_2$ |
|---|---|---|---|
| Mean | 109.28 | 28.95 | 80.62 |
| Std. Deviation | 25.15 | 8.14 | 14.141 |
| Median (25th to 75th Percentile) | 100 (89-129.5) | 27 (22-33) | 85 (78 - 90) |
| Minimum | 68.00 | 18.00 | 34 |
| Maximum | 164.00 | 49.00 | 97 |

***Table 5. Other Admission Vitals***

| | At Admission | 12th Hour | 24 Hour | 48th Hour |
|---|---|---|---|---|
| Mean | 4.68 | 4.20 | 3.54 | 3.21 |
| Std. Deviation | 2.65 | 2.85 | 2.94 | 4.08 |
| Median (25th to 75th Percentile) | 4.15 (2.32 - 6.6) | 3 (2 - 6) | 2.1 (1.6 - 5.4) | 1.3 (0.9 - 3.25) |
| Minimum | 0.80 | 0.50 | 0.60 | 0.30 |
| Maximum | 11.00 | 12.00 | 12.00 | 18.00 |

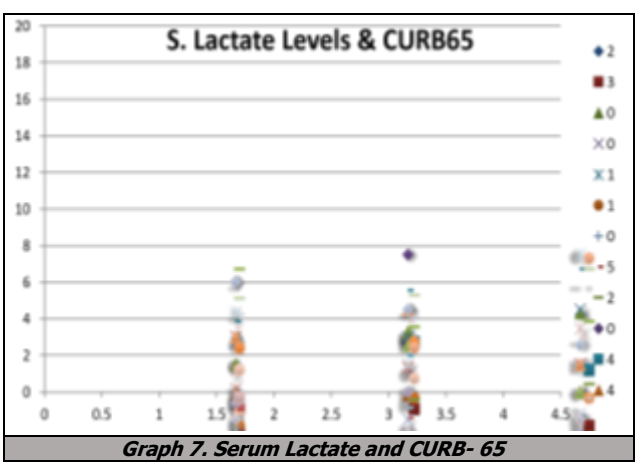
***Table 6. Serum Lactate Levels***

In the study, out of 100 subjects 54 were males and 46 were females. Among the 100 study subjects more were middle aged and elderly. Out 0f 100, 22 patients were in the age group 61 to 70 years. Only 6 patients were in the age group less than 30 years. 12 patients were above 80 years of age. Median age was 65 with maximum age of 90 years and minimum age of 21 years. Among 100 subjects only 21 were smokers and more than half of the subjects were non-smokers. The graphs show that only 21 patients of the 100 study subjects were smokers and rest 79 were non-smokers. In this study, 16 patients had unrecordable blood pressure on admission and 84 had recordable blood pressures. 26 patients had blood pressure lower than 90/60 mmHg. Mean pulse rate at the time admission was 109 with minimum of 68 and maximum of 164.

| Serum Lactate Levels | r Value | p | Significance |
|---|---|---|---|
| At admission | 0.453 | p<0.000 | HS |
| 12th hour | 0.479 | p<0.000 | HS |
| 24 hour | 0.486 | p<0.000 | HS |
| 48th hour | 0.416 | p<0.000 | HS |

***Table 7. Pearson's Correlation between Serum Lactate Levels & CURB-65***

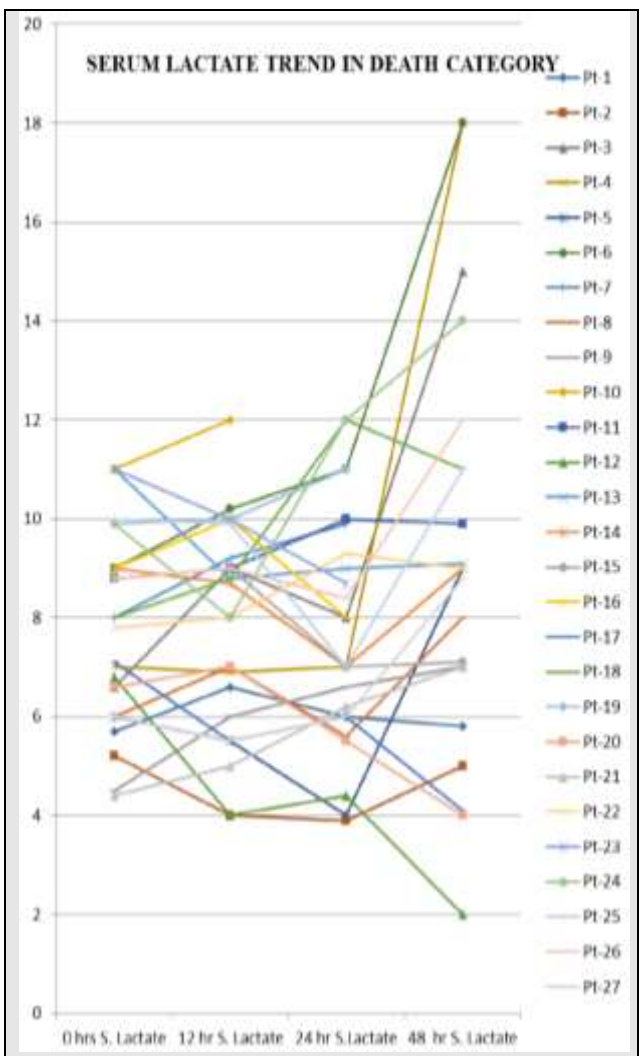
HS = Highly Significant




***Graph 7. Serum Lactate and CURB- 65***

Most of the patients belonged to tachypnoeic group with median respiratory rate of 18. The mean oxygen saturation measured by pulse oximetry was 80.62 with minimum value of 34% and maximum of 97%. The mean values of pulse rate, respiratory rate and $SpO_2$ of 109.28, 28.95 And 80.62 respectively.

The mean serum lactate at different time interval. At admission the mean serum lactate level was 4.68 with a minimum value of 0.80 and maximum value of 11. The mean values at 12$^{th}$ hour, 24$^{th}$ hour and 48$^{th}$ hour is 4.2, 3.54 and 3.21 respectively. The maximum measured serum lactate was 18. There is strong linear relationship between serum lactate levels and CURB -65 values. The above graph depicts the trend of serum lactate levels in dead patients. Most of the patients showed a rising trend in serum lactate levels. Only 3 patients showed decreasing trend.




***Graph 8. Serum Lactate Trend in Dead Category***

## DISCUSSION

The study was focused to find the efficacy of serum lactate levels as a prognostic marker in community acquired pneumonia and its comparison with CURB-65 score. In the study, among 100 study subjects more were middle aged and elderly. Out of 100, 22 patients were in the age group 61 to 70 years. Only 6 patients were in the age group less than 30 years. 12 patients were above 80 years of age. Out of 100 study subjects 54 were males and 46 were females

in this study, 21 patients were smokers and 79 were non-smokers. Admission BP can be considered as one of the major determining factor of severity of illness. Hypotension in community acquired pneumonia is mostly a consequence of septic shock. Among the 100 patients in the study, 84 had blood pressure in recordable range and the rest 16 had profound hypotension with unrecordable blood pressure. The mean heart rate of 100 study subjects was 109.28. The mean heart rate of non survivors is 140 beats per minutes and that survivors is below 100 beats per minutes. Most of the patients belonged to tachypnoeic group with median respiratory rate of 18. The mean oxygen saturation measured by pulse oximetry was 80.62 with minimum value of 34% and maximum of 97%.

The mean serum lactate in the 100 study subjects were 4.68 with a standard deviation of 2.65. The maximum serum lactate measured was 11. The CURB-65 score has been widely used in CAP patients. It stands for Confusion, Urea >7 mmol/L, Respiratory rate ≥30/min, Blood pressure <90 mm Hg systolic and/or ≤60 mm Hg diastolic, and age ≥65 years and was primarily designed to predict mortality and identify low-risk patients potentially suitable for ambulatory management.[10] its simplicity made it widely accepted over the world. The statistical analysis of this study revealed that correlation between serum lactate levels with CURB -65 score was highly significant ($p<0.0001$). High CURB-65 scores were almost always accompanied by high lactate levels. Non survivors with high CURB-65 had high lactate levels at admission with high inotrope requirement and highest incidence of complications.

## CONCLUSIONS

Serum lactate which can be obtained as a part of routine blood gas analysis can be considered as a simple, cheap and easily available prognostic marker in community acquired pneumonia.

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