*Original Research Article*

Indian Journal of Emergency Medicine
Volume 5 Number 2, April - June 2019
DOI: http://dx.doi.org/10.21088/ijem.2395.311X.5219.3

# To Determine Severity and Prognostic Factors of Patients Admitted in Emergency with Community Acquired Pneumonia

**M. Sudarshan Reddy[1], S. Bhaskar[2], K. Raghu[3]**

**Author's Affiliation:**
[1]Post graduate, [2]Professor, [3]Associate Professor, Department of Emergency & Critical Care Medicine, Narayana Medical College and Hospital, Chintareddypalem, Nellore, Andhra Pradesh 524003, India.

**Corresponding Author:**
**K. Raghu,** Associate Professor, Department of Emergency & Critical Care Medicine, Narayana Medical College and Hospital, Chintareddypalem, Nellore, Andhra Pradesh 524003, India.

**E-mail:** kondleraghu27@gmail.com

**Received on** 01.04.2019,
**Accepted on** 30.04.2019

**Abstract**

*Aim:* The aim of the study is to determine systematically the performance of existing clinical prediction score (SMART_COP, CURB_65, PSI, ATS/ IDSA, SCAP Score) to risk stratify the Emergency department patients with Community acquired pneumonia. *Method:* This study was conducted on 80 patients presented to the department of emergency medicine, during July 2016 to November 2019. *Results:* Maximum age group of 51-70 with mean age 57.5 ± 14.78 years. Smoking about 75% males have smoking as risk factor and the most common comorbid condition is hypertension. Among 80 patients, 10 have CURB_65 score of 0, 24 patients have score of 1, 30 patients have score of 2, 11 patients have score of 3, 3 patients have score of 4 and 2 patients have score of 5. Among 80 patients, 19 patients has SCAP major criteria and 36 patients had minor criteria. The mortality was seen in about 10 patients. SMART_COP has highest AUC value among different pneumonia severity score for predicting the need of vasopressor support and SMART_COP score > 5 have good accuracy in predicting the need of vasopressor support in patients with CAP. *Conclusion:* Early microbiological diagnosis, early antibiotic administration in patients with SMART_COP score > 4 and PSI class 4 and 5 can decrease the morbidity and mortality in CAP patients.

**Keywords:** Pneumonia; Vasopressor; SMART_COP.

## Introduction

Pneumonia is defined as an acute infection of the lung parenchyma, with symptom onset in the community [1]. Community-acquired pneumonia (CAP), "*Captain of the men of Death*" as described by Sir William Osler in 1982 still remains a major cause for morbidity and mortality despite all highly sophisticated advances in both diagnosis and therapeutic management of community acquired pneumonia [2,3]. Community acquired pneumonia (CAP) is a common disorder with an incidence of about 20% to 30% in developing countries compared to an incidence of 3% to 4% in developed countries [4-6].

Severe CAP is defined as a pneumonia requiring supportive therapy within a critical care environment that is associated with a higher mortality rate. Severe CAP is frequently a multisystem disease and patients will often present with multiple organ failure [7].

Despite their widespread use in clinical practice, traditional markers such as severity of disease estimation by the patient, fever, or white blood cell counts do not reliably assess disease severity and mortality risk [8].

Mortality reduction can be achieved by correct prediction rule that allows physicians to select patients with severe CAP who require ICU treatment early in the course of illness facilitates the appropriate initial management and antibiotic treatment [9]. Number of studies suggest that routine clinical judgment is often not sufficient for assessing the severity of CAP [10].

Clinical judgment alone may underestimate its severity and lead to variations in rates of admission to the hospital and intensive care unit (ICU). In addition, the decision to admit a patient to the ICU based on clinical judgment alone has been found to be sub optimal. In this light, validated clinical prediction rules for CAP management offer a useful adjunct to the art of clinical practice.

In developing countries such as India where half population is low economical status site of care is major burden for the patients. Determination of extent of disease severity in vital in optimizing therapeutic options such as requirement of invasive or non invasive ventilator support, need of vasopressor or inotropic support, path of treatment, whether patient can be discharged home, diagnostic strategy and oral or intravenous antibiotics [11].

The aim of the study is to validate the significance of clinical prediction scores in prognosis of severity of Community Acquired Pneumonia and to determine site of care decisions based on clinical prediction scores.

## Materials and methods

*Study Design*

This is a prospective study done in a tertiary care hospital during July 2016 to November 2018 in Department of Emergency Medicine. A total of 80 patients presented to emergency department wit Community acquired pneumonia are selected for the study.

*Inclusion Criteria*

1. Signs and symptoms suggestive of Community Acquired Pneumonia.
2. Evaluation variables performed with in 24 hrs.

*Exclusion Criteria*

1. Age <18 and >80 years.
2. Previously admitted in a hospital for >48.
3. Presence of structural lung disease.
4. Broad-spectrum antibiotic therapy (lasted for at least 7 days in the past month).
5. Corticosteroid therapy with at least 10mg of prednisone per day.
6. Malnutrition.
7. Neutropenic patients.
8. Chemotherapy patients.
9. Patients with HIV related disorders.
10. Transplant recipients.

## Results

*Age distribution:* Among patients studied there were totally 80 patients among which maximum number of patients 42 patients belong to age group between 51-70 (52.5%) followed by 21 patients between age 31-50 (26.3%). 5 patients belong to age < 30 (6.3%) and 12 (15%) patients belong to age >70 as shown in the table. The mean age of the study is 57.5 ± 14.78.

*Smoking distribution:* 48.75% patients has smoking as risk factor and 51.25% patients do not have smoking as risk factor. Among 55% of male 75% males have smoking as a risk factor.

*Comorbidities:* The most common comorbid condition is hypertension in 46 patients followed by diabetes mellitus in 36 patients, COPD in 20 patients, Cerebrovascular accident in 8 patients, Coronary artery disease in 5 patients, Tuberculosis and Chronic kidney disease in one patient each.

*Distribution of need of vasopressors:* In present study among 80 patients 20 (25%) patients required vasopressor support.

*Ventilator support:* Need for ventilator support studied among the patients studied among 80 patients 52 (65%) patients required ventilator support, which includes both invasive and non-invasive ventilation, and 28 (35%) patients did not require ventilator support.

*Distribution of outcome:* among 80 patients 70 (87.5%) patients was discharged and mortality was seen in 10 patients (12.5%).

*Distribution of patients admitted in ICU and Ward:* among 80 patients, 61 (76.3%) patients were admitted in ICU and 19 (23.8) patients were admitted in ward.

**Table 1:** Distribution of laboratory parameters of patient studied

| Laboratory parameters | Number of patients (n=80) | Percentage (%) |
|---|---|---|
| *Blood urea ≥ 20 mmol/lt* | | |
| Yes | 75 | 93.75 |
| No | 5 | 6.25 |
| *Sodium ≤ 130* | | |
| Yes | 18 | 22.5 |
| No | 62 | 77.5 |
| *RBS >250* | | |

| | | |
|---|---|---|
| Yes | 40 | 50.0 |
| No | 40 | 50.0 |
| *HCT ≤ 30%* | | |
| Yes | 42 | 52.5 |
| No | 38 | 47.5 |
| *Ph ≤ 7.35* | | |
| Yes | 33 | 41.25 |
| No | 47 | 58.75 |
| *Serum Albumin (< 35)* | | |
| Yes | 16 | 20.0 |
| No | 64 | 80.0 |
| *Pleural effusion* | | |
| Yes | 38 | 47.5 |
| No | 42 | 52.5 |
| *Chest X-Ray (ML)* | | |
| Yes | 39 | 48.75 |
| No | 41 | 51.25 |

*SMART_COP score:* 36 patients belong to low risk, 21 patients to moderate risk, 10 (12.5%) patients to high risk and 13 patients (16.3%) belonged to very high risk need of IRVS.

*CURB65 score:* among patients studied 10 (12.5%) belonged to Class 0, 24 (30.0) patients belonged to Class 1, 30 patients (37.5%) belonged to class 2, 11 (13.8%) patients belonged to class 3, 3 (3.8%) patients belonged to class 4, 2(2.5%) patients belonged to class 5.

*SCAP_MAJOR score:* among 80 patients 19 (23.75%) patients were met with SCAP major criteria.

*SCAP_MINOR score:* among 80 patients 36 (45%) patients were met with SCAP minor criteria.

*ATS_MAJOR score:* among 80 patients 16 (20%) patients were met with ATS/IDSA major criteria.

*ATS/IDSA minor criteria:* 34 (42.5%) patients were met with ATS/IDSA minor criteria.

*Sputum Culture:* 25 patients had shown streptococcus in culture, 18 pts had shown sthaphylococcus, 14 had shown klebsiella, 3 had shown E.coli, pseudomonas is seen in 12 and others in 9 pts.

**Table 2:** Comparison of various clinical variables with SMART COP

| Clinical Variables | SMART_COP_GRP (Mean ± SD) | | | | | F Value | p Value |
|---|---|---|---|---|---|---|---|
| | Low Risk [n = 36] | Moderate Risk [n = 21] | High Risk [n = 10] | Very High Risk [n = 13] | Total [n = 80] | | |
| AGE | 59.36 ± 13.55 | 56.14 ± 15.76 | 53.3 ± 18.73 | 57.77 ± 14 | 57.5 ± 14.78 | 0.51 | 0.68 |
| GCS | 15 ± 0.0 | 14.43 ± 2.4 | 15 ± 0.0 | 14.38 ± 1.66 | 14.75 ± 1.4 | 1.16 | 0.33 |
| SBP | 124.72 ± 22.36 | 130.95 ± 28.62 | 104 ± 30.98 | 90.77 ± 32.26 | 118.25 ± 30.14 | 7.71 | 0.00** |
| DBP | 76.67 ± 13.31 | 77.62 ± 14.8 | 63 ± 17.67 | 55.38 ± 18.98 | 71.75 ± 17.27 | 8.35 | 0.00** |
| HR | 111.28 ± 18.95 | 109.19 ± 21.46 | 101.2 ± 23.4 | 137.54 ± 20.25 | 113.74 ± 22.84 | 7.68 | 0.00** |
| RR | 31.83 ± 9.69 | 35.33 ± 8.74 | 33.6 ± 9.16 | 44.31 ± 4.33 | 35 ± 9.62 | 6.60 | 0.00** |
| TEMP | 99.49 ± 1.29 | 99.2 ± 1.2 | 99.08 ± 1.01 | 100.34 ± 1.3 | 99.5 ± 1.28 | 2.79 | 0.049* |
| CBG | 242.42 ± 102.05 | 220 ± 110.46 | 201.8 ± 91.02 | 242.46 ± 119.8 | 231.46 ± 105.11 | 0.52 | 0.67 |
| HB | 11.19 ± 2.03 | 10.78 ± 2.51 | 9.97 ± 1.52 | 10.78 ± 2.67 | 10.86 ± 2.22 | 0.81 | 0.49 |
| TC | 15950 ± 5218.95 | 16023.81 ± 4972.01 | 11440 ± 4021.66 | 16669.23 ± 8292.1 | 15522.5 ± 5752.29 | 2.05 | 0.11 |
| PLT | 227388.89 ± 85624.86 | 272519.05 ± 152938.77 | 275110 ± 104657.37 | 238823.08 ± 141591.16 | 247058.75 ± 117992.64 | 0.86 | 0.46 |
| UREA | 45.69 ± 24.28 | 56.51 ± 40.76 | 47.82 ± 28.95 | 67.5 ± 43.46 | 52.34 ± 33.61 | 1.55 | 0.21 |
| S_CR | 1.36 ± 0.61 | 1.55 ± 0.92 | 1.63 ± 1.02 | 2.18 ± 1.58 | 1.58 ± 0.98 | 2.38 | 0.08 |
| NA | 133.14 ± 8.21 | 135.95 ± 9.16 | 137.1 ± 4.68 | 135.38 ± 6.69 | 134.74 ± 7.92 | 0.98 | 0.41 |
| K | 4 ± 0.65 | 3.87 ± 0.9 | 4.35 ± 0.47 | 4.38 ± 0.53 | 4.07 ± 0.71 | 2.16 | 0.10 |
| CL | 96.86 ± 3.85 | 94.86 ± 20.12 | 97.4 ± 3.63 | 99.15 ± 4.52 | 96.78 ± 10.75 | 0.44 | 0.73 |
| HCT | 31.14 ± 4 | 30.33 ± 4.76 | 29.2 ± 2.62 | 31.92 ± 5.27 | 30.81 ± 4.3 | 0.91 | 0.44 |
| S_ALB | 40.01 ± 6.12 | 40.24 ± 3.16 | 36.5 ± 5.97 | 32.54 ± 3.91 | 38.42 ± 5.8 | 8.14 | 0.00** |
| Ph | 7.4 ± 0.06 | 7.35 ± 0.1 | 7.31 ± 0.12 | 7.26 ± 0.12 | 7.35 ± 0.1 | 7.16 | 0.00** |
| $pCO_2$ | 33.32 ± 7.18 | 34.17 ± 13.57 | 37.54 ± 13.25 | 38.02 ± 18.73 | 34.84 ± 12.1 | 0.67 | 0.58 |
| $pO_2$ | 163.73 ± 63.94 | 105.91 ± 54.36 | 88.29 ± 25.49 | 108.15 ± 43.64 | 130.09 ± 62.4 | 8.42 | 0.00** |
| $HCO_3$ | 18.91 ± 3.89 | 19.83 ± 6.17 | 19.38 ± 4.93 | 18.65 ± 7.77 | 19.17 ± 5.33 | 0.18 | 0.91 |
| $SaO_2$ | 98.41 ± 3.34 | 95.64 ± 4.18 | 95.06 ± 5.26 | 93.41 ± 5.41 | 96.45 ± 4.55 | 5.52 | 0.00** |
| LAC | 1.54 ± 0.94 | 2.07 ± 0.79 | 2.19 ± 1.37 | 4.91 ± 1.44 | 2.31 ± 1.57 | 32.83 | 0.00** |
| LOS | 5.19 ± 1.65 | 5.62 ± 1.16 | 6.6 ± 1.35 | 6.31 ± 3.2 | 5.66 ± 1.9 | 2.14 | 0.10 |

***p < 0.05 - Significant, **p < 0.0001 - Very High Significant***

**Table 3:** Comparison of various clinical variables with CURB 65

| Clinical Variables | CURB_65 [Mean ± SD] | | | | | | | F Value | p Value |
|---|---|---|---|---|---|---|---|---|---|
| | 0.0 [n = 10] | 1.0 [n = 24] | 2.0 [n = 30] | 3.0 [n = 11] | 4.0 [n = 3] | 5.0 [n = 2] | Total [n = 80] | | |
| AGE | 54.7 ± 10.92 | 52.5 ± 15.15 | 57.17 ± 15.66 | 67.36 ± 9.41 | 73.33 ± 10.41 | 58.5 ± 13.44 | 57.5 ± 14.78 | 2.52 | 0.04* |
| GCS | 15 ± 0 | 14.5 ± 2.25 | 14.97 ± 0.18 | 14.45 ± 1.81 | 15 ± 0 | 14.5 ± 0.71 | 14.75 ± 1.4 | 0.47 | 0.80 |
| SBP | 116 ± 10.75 | 132.08 ± 27.5 | 111.67 ± 28.9 | 126.36 ± 37.76 | 76.67 ± 5.77 | 80 ± 0 | 118.25 ± 30.14 | 3.84 | 0.00** |
| DBP | 74 ± 12.65 | 78.33 ± 14.04 | 68.33 ± 17.24 | 74.55 ± 22.07 | 50 ± 0 | 50 ± 14.14 | 71.75 ± 17.27 | 2.93 | 0.02* |
| HR | 98.7 ± 18.1 | 108.13 ± 20.11 | 114.73 ± 18.52 | 133.18 ± 26.74 | 129.67 ± 31.79 | 110.5 ± 43.13 | 113.74 ± 22.84 | 3.56 | 0.01* |
| RR | 26.7 ± 6.04 | 34.25 ± 9.74 | 34.87 ± 10.14 | 40.09 ± 4.41 | 43 ± 7.55 | 47.5 ± 3.54 | 35 ± 9.62 | 3.80 | 0.00** |
| TEMP | 99.56 ± 1.33 | 99.31 ± 1.28 | 99.27 ± 1.15 | 100.09 ± 1.54 | 100.2 ± 1.39 | 100.5 ± 0.71 | 99.5 ± 1.28 | 1.20 | 0.32 |
| CBG | 228.5 ± 97.22 | 225.33 ± 113.18 | 236.07 ± 110.5 | 234.82 ± 95.34 | 214.33 ± 78.36 | 258 ± 178.19 | 231.46 ± 105.11 | 0.07 | 1.00 |
| HB | 10.86 ± 1.78 | 11.3 ± 2.08 | 10.25 ± 2.12 | 11 ± 2.89 | 11.4 ± 3.14 | 13.3 ± 0 | 10.86 ± 2.22 | 1.17 | 0.33 |
| TC | 14320 ± 3651.73 | 15150 ± 4815.64 | 14203.33 ± 6423.1 | 19636.36 ± 5529.24 | 21366.67 ± 6619.92 | 14400 ± 3111.27 | 15522.5 ± 5752.29 | 2.37 | 0.047* |
| PLT | 220400 ± 83764.48 | 271754.17 ± 140662.83 | 240130 ± 110470.64 | 245336.36 ± 134294.25 | 239666.67 ± 102163.27 | 208500 ± 12020.82 | 247058.75 ± 117992.64 | 0.36 | 0.87 |
| UREA | 34.41 ± 18.91 | 38.07 ± 28.92 | 52.97 ± 28.19 | 90.72 ± 36.28 | 82.33 ± 33.71 | 47.75 ± 35 | 52.34 ± 33.61 | 6.44 | 0.00** |
| S_CR | 1.07 ± 0.84 | 1.08 ± 0.44 | 1.78 ± 0.84 | 2.28 ± 1.55 | 2.67 ± 0.58 | 1.55 ± 1.06 | 1.58 ± 0.98 | 4.86 | 0.00** |
| NA | 131.2 ± 6.18 | 136.08 ± 10.76 | 133.87 ± 6.66 | 136.09 ± 5.65 | 135 ± 4.58 | 141.5 ± 0.71 | 134.74 ± 7.92 | 0.96 | 0.45 |
| K | 3.92 ± 0.52 | 3.99 ± 0.86 | 4.11 ± 0.73 | 4.11 ± 0.44 | 4.57 ± 0.8 | 4.25 ± 0.07 | 4.07 ± 0.71 | 0.48 | 0.79 |
| CL | 96.4 ± 4.2 | 94.5 ± 18.78 | 97.53 ± 3.95 | 98.36 ± 3.8 | 99.33 ± 3.06 | 102 ± 1.41 | 96.78 ± 10.75 | 0.41 | 0.84 |
| HCT | 29.6 ± 3.89 | 31.75 ± 4.75 | 29.77 ± 3.86 | 30.91 ± 3.59 | 32.33 ± 4.93 | 38.5 ± 0.71 | 30.81 ± 4.3 | 2.27 | 0.06 |
| S_ALB | 41.4 ± 1.84 | 40.33 ± 2.58 | 37.15 ± 7.52 | 38.36 ± 5.28 | 30.67 ± 3.06 | 31.5 ± 6.36 | 38.42 ± 5.8 | 3.44 | 0.01* |
| Ph | 7.38 ± 0.06 | 7.39 ± 0.1 | 7.35 ± 0.11 | 7.29 ± 0.09 | 7.26 ± 0.13 | 7.33 ± 0.03 | 7.35 ± 0.1 | 2.19 | 0.07 |
| $pCO_2$ | 35.35 ± 9.26 | 34 ± 12.35 | 32.88 ± 10.67 | 44.66 ± 14.76 | 25.8 ± 12.17 | 31.1 ± 7.21 | 34.84 ± 12.1 | 2.15 | 0.07 |
| $pO_2$ | 152.51 ± 40.28 | 128.8 ± 69.22 | 125.25 ± 61.63 | 133.08 ± 73.31 | 136.2 ± 61.37 | 80.5 ± 21.92 | 130.09 ± 62.4 | 0.54 | 0.74 |
| $HCO_3$ | 20.5 ± 4.25 | 20.16 ± 5.57 | 18.09 ± 4.2 | 21.03 ± 7.08 | 13.33 ± 7.57 | 15.3 ± 0.42 | 19.17 ± 5.33 | 1.82 | 0.12 |
| $SaO_2$ | 99.5 ± 1.27 | 96.68 ± 3.56 | 96.67 ± 4.01 | 93.03 ± 7.47 | 96 ± 5.29 | 94.8 ± 3.96 | 96.45 ± 4.55 | 2.44 | 0.04* |
| LAC | 1.24 ± 0.49 | 1.66 ± 0.75 | 2.38 ± 1.44 | 3.83 ± 2.03 | 4.33 ± 2.89 | 3 ± 1.41 | 2.31 ± 1.57 | 6.59 | 0.00** |
| LOS | 5 ± 1.89 | 5.25 ± 1.54 | 5.73 ± 1.36 | 5.82 ± 1.99 | 6.33 ± 3.06 | 11 ± 4.24 | 5.66 ± 1.9 | 4.59 | 0.00** |

*$p < 0.05$ - Significant, **$p < 0.0001$ - Very High Significant

**Table 4:** Comparison of various clinical variables with PSI GRP

| Clinical Variables | PSI_GRP (Mean ± SD) | | | | | F Value | p Value |
|---|---|---|---|---|---|---|---|
| | Class-II [n=4] | Class-III [n=5] | Class-IV [n=53] | Class-V [n=18] | Total [n=80] | | |
| AGE | 66.25 ± 10.9 | 61.8 ± 4.32 | 53.32 ± 15.23 | 66.67 ± 10.64 | 57.5 ± 14.78 | 4.99 | 0.00** |
| GCS | 15 ± 0 | 15 ± 0 | 14.74 ± 1.52 | 14.67 ± 1.41 | 14.75 ± 1.4 | 0.12 | 0.95 |
| SBP | 130 ± 34.64 | 128 ± 25.88 | 117.55 ± 28.75 | 115 ± 35.36 | 118.25 ± 30.14 | 0.45 | 0.72 |
| DBP | 75 ± 23.8 | 78 ± 10.95 | 71.89 ± 15.82 | 68.89 ± 21.66 | 71.75 ± 17.27 | 0.42 | 0.74 |
| HR | 98.75 ± 15.39 | 106.4 ± 16.02 | 108.77 ± 19.91 | 133.72 ± 23.27 | 113.74 ± 22.84 | 7.76 | 0.00** |
| RR | 21.75 ± 3.95 | 26.2 ± 5.97 | 34.09 ± 9.08 | 43.06 ± 5.57 | 35 ± 9.62 | 11.65 | 0.00** |
| TEMP | 99.15 ± 1.24 | 99.16 ± 0.77 | 99.39 ± 1.27 | 99.99 ± 1.39 | 99.5 ± 1.28 | 1.23 | 0.31 |
| CBG | 131.5 ± 11.36 | 197.2 ± 64.92 | 222.55 ± 102.15 | 289.44 ± 109.11 | 231.46 ± 105.11 | 3.68 | 0.02* |
| HB | 11.23 ± 1.61 | 12.18 ± 0.86 | 10.84 ± 2.13 | 10.48 ± 2.77 | 10.86 ± 2.22 | 0.80 | 0.50 |
| TC | 15250 ± 3570.71 | 11900 ± 2952.96 | 15162.26 ± 5512.16 | 17650 ± 6888.46 | 15522.5 ± 5752.29 | 1.59 | 0.20 |
| PLT | 241500 ± 87857.84 | 231800 ± 85106.99 | 254301.89 ± 122261.65 | 231205.56 ± 124107.53 | 247058.75 ± 117992.64 | 0.20 | 0.90 |
| UREA | 37.8 ± 9.38 | 37.46 ± 19.66 | 47.48 ± 29.81 | 74.03 ± 41.67 | 52.34 ± 33.61 | 3.81 | 0.01* |
| S_CR | 1.25 ± 0.5 | 1.17 ± 0.26 | 1.51 ± 0.86 | 1.98 ± 1.36 | 1.58 ± 0.98 | 1.58 | 0.20 |
| NA | 143 ± 4.9 | 135.2 ± 7.79 | 134.49 ± 8.4 | 133.5 ± 6.25 | 134.74 ± 7.92 | 1.66 | 0.18 |
| K | 4.18 ± 0.69 | 3.42 ± 0.29 | 4.15 ± 0.79 | 4.01 ± 0.43 | 4.07 ± 0.71 | 1.76 | 0.16 |
| CL | 98.75 ± 4.57 | 97.6 ± 2.97 | 96.02 ± 12.89 | 98.33 ± 4.2 | 96.78 ± 10.75 | 0.26 | 0.85 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| HCT | 31.75 ± 4.65 | 34 ± 3.39 | 30.7 ± 4.26 | 30.06 ± 4.45 | 30.81 ± 4.3 | 1.19 | 0.32 |
| S_ALB | 39.75 ± 4.27 | 41.8 ± 2.05 | 38.44 ± 6.35 | 37.11 ± 4.85 | 38.42 ± 5.8 | 0.94 | 0.43 |
| Ph | 7.41 ± 0.04 | 7.43 ± 0.04 | 7.36 ± 0.1 | 7.3 ± 0.11 | 7.35 ± 0.1 | 3.36 | 0.02* |
| $pCO_2$ | 35.58 ± 6.79 | 32.26 ± 6.48 | 32.07 ± 10.91 | 43.53 ± 13.89 | 34.84 ± 12.1 | 4.67 | 0.01* |
| $pO_2$ | 124.33 ± 97.21 | 140.16 ± 62.69 | 125.87 ± 59.01 | 140.99 ± 68.06 | 130.09 ± 62.4 | 0.31 | 0.82 |
| $HCO_3$ | 20.75 ± 1.58 | 21.04 ± 4.75 | 18.71 ± 5.38 | 19.65 ± 5.96 | 19.17 ± 5.33 | 0.49 | 0.69 |
| $SaO_2$ | 97 ± 2.58 | 98.2 ± 2.68 | 97.06 ± 3.51 | 94.05 ± 6.87 | 96.45 ± 4.55 | 2.38 | 0.08 |
| LAC | 1.03 ± 0.45 | 0.9 ± 0.64 | 2 ± 1.16 | 3.91 ± 1.81 | 2.31 ± 1.57 | 13.39 | 0.00** |
| LOS | 3.75 ± 2.75 | 4.6 ± 0.55 | 5.98 ± 1.77 | 5.44 ± 2.04 | 5.66 ± 1.9 | 2.61 | 0.06 |

*p < 0.05 - Significant, **p < 0.0001 - Very High Significant

**Table 5:** Comparison of various clinical variables with SCAP MAJOT

| Clinical Variables | SCAP_MAJOR [Mean + SD] | | | t Value | P Value |
|---|---|---|---|---|---|
| | No [n=61] | Yes [n=19] | Total [n=80] | | |
| AGE | 58.25 ± 15.02 | 55.11 ± 14.1 | 57.5 ± 14.78 | 0.81 | 0.42 |
| GCS | 14.98 ± 0.13 | 14 ± 2.79 | 14.75 ± 1.4 | 1.54 | 0.14 |
| SBP | 126.39 ± 23.6 | 92.11 ± 34.41 | 118.25 ± 30.14 | 4.93 | 0.00** |
| DBP | 76.72 ± 13.87 | 55.79 ± 17.74 | 71.75 ± 17.27 | 5.36 | 0.00** |
| HR | 109.59 ± 20.25 | 127.05 ± 26.04 | 113.74 ± 22.84 | -3.06 | 0.00** |
| RR | 32.82 ± 9.09 | 42 ± 7.9 | 35 ± 9.62 | -3.96 | 0.00** |
| TEMP | 99.31 ± 1.23 | 100.12 ± 1.28 | 99.5 ± 1.28 | -2.43 | 0.02* |
| CBG | 229.62 ± 98.81 | 237.37 ± 126.07 | 231.46 ± 105.11 | -0.28 | 0.78 |
| HB | 10.86 ± 2.07 | 10.89 ± 2.71 | 10.86 ± 2.22 | -0.05 | 0.96 |
| TC | 15455.74 ± 5187.28 | 15736.84 ± 7447.61 | 15522.5 ± 5752.29 | -0.19 | 0.85 |
| PLT | 242672.13 ± 114775.12 | 261142.11 ± 130067.7 | 247058.75 ± 117992.64 | -0.59 | 0.56 |
| UREA | 50.37 ± 31.8 | 58.66 ± 39.12 | 52.34 ± 33.61 | -0.94 | 0.35 |
| S_CR | 1.45 ± 0.77 | 1.99 ± 1.41 | 1.58 ± 0.98 | -1.60 | 0.12 |
| NA | 134.36 ± 8.47 | 135.95 ± 5.84 | 134.74 ± 7.92 | -0.76 | 0.45 |
| K | 3.99 ± 0.73 | 4.34 ± 0.58 | 4.07 ± 0.71 | -1.90 | 0.06 |
| CL | 96.18 ± 12.08 | 98.68 ± 3.96 | 96.78 ± 10.75 | -0.89 | 0.38 |
| HCT | 30.64 ± 3.84 | 31.37 ± 5.6 | 30.81 ± 4.3 | -0.53 | 0.60 |
| S_ALB | 40.24 ± 5.06 | 32.58 ± 3.92 | 38.42 ± 5.8 | 6.05 | 0.00** |
| Ph | 7.38 ± 0.08 | 7.26 ± 0.12 | 7.35 ± 0.1 | 3.96 | 0.00** |
| $pCO_2$ | 33.8 ± 9.33 | 38.16 ± 18.37 | 34.84 ± 12.1 | -1.00 | 0.33 |
| $pO_2$ | 137.42 ± 66.8 | 106.56 ± 38.03 | 130.09 ± 62.4 | 2.53 | 0.01* |
| $HCO_3$ | 19.69 ± 4.71 | 17.51 ± 6.86 | 19.17 ± 5.33 | 1.57 | 0.12 |
| $SaO_2$ | 97.26 ± 3.97 | 93.86 ± 5.38 | 96.45 ± 4.55 | 2.98 | 0.00** |
| LAC | 1.75 ± 0.95 | 4.1 ± 1.84 | 2.31 ± 1.57 | -5.35 | 0.00** |
| LOS | 5.52 ± 1.42 | 6.11 ± 2.96 | 5.66 ± 1.9 | -0.83 | 0.42 |

*p < 0.05 - Significant, **p < 0.0001 - Very High Significant

In the present study among 80 patients 36 patients had ATS/IDSA minor criteria and 44 patients did not have minor criteria. The mean age for patients who had minor criteria was 56.47 ± 14.08. The mean SBP for patients who had minor criteria was 110. ± 37.25. The mean DBP for patients who had minor criteria was 67.35 ± 20.5. The mean HR for patients who had minor criteria was 123.5 ± 23.8. The mean RR for patients who had major criteria was 39.88 ± 7.46. The mean temperature for patients who had minor criteria was 99.73 ± 1.29. The mean serum creatinine for patients who had minor criteria was 2.02 ± 1.22. The mean serum albumin for patients who had minor criteria was 35.85 ± 5.34. The mean serum blood urea nitrogen for patients who had minor criteria was 68.65 ± 39.34. The mean pH for patients who had minor criteria was 7.3 ± 0.12. The mean partial pressure of oxygen for patients who had minor criteria was 108.82 ± 51.68. The mean saturation of oxygen for patients who had minor criteria was 94.48 ± 5.49. The mean lactate for patients who had minor criteria was 3.17 ± 1.88.

**Table 6:** Area under the ROC curve (AUC) for Vasopressor with SMART COP, CURB 65, PSI, SCAP (Major, Minor) and ATS (Major, Minor).

| Test Result Variable(s) | Area | Std. Error | P Value | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| SMART_COP | 0.885 | 0.053 | <0.0001 | 0.780 | 0.989 |
| CURB_65 | 0.815 | 0.051 | <0.0001 | 0.715 | 0.914 |
| PSI | 0.829 | 0.049 | <0.0001 | 0.733 | 0.926 |
| SCAP_MAJOR | 0.867 | 0.060 | <0.0001 | 0.750 | 0.983 |
| SCAP_MINOR | 0.800 | 0.054 | <0.0001 | 0.694 | 0.906 |
| ATS_MAJOR | 0.833 | 0.064 | <0.0001 | 0.708 | 0.959 |
| ATS_MINOR | 0.817 | 0.053 | <0.0001 | 0.713 | 0.920 |

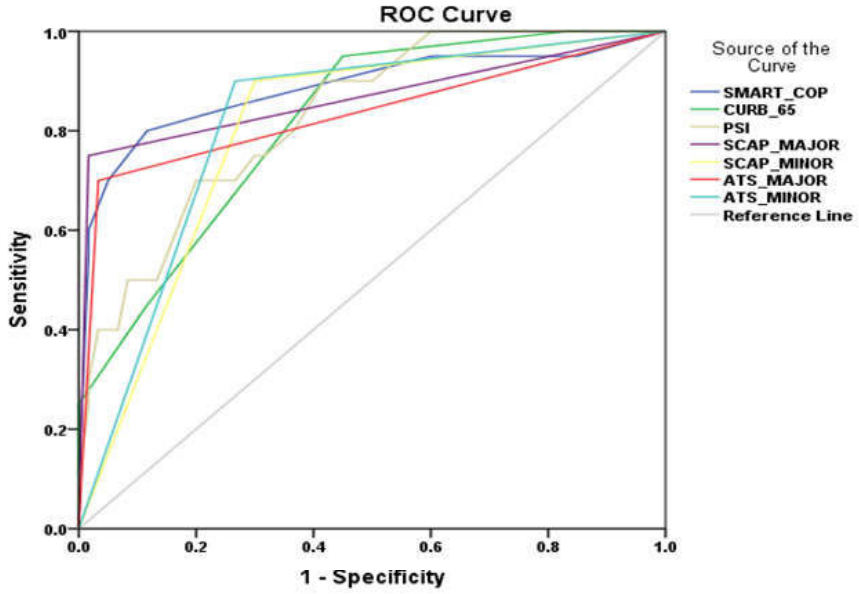


**Fig. 1:** Receiver operating characteristic (ROC) curves for Vasopressor with SMART COP, CURB 65, PSI, SCAP (Major, Minor) and ATS (Major, Minor)

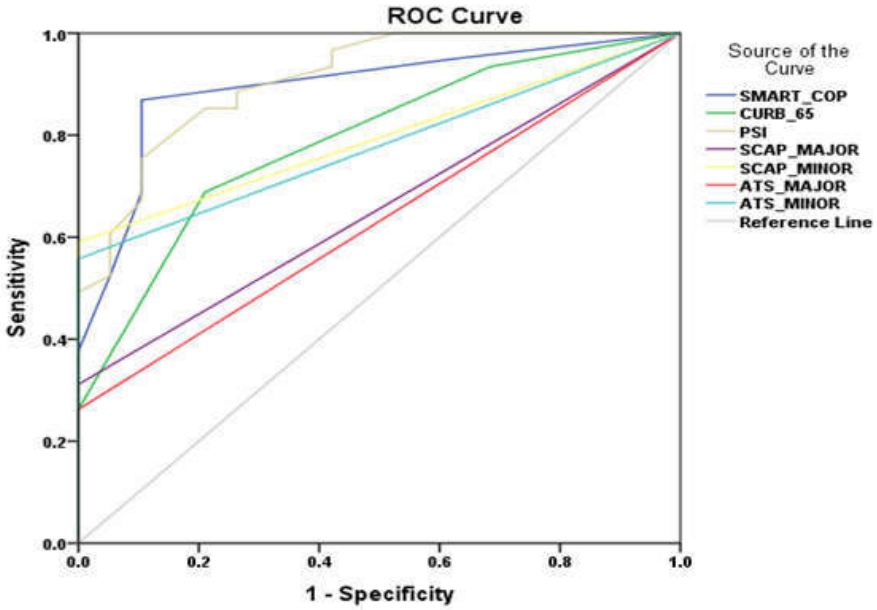


**Fig. 2:** Receiver operating characteristic (ROC) curves for Admit_in (ICU) with SMART COP, CURB 65, PSI, SCAP (Major, Minor) and ATS (Major, Minor).

ROC curve to predict ICU admission among different score studied. PSI was sensitive to predict ICU admission when compared to other pneumonia severity scores. Area under curve for PSI is 0.91 where as SMART COP is 0.89, CURB65 is 0.79, SCAP major criteria is 0.65, minor criteria is 0.79, ATS/IDSA minor criteria was 0.77, major criteria was 0.63. p value of SMART_COP, CURB65,PSI, SCAP minor and ATS/IDSA minor criteria was very high significant i.e, <0.0001 and p value of SCAP major criteria 0.041 and ATS major criteria was 0.086.

ROC curve to predict mortality among different score studied. PSI was sensitive to predict mortality when compared to other pneumonia severity scores. Area under curve for PSI is 0.936 where as SMART COP is 0.89, CURB65 is 0.828, SCAP major criteria is 0.92, minor criteria is 081, ATS/IDSA minor criteria was 0.82, major criteria was 0.84. P value of SMART_COP, CURB65, PSI, SCAP major/ minor and ATS/IDSA major/minor criteria was very high significant i.e, p<0.0001 (Table 7).

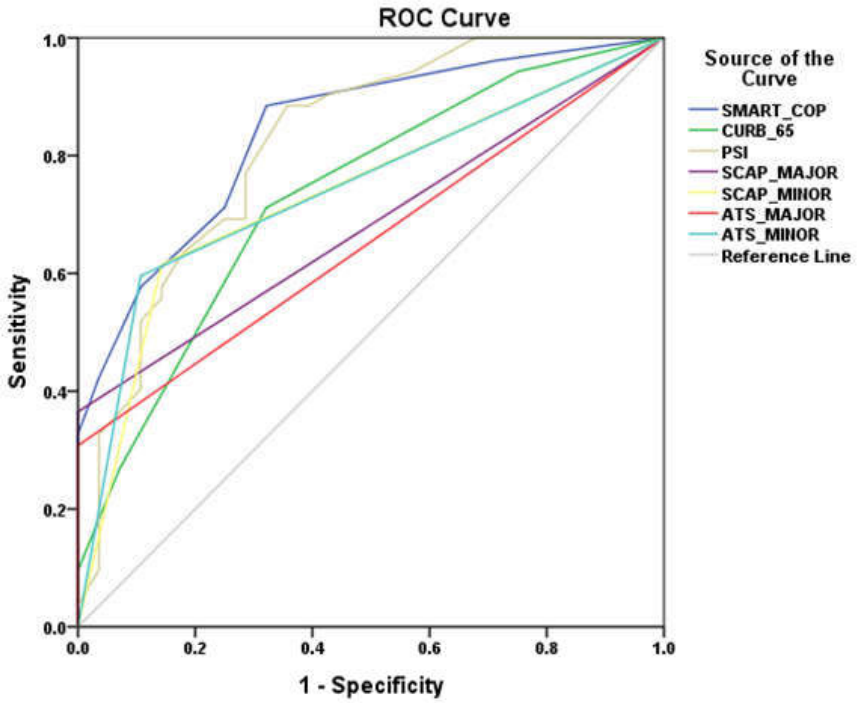


**Fig. 3:** Receiver operating characteristic (ROC) curves for Ventilator support with SMART COP, CURB 65, PSI, SCAP and ATS.

**Table 7:** Area under the ROC curve (AUC) for outcome with SMART COP, CURB 65, PSI, SCAP (Major, Minor) and ATS (Major, Minor).

| Test Result Variable(s) | Area | Std. Error | p Value | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| SMART_COP | 0.891 | 0.088 | <0.0001 VHS | 0.719 | 10.000 |
| CURB_65 | 0.828 | 0.056 | 0.001 SIG | 0.718 | 0.938 |
| PSI | 0.936 | 0.027 | <0.0001 VHS | 0.883 | 0.988 |
| SCAP_MAJOR | 0.926 | 0.036 | <0.0001 VHS | 0.855 | 0.996 |
| SCAP_MINOR | 0.814 | 0.050 | 0.001 SIG | 0.716 | 0.912 |
| ATS_MAJOR | 0.843 | 0.077 | <0.0001 VHS | 0.692 | 0.994 |
| ATS_MINOR | 0.829 | 0.048 | 0.001 SIG | 0.735 | 0.922 |

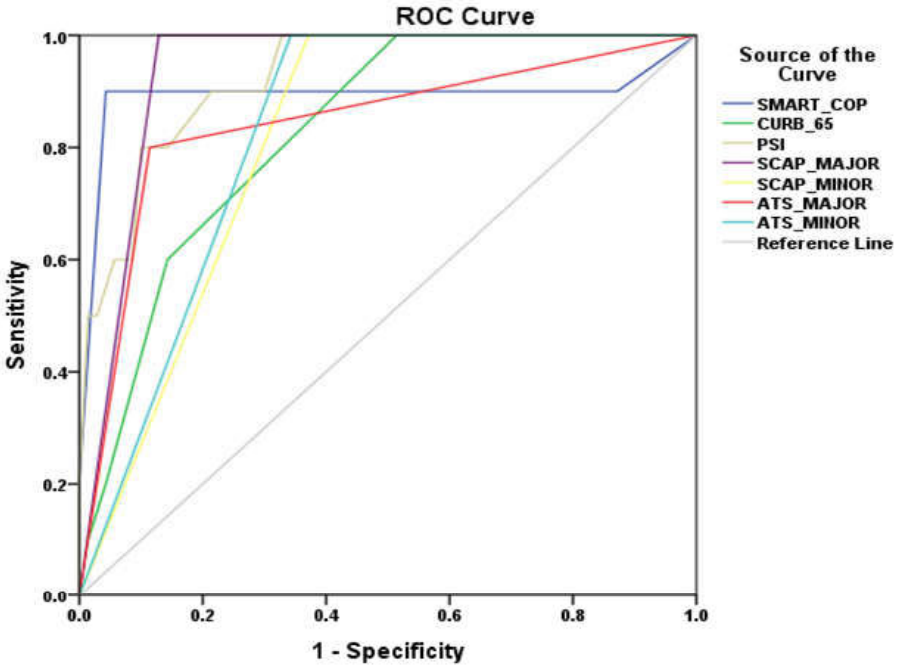


**Fig. 4:** Receiver operating characteristic (ROC) curves for outcome with SMART COP, CURB 65, PSI, SCAP and ATS.

## Discussion

In present study (n=80), 5 (6.3%) patients were <30 years, 21 patients (26.3%) were between 31-50 years, 42 (52.5%) patients are between 51-70 years, 12 (15%) patients are greater than 70 years of age. In this study group majority of patients were between 51-70 years.

In a study by Vidyasagar et al. [12] majority of subjects (70%) were less than 60 yrs of age with 30% in the age group > 60 years. 25% were in 51 to 60 years. In the present study, 55% were males, and 45% were females.

The most common comorbidity of patients associated with CAP was hypertension in 46 patients. In a study conducted by Babu et al. (2017) [13] the major comorbidities of patients associated with CAP were chronic renal failure (40%), congestive heart failure (30%), and chronic liver failure (25%).

Among 80 patients, 25 patients had shown streptococcus in culture, 18 pts had shown staphylococcus, 14 had shown Klebsiella, 3 had shown E.coli, Pseudomonas is seen in 12 and others in 9 patients respectively.

In a study by Vidyasagar et al. (2015) [12] out of 95 patients, 34 subjects (42.5%) were admitted in ICU, 32.5% of subjects were put on ventilator support.

In present study, 61 (76.3%) patients were admitted in ICU and 19 (23.8) patients were admitted in ward. Study done by Man et al. (2007) [2] demonstrated that prospective comparison of three predictive rules for assessing severity of community-acquired pneumonia The ICU admission rate of low-risk groups was 2.7% in PSI, 2.3% in CURB65.

In a study done Shah et al. (2009) [1] to validate Pneumonia Severity Index and CURB-65 Severity Scoring Systems in Community Acquired Pneumonia in an Indian Setting out of 130 patients 35 patients required ICU admission.

Out of 80 patients, mortality is seen in 10 patients (12.5%). In a study by Eldaboosy et al. (2015) [14], the mortality rate in this study was 10% and mortality was higher in the elderly and patients with comorbidities.

In a study done by Shah et al. (2009) [1] to Validate Pneumonia Severity Index and CURB-65 Severity Scoring Systems in Community Acquired Pneumonia in an Indian Setting out of 150 patients mortality was seen in 16 patients.

In present study, 20 patients required Vasopressor support. In a study done by Chalmers et al. (2008) [15] in Predicting the Need for Inotropic Support for Young Adults Admitted to the Hospital with Community-Acquired Pneumonia.

AUC value to predict the need of vasopressor among different group studied SMART_COP score has highest AUC value to predict the need of vasopressor support i.e. 0.88. AUC value for CURB_65 is 0.81, PSI is 0.82, SCAP major /minor 0.86/0.80, ATS/IDSA major and minor criteria is 0.83/0.81.

In Australian CAP Charles et al. (2008) [16] studies A SMART-COP has highest AUC value (0.87) to predict the need of vasopressor support. Whereas the AUC value for PSI is 0.69 and CURB_65 is 0.67. The AUC values correlates with present study.(31).

Marti et al. (2012) [17], performed a meta-analysis comparing different scoring systems in pneumonia prognosis. They concluded that new severity scores for CAP in predicting the need for IRVS or ICU admission (ATS/IDSA 2007 minor criteria, SCAP score and SMART- COP), had better discriminative performance in comparison to the previous ones (PSI and CURB-65).

In present study, 61 patients required ICU admission. 36 patients belong to low risk group and among them 19 patients required ICU admission.

Among 80, 16 patients had major criteria and all patients required ICU admission. 34 patients had minor criteria and 34 patients required ICU admission.

Among different scores used to predict ventilator support in patients admitting to ER PSI has more AUC to predict ICU admission.

In a study by Splinder et al. (2006) [18] to evaluate the accuracy of score systems. The need for ICU treatment was significantly higher (P<0.0001) in high-risk than in low-risk patients for two severity scores: 19 out of 53 (35.8%) versus one out of 61 (1.6%) for PSI; 12 out of 22 (54.5%) versus eight out of 92 (8.7%) for CURB-65.

In a study done by Pereira et al (2012) [8] to assess severity of patients with community acquired of pneumonia, a ROC value for predicting ICU admission in patients with CAP PSI was 0.86, curb 65 was 0.79 ATS/IDSA was 0.82, SMARTCOP 0.83, SCAP 0.75. The value of the study correlates with present study.

In a study done by Singanayagam et al. (2009) [19] in severity assessment of SCAP AUC value to predict ICU admission are 0.87, 0.77, 0.80 for SMART_COP, CURB_65, PSI respectively.

In present study among 80 patients 52 patients required ventilator support. In present study among 80 patients mortality was seen in 10 patients and 70 patients were discharged home.

In distribution of patients in SMART_COP, 36 patients belong to low risk group and 21 patients belong to moderate risk group, 10 patients belong to high risk group, only 1 patient of low risk group had mortality 13 patients belong to very high risk group and mortality was seen in 9 patients.

In distribution of patients in CURB_65, among 80 patients 10 patients has score 0 and, 24 patients has score 1 and no mortality was seen in both scores, 30 patients has score 2 and mortality was seen in 4 patients, 11 patients has score 3 and mortality was seen in 4 patients, 3 patients has score 4 and mortality was seen in 1 patient, 2 patients has score 5 and mortality was seen in 1 patient.

In distribution of patients in PSI, among 80 patients no patient belonged to class 1, 4 patients belonged to class 2, 5 patients belonged to class 3 and no mortality was seen in first 3 classes, 53 patients belonged to class 4 and 2 patients had mortality, 18 patients belonged to class 5 and 8 patients had mortality.

In distribution of patients in ATS/IDSA, among 80 16 patients had major criteria and mortality was seen in 8 patients. 34 patients had minor criteria and mortality was seen in 10 patients.

In distribution of patients in SCAP, among 80 19 patients had major criteria and mortality was seen in 10 patients. 36 patients had minor criteria and mortality was seen in 10 patients. Among different scores used to predict ventilator support in patients admitting to Emergency department PSI has more AUC value to predict outcome.PSI has AUC of 0.93 where as CURB65 has 0.82 SMART_COP has 0.89, major criteria of SCAP has 0.92 minor criteria of SCAP has 0.81, major criteria of ATS/IDSA has 0.84, minor criteria of ATS/IDSA has 0.82. P value for SMART_ COP, PSI, SCAP major criteria, SCAP minor criteria, ATS/IDSA major and minor criteria have very high significant P value <0.0001, whereas CURB 65 have P value of 0.13.

In a study done by Pereira et al. (2012) [8] to assess severity of patients with community acquired of pneumonia, AUC value for predicting mortality in patients with CAP PSI was 0.89,CURB_ 65 was 0.87, ATS/IDSA was 0.67, SMART_COP and SCAP were not assessed.

**Conclusion**

SMART_COP and PSI can be used to determine the severity and prognosis of the patients presenting to Emergency Department with Community acquired pneumonia. Early microbiological diagnosis, early

antibiotic administration in patients with SMART_ COP score > 4 and PSI class 4 and 5 can decrease the morbidity and mortality in CAP patients.

## References


1. Shah BA, Ahmed W, Dhobi GN, Shah NN, Khursheed SQ, Haq I. Validity of pneumonia severity index and CURB-65 severity scoring systems in community acquired pneumonia in an Indian setting. The Indian journal of chest diseases & allied sciences. 2010 Jan;52(1):9-17.
2. Osler W. The principles and practice of medicine, ed 4. New York: D'Appleton and Co, 1901:1082.
3. Osler W. The principles and practice of medicine, ed 7. New York: D'Appleton and Co, 1909:166-68.
4. Karetzky M. Community-acquired pneumonia. In: Brandstetter RD, Karetzky M, Cunha BA, editors. The Pneumonias. New York: Springer-Verlag; 1993. pp.25-48.
5. Regional situation on health statistics reporting. Health Situation in the South-East Asia Region 1994-1997. NewDelhi: EHI/WHO-SEARO. September 2007.3.
6. Garibaldi RA. Epidemiology of community acquired respiratory tract infections in adults: incidence, etiology andimpact. Am J Med. 1985;78:32-7.
7. Morgan AJ, Glossop AJ. Severe community-acquired pneumonia. Bja Education. 2016 May 31;16(5):167-72.
8. Pereira JM, Paiva JA, Rello J. Assessing severity of patients with community-acquired pneumonia. Seminars in Respiratory and Critical Care Medicine 2012;33(3):272-83.
9. Mandell LA. Severe community-acquired pneumonia (CAP) and the Infectious Diseases Society of America/American Thoracic Society CAP guidelines prediction rule: validated or not. CID. 2009;48:386-88. DOI: 10.1086/596308.
10. Special Issue on Community-Acquired Pneumonia. Importance of Severity Assessment: Community-Acquired Pneumonia. Journal of the Association of Physicians of India. 2013,61:14-19.
11. Lim WS, Van der Eerden MM, Laing R, Boersma WG, Karalus N, Town GI, Lewis SA, Macfarlane JT. Defining community acquired pneumonia severity on presentation to hospital: An international derivation and validation study. Thorax. 2003 May 1;58(5):377-382.
12. Vidyasagar CR, Gupta U, Prabhakar K, Prasad RBN, Lakshmaiah V, Raveesha A. Comparison of validity of severity scoring systems in community acquired pneumonia. Journal of Evolution of Research in General Medicine. 2015;1(1):10- 15.
13. Babu A, Jose N, Jose J. A prospective observational study to evaluate the severity assessment scores in community-acquired pneumonia for adult patients. Indian Journal of Respiratory Care. 2017;6(2):820-823.
14. Eldaboosy SA, Halima KM, Shaarawy AT, Kanany HM, Elgamal EM, El-Gendi AA, Nour MO, Abuelhassan UG, Alshamery HA. Comparison between CURB-65, PSI, and SIPF scores as predictors of ICU admission and mortality in community-acquired pneumonia. The Egyptian Journal of Critical Care Medicine. 2015 Aug 1;3(2-3):37-44.
15. Chalmers JD, Singanayagam A, Hill AT. Predicting the need for mechanical ventilation and/or inotropic support for young adults admitted to the hospital with community-acquired pneumonia. Clinical infectious diseases. 2008 Dec 15;47(12):1571-1574.
16. Charles PG, Wolfe R, Whitby M, Fine MJ, Fuller AJ, Stirling R, Wright AA, Ramirez JA, Christiansen KJ, Waterer GW, Pierce RJ. SMART-COP: a tool for predicting the need for intensive respiratory or vasopressor support in community-acquired pneumonia. Clinical infectious diseases. 2008 Aug 1;47(3):375-384.
17. Marti C, Garin N, Grosgurin O, Poncet A, Combescure C, Carballo S, Perrier A. Prediction of severe community-acquired pneumonia: a systematic review and meta-analysis. Critical care. 2012 Aug;16(4):R141:1-12. doi:10.1186/cc11447.
18. Spindler C, Örtqvist Å. Prognostic score systems for evaluation of severity in community-acquired bacteraemic pneumococcal pneumonia: utility of the Pneumonia Severity Index (PSI), CURB-65, and modified ATS rules. European Respiratory Journal. 2006 May 31:28:816-823.
19. Singanayagam A, Chalmers JD, Hill AT. Severity assessment in community-acquired pneumonia: a review. QJM: An International Journal of Medicine. 2009 Mar 18;102(6):379-88.