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Lactate Curb-65 As a Predictor of Mortality in Community Acquired Pneumonia in a Tertiary Care Hospital

Dr.V Ch S Sai Snigdha Sri Veeramalla[1], Dr Ch.R.N.Bushana Rao M.D[2], Dr.K.Venkata Ramana M.D[3], Dr.B.Padmaja M.D[4]

[1](Department of Respiratory Medicine, Andhra Medical College/ Dr.NTR University of Health Sciences, India)
[2](Department of Respiratory Medicine, Andhra Medical College/ Dr.NTR University of Health Sciences, India)
[3](Department of Respiratory Medicine, Andhra Medical College/ Dr.NTR University of Health Sciences, India)
[4](Department of Respiratory Medicine, Andhra Medical College/ Dr.NTR University of Health Sciences, India)

Abstract:
Background*: Pneumonia is the leading cause of sepsis, which can progress to severe sepsis, septic shock & death. Timely and effective initial assessment, decisions on site of care, management are crucial to improving outcome [(1).] This condition imposes a heavy burden on the healthcare system in terms of its high cost both for diagnosing and treating the condition as well as for the hospital and ICU stay. Blood lactate is regarded as an effective biomarker of tissue hypoperfusion and organ dysfunction [(2) (3) (4)]. To patients with sepsis, elevated lactate has given physicians a quantitative marker of abnormal physiology to support risk stratification and as a treatment end point in sepsis. Elevated lactate is independently associated with mortality rate in critically ill patients [(5) (6).] By adding lactate as a sixth parameter to CURB65 score, the present study aimed to predict mortality in CAP patients at time of admission, thus aiding decision making regarding further management of case in triage itself and to prognosticate the outcome.*
Materials and Methods*: In this prospective longitudinal observational study for a period of 8 months in the year 2022, 72 patients of Community Acquired Pneumonia belonging to age group of >18 years satisfying the inclusion and exclusion criteria were selected. The selected patients underwent a complete clinical history and examination; chest radiograph (postero-anterior or antero-posterior views) at presentation; ECG; arterial blood gas analysis and serum electrolyte measurement; sputum for gram staining and culture; complete blood counts, blood urea nitrogen and serum creatinine; fasting blood glucose.*
Results*: Risk stratification by adding lactate to CURB65 resulted in 11 (15.2%),33 (45.8%) 28 (38.8%) number of patients of mild ,moderate and severe disease thereby increasing number of patients with severe group. There was a non-survivor in moderate and 5 in severe group according to CURB65 and all were in severe disease of L-CURB65 score when re-stratified. Lactate as an independent marker was also used, level ≥ 2m.mol/l was observed in 29 (40.2%) patients and < 2 m.mol/l was seen in 43 (59.7%) patients. 20.6% mortality was seen in high lactate group.*
Conclusion: *CURB65 score is a well studied scoring system used in assessing severity of pneumonia. Lactate is another parameter found to be useful in a similar manner. Combining lactate to CURB65 results in increased sensitivity of assessment of mortality, ICU admission*
Key Word*: Lactate CURB-65, CURB-65, Mortality, ICU admission, Community Acquired Pneumonia.*

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I. Introduction

Pneumonia is the leading cause of sepsis, which can progress to severe sepsis, septic shock & death. Timely and effective initial assessment, decisions on site of care, management are crucial to improving outcomes [(1).] This condition imposes a heavy burden on the healthcare system in terms of its high cost both for diagnosing and treating the condition as well as for the hospital and ICU stay.4Blood lactate is regarded as an effective biomarker of tissue hypo perfusion and organ dysfunction [(2) (4) (3)]. To patients with sepsis, elevated lactate has given physicians a quantitative marker of abnormal physiology to support risk stratification and as a treatment end point in sepsis. Elevated lactate is independently associated with mortality rate in critically ill patients [(5) (6)]. By adding lactate as a sixth parameter to CURB65 score, the present study aimed to predict mortality in CAP patients at time of admission , thus aiding decision making regarding further management of case in triage itself and to prognosticate the outcome.

II. Materials and Methods

This prospective longitudinal observational study was carried out on patients of Department of Respiratory Medicine at Government hospital for chest and communicable diseases, Andhra Medical College, Visakhapatnam, Andhra Pradesh from January 2022 to August 2022. A total of 72 adult subjects (both male and females) of aged ≥ 18, years were for in this study.

Study Design: Prospective longitudinal observational study

Study Location: This was a tertiary care teaching hospital based study done in Department of Respiratory Medicine, at Government hospital for chest and communicable diseases, Andhra Medical College, Visakhapatnam, Andhra Pradesh.

Study Duration: January 2022 to August 2022.

Sample size: 72 patients.

Subjects & selection method: All adult patients more than 18years of both gender admitted in Government hospital for chest and communicable diseases with the provisional diagnosis of community acquired pneumonia during the study period fulfilling the inclusion criteria were included in the study after obtaining informed consent

Patients were diagnosed as suffering from CAP if they have:-

i. Fever or hypothermia, tachypnea, cough with or without sputum, dyspnea, chest discomfort, sweats or rigors (or both).

ii. Bronchial breath sounds or inspiratory crackles on chest auscultation.

iii. Parenchymal opacity on chest radiograph.

iv. Symptoms occured outside the hospital or within 48 hours of hospital admission in a patient not residing in a long-term care facility.

Inclusion criteria:

1. Age > 18 years
2. Symptoms and signs suggestive of pneumonia at time of admission
3. Either sex

Exclusion criteria:

1. Pulmonary edema
2. Pulmonary embolism
3. Nosocomial pneumonia (Pneumonia developing 72hrs or more after admission to hospital is nosocomial, or hospital acquired)
4. Tuberculosis
5. Structural lung diseases
6. Patients on immunosuppression
7. Congenital immunodeficiency disorders
8. HIV patients
9. Chronic renal disease, cardiovascular diseases, chronic liver diseases
9. Malignancy
10. Patient who did not give consent

Procedure methodology

At the time of initial evaluation, the selected patients underwent a complete clinical history and examination; chest radiograph (postero-anterior or antero-posterior views) at presentation; electrocardiogram; arterial blood gas analysis and serum electrolyte measurement; sputum for gram staining and culture; complete blood counts, blood urea nitrogen and serum creatinine; fasting blood glucose.

For performing ABG (arterial blood gas analysis) analysis best care practices were followed. Modified Allen's test was performed in the limb selected for the procedure. The patient's radial pulse was palpated with the index and middle finger pads of the non-dominant hand. After visualizing the direction of the artery, and the desired puncture site was cleaned. The needle was inserted just under the skin at a 45º angle, aiming in the direction of the artery, while palpating the radial pulse proximal to the puncture site with the non-dominant hand. After 2-3 ml of arterial blood has been obtained, the needle was removed.

PNEUMONIA SCORING ITEMS:

CURB65 (Confusion, Urea > 19mg/dl, Respiratory rate >30, Blood pressure< 90mm Hg systolic and/or < 60 mmHg diastolic, Age >65) score

Each variable is given 1 score; Lactate score given as 0 for lactate value of 2m mol/l and 1 for ≥ 2m mol/l, total of 6 score
Subjects were classified into 3 classes;
Mild risk 0 or 1 - are in low risk for intubation or mortality
Moderate risk = 2 - intermediate risk
Severe risk ≥ 3 - are at high risk for intubation and/or mortality
A questionnaire with demographic information, clinical signs and symptoms, laboratory and radiographic findings was completed for each patient. Each patient was assessed with both the scoring systems and total score for each patient for each scoring system was calculated

Statistical analysis

Data was analyzed using SPSS software and statistical methods will be performed by using data will be analyzed and represented with mean, mode, median and standard deviation and other statistical methods whenever necessary. Continuous variables were compared via analysis of variance. Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two or more groups. The level $P < 0.05$ was considered as the cutoff value for significance. Predictive ability of the Lactate CURB65 was assessed for the primary end points using the area under the receiver operating characteristic curve (AUROC). Sensitivity, specificity, and positive and negative predictive values of the Lactate CURB65 for the primary end points assessed.

III. Result

Among 72 patients**,** Mean age of the study group is 68.04 yrs & 46(63.9%) were males, 26(36.1%) were females.
8 (11.1%) patients were hypertensive, 37(51.4%) were diabetic & 27 (37.5%) patients were both diabetic and hypertensive. Among the study group, 46 (63.8%) patients were non-smokers, 15 (20.83%) were smokers and 11 (15.27%) were alcoholics. CXR features among the patients were Consolidation (unilateral /bilateral) seen in 61(84.7%), bronchopneumonia in 9 (12.5%), synpneumonic effusion in 2 (2.7%) patients.
In the study population, persons with the lactate level ≥2 m.mol/l were 29(40.2%), and lactate level of ≤ 2m.mol/l were 43(59.7%)

Table 1: severity scoring in the present study

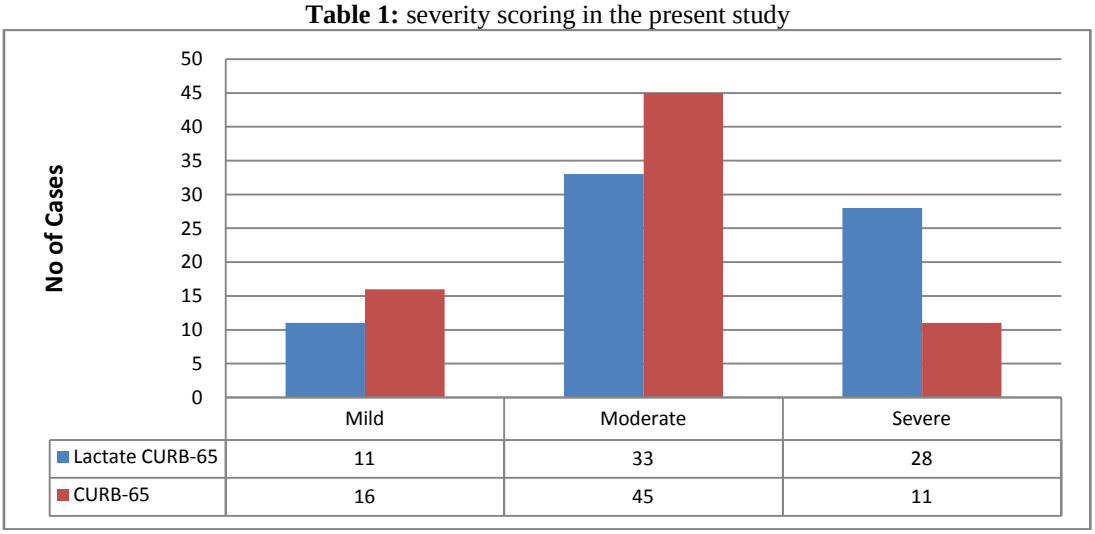

Table 2: The mean ranks of various parameters of study population with CURB65 score areas follows-

mean ranks **Parameter**	**Mild n=16**	**Moderate n=45**	**Severe n=11**	**P value**
No. Of days	28.12	40.22	32.59	0.129
Urea	8.97	43.46	48.09	0.001
Respiratory rate	30.41	33.77	36.55	0.002
Systolic bp	42.06	32.33	21.32	0.022
Diastolic bp	39.44	37.93	26.36	0.167
Age	27.34	36.73	48.86	0.027

The clinical parameters, respiratory rate, systolic blood pressure, age and urea were found to have p value < 0.05, so there is a significant difference between three groups- mild, moderate, severe among these parameters.

Table 3: The mean ranks of various parameters of study population with Lactate CURB65 score areas follows-

Parameter	Mild n=11	Moderate n=33	Severe n=28	P value
No. Of days	25.41	37.89	39.21	0.151
Urea	10.05	36.35	47.07	0.001
Respiratory rate	29.82	33.91	42.18	0.143
Systolic	47.59	39.21	28.95	0.021
Diastolic	48.32	37.88	30.23	0.029
Age	20.77	38.48	40.34	0.020
Lactate	19.36	28.92	52.16	0.001

23 (31.9%) patients were admitted in ICU among 72 persons. Among study population of 72 persons, there were 6 deaths. In CURB65 category of moderate severity (score 2) there was 1 death and 5 deaths were seen in severe category (3) when Lactate CURB 65 score is taken into consideration all 6 deaths were seen in severe category

The sensitivity, specificity, positive predictive value, accuracy of CURB65, Lactate CURB65 in predicting mortality was computed and presented in the table form-**CURB65**

Table 4: CURB-65 sensitivity and other parameters

Statistic	Value	95% CI
Sensitivity	83.33%	35.88% to 99.58%
Specificity	90.91%	81.26% to 96.59%
Positive Predictive Value (*)	45.45%	26.41% to 65.93%
Negative Predictive Value (*)	98.36%	90.92% to 99.72%
Accuracy (*)	90.28%	80.99% to 96.00%

Table 5: Lcurb65 sensitivity and other parameters

Statistic	Value	95% CI
Sensitivity	100.00%	54.07%to 100.00%
Specificity	66.67%	53.99%to 77.80%
Positive Predictive Value (*)	21.43%	16.24%to 27.73%
Negative Predictive Value (*)	100.00%	
Accuracy (*)	69.44%	57.47%to 79.76%

As the utility of CURB65, LactateCURB65 estimated on day '1' of hospital admission is to predict mortality, the test with higher sensitivity is more reliable than specificity.
Therefore as LactateCURB65 has sensitivity of 100% and specificity of 66.67% it would be a better screening test to predict mortality than CURB65 with sensitivity 83.3%, specificity of 90.9%.

COHEN'S K TEST
It was done to test the agreement between CURB65, LactateCURB65 in predicting mortality.

LCURB65	Mild n = 16	Moderate n = 45	Severe n = 11
Mild n =11	11	0	0
Moderate n = 33	5	28	0
Severe n = 28	0	17	11

The measure of agreement kappa between Lactate CURB and CURB65 was found to be 0.507 which was p< 0.001 which indicates that LactateCURB65 and CURB65 scores have an agreement of 50% above chance agreement and they disagree for 50% of cases

IV. Discussion

Community acquired pneumonia is a common clinical problem associated with considerable morbidity and mortality. With the advent of several strategies severity assessment of pneumonia has become an important step to decide the therapy options and site of care decisions. These strategies included various clinical and biochemical parameters integrated and structured to form effective scales and have been validated in several clinical studies.

CURB 65 (Confusion, Urea, Respiratory rate, Blood pressure and age more than 65) is one such important scale found to be useful in managing pneumonia, this consists of all routinely measured parameters and is found to be very useful in assessing severity & deciding site of care and is recommended by BTS. A score of 0-1 indicates mild disease, 2 - moderate disease and score of ≥3 (maximum 5) indicate severe disease [(7)].

Lactate is a metabolic end product and its levels may indicate tissue perfusion. Its prognostic importance in pneumonia has been evaluated in various studies. Sepsis management protocols also have advised to follow lactate levels as guidance for resuscitation. A lactate of more than 2 m mol/l has been advised as a marker of poor prognosis. Our study aimed at evaluating the advantage of addition of lactate to CURB 65 in assessing survival in pneumonia patients.

Our study included 72 patients, who presented with provisional diagnosis of community acquired pneumonia. There were 46 males (63.9%), 26 (36.1%) were females. In a study done by Metley et al [(8)] 61 80% were males and 20% were females. In another study done by Shah BA et al [(9)] (n=150), 89 (59.3%) were males.

In our study the mean age group of patients was 68.04 years. In the study of Dey et al [(10)] patients aged > 50 years constituted majority. It is well documented that pneumonia is a disease of extremes of age. Smoking is a risk factor for pneumonia and 20.8% of our patients were smokers.

There were 16 (22.2 %) patients in mild, 45(62.5%) in moderate and 11(15.2%) patients in severe group according to CURB 65. when Lactate CURB65 score was applied they were reclassified as mild in 11(15.2%), moderate in 33(45.8%) and severe in 28(38.8%) patients. There is statistically significant change in the assessment of mortality and severity grading when lactate was added to CURB 65 score.

In a study done by Yun xia et al [(11)], L-CURB65 mortality rates were 2%, 14%, 52% & hospitalization rates were 15%, 40%, 70% in low, moderate, high risk patients respectively. L-CURB 65 has significantly improved the predictive value of CURB65.

In our study, 23(31.9%) patients were admitted into ICU and mechanical ventilation was given to 4 patients (5.55%). When CURB65 score was applied to ICU admissions, there were 12(52.17%) patients in moderate severity group and severe disease was seen in 11(47.8%) patients. When LactateCURB65 score applied to ICU admissions, all 23(100%) patients were classified into severe group. In a study done by Yun xia et al [(11)] lactate CURB65 ICU admission rates were 27%. A study conducted by Stine Anderson et al [(12)], Early Warning Score (EWS), CURB65 had similar performance in predicting severe outcome in CAP the study showed CURB65 as a better mortality predictor(9.8%) and EWS was a better predictor of ICU admission(9.3%).

V. Conclusion

CURB65 score is a well studied scoring system used in assessing severity of pneumonia. Lactate is another parameter found to be useful in a similar manner. Combining lactate to CURB65 results in increased sensitivity of assessment of mortality, ICU admission.

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