Predictive Value of Different Severity Scoring Systems in Patients with Community Acquired Pneumonia

Abstract

Background: For patients with community-acquired pneumonia (CAP), determining the severity and location of care is essential for ensuring their safety and apportion of resources appropriately. Severity scores can help clinicians fortell the outcome of patients having CAP.

This study aimed to compare different scoring systems of CAP in predicting mortality, Intensive Care Unit (ICU) admission, mechanical ventilation, and need for vasopressors. **Methods:** This was a prospective cohort study carried out at Benha University Hospitals from March 2022 to March 2023 on 60 patients aging above 18 years (58 ±16) presented by CAP. Scores for assessment were pneumonia severity index (PSI), CURB-65, CORB, CRSI-65, SCAP, and SMART COP scoring systems. **Results**: Higher severity scores were associated with increased mortality, ICU admission and Intensive Respiratory & Vasopressor Support (IRVS). SMART COP was best score with AUC 0.750 (95% CI: 0.577-0.923) for ICU admission prediction (cutoff >2, sensitivity 83.3%, P=0.008). SCAP score was the best score with AUC 0.710 (95% CI: 0.579-0.820) for mortality prediction. CORB score (AUC 0.674, cutoff >1, sensitivity 80.00%, P=0.015) and SCAP score (AUC 0.711, cutoff >21, sensitivity 80.00%, P=0.002) were most sensitive in predicted vasopressor use. PSI score was the most sensitive AUC 0.727 (95% CI: 0.597-0.834) for MV use (cutoff >115, sensitivity 94.10%, P=0.001). **Conclusion:** Severity scoring systems, including PSI, CURB-65, CORB, CRSI 65, SCAP, and SMART COP, are valuable tools for predicting the severity, mortality, ICU admission, and the need for mechanical ventilation and vasopressors in patients with CAP. SCAP score was the most valuable.

Keywords: Severity Scoring Systems; Community Acquired Pneumonia.intensive care unit.outcome

Introduction

Severe community-acquired pneumonia (CAP) has been defined as those cases that require admission to the ICU. Direct admission to the ICU is required for patients with septic shock or acute respiratory failure requiring invasive mechanical ventilation, which are defined as major severity criteria [1].

Today, severe community acquired pneumonia is considered as a separate clinical entity with specific epidemiological characteristics, different distribution of etiological agents, increased risk of complications such as acute respiratory distress syndrome (ARDS) and septic shock, as well as high mortality rate [2].

During recent decades, the patients' number requiring ICU admission due to severe community-acquired pneumonia has increased globally, especially among the elderly patients with comorbidities and the immunocompromised. According to a major population-based surveillance study of CAP patients who were hospitalized, 21% of patients required admission to an intensive care unit (ICU), and 26% of them required mechanical breathing. Since delays in admission to the intensive care unit have been linked to higher mortality, severe pneumonia hospital mortality is still substantial, ranging from 25% to more than 50% [3].

Management strategies can be appropriately tailored to include hospital admission, the involvement of a skilled clinician in their care, early consideration of intensive care unit (ICU) management, and using broad spectrum empirical antibiotics for

patients who are determined to have "severe pneumonia" [4]. Physicians have been encouraged to use severity scores as helpful tools to predict patient outcomes when they appear with CAP [5].

These scores were:

1- PSI score

On the basis of 20 variables that are frequently available at presentation, it divides pneumonia patients into 5 classes with a higher risk of short-term mortality. Patients in risk classes I through III are considered to be at "low risk," whereas those in risk classes IV and V are considered to be at "high risk." [6].

2- CURB-65 scoring system

It includes confusion, urea >30 mg/dL (7 mmol/L), respiratory rate 30 breaths per minute, blood pressure≤ 90/60 mmHg, Age ≥ 65 years; each characteristic was given 1 point; a severe score was regarded as a score 3. [7].

3-CORB score

New beginning or aggravation of an existing condition of confusion, 90% or less oxygen saturation (on any FiO2), breathing more than 30 times per minute Systolic blood pressure below 90 mmHg or diastolic blood pressure below 60 mmHg, with 1 point assigned for each parameter. A severe score was classified as a score ≥2. [5].

4-CRSI 65

The score includes Confusion, a respiratory rate of greater than 30 breaths per minute, a shock index ≥1 (systolic pressure multiplied by heart rate), a patient who is older than 65, with 1 point assigned for each parameter. A score of two or more suggest serious pneumonia[8].

5- SCAP (severe community-acquired pneumonia score)

P = arterial pH (13 points), S = systolic pressure (11 points), C = confusion (5 points), U = BUN (5 points), R = respiratory rate (9 points), X = x-ray (5 points), O = Pao2 (6 points), and Age > 80 years (5 points).These are the points attributed to each variable of the SCAP score. The eight scoring factors were divided into major and minor criteria based on the number of points allocated to each. Patients are classified as having severe SCAP if they meet either one major criterion or two minor criteria. [9].

6- SMART-COP score

It includes systolic blood pressure < 90 mmHg: 2, Multilobar CXR involvement :1, Albumin level < 35 g/L :1, Respiratory rate increased : 1, ≤50 years …≥25 breaths/min, ≤60 years …≥30 breaths/min, Tachycardia 125 beats/min:1, Confusion of new onset : 1, Oxygen Saturation low: 2 , ≤50 years , oxygen saturation ≤93% ≤60 years … oxygen saturation ≤90%, PH < 7.35 :2, score ≥5 is considered severe [10].

The aim of this work was to compare different scoring systems of CAP in predicting mortality, ICU admission, mechanical ventilation, and need for vasopressors.

Patients and methods

This was a prospective study on all CAP patients who visited Benha University Hospital's emergency room, chest, internal medicine ward, and general and chest critical care unit between March 2022 and March 2023.

Before participating, each Patient or relative's informed consent was obtained. After receiving approval from the Benha, Faculty of Medicine's Research Ethics Committee, the study was carried out.

The following were the exclusion criteria: age below 18, history of home nursing or hospitalization lasting more than 24 hours in the previous 90 days, receipt of chemotherapy and/or radiotherapy in the previous 30 days, active tuberculosis, bronchiectasis, HIV infection, COVID-19 infection, and regular hemodialysis.

For all patients full history taking, complete physical examination (General& Local), radiology (Chest x-ray, CT Chest if needed).The demographic information, comorbidities, clinical observations, and lab tests were documented. Indicators of severity were computed within the first 24 hours after admission. Patients received treatment in accordance with the national CAP guidelines .

Statistical analysis

Data management and statistical analysis were done using SPSS version 28 (IBM, Armonk, New York, United States). Initially, quantitative data were assessed for normality using the Kolmogorov-Smirnov test, Shapiro-Wilk test, and direct data visualization methods. According to normality, quantitative data were summarized as means and standard deviations or medians and ranges. Categorical data were summarized as numbers and percentages. Quantitative data were compared using the independent t-test or Mann-Whitney U test for normally and non-normally distributed quantitative variables. Categorical data were compared using the Chi-square or Fisher's exact test. ROC analyses were done. Areas under the curve (AUC) with 95% confidence intervals, best cutoff points, and diagnostic indices were calculated. All statistical tests were two-sided. P values less than 0.05 were considered significant [11]

Results

This was a prospective study conducted on 60 patients presented by CAP.

Table 1: General, clinical, and laboratory findings according to the site of care and Mortality

The mean age of the studied patients was 58 ±16 years. Males predominated in this study (61.7%).Over one-third were smokers (41.5%), while only 5% were ex-smokers. Co-morbidities included diabetes (25%), hypertension (40%), cardiac affection (21.7%), neurological affection (18.3%), and renal disease (15%). ICU patients showed significantly higher cardiac affection (27.1%) compared to ward patients (0%) (P = 0.042).They also demonstrated a significantly higher confusion rate (41.7% vs. 8.3%, P = 0.03) and lower AMT scores (median = 9 vs. 10, P = 0.041). **(Table 1)**

Table 2: Site of care and severity scores.

Regarding site of care of the studied group (n 60);12(20%) patients were admitted to the ward while 48 (80%) patients were admitted to ICU. ICU patients demonstrated significantly higher severity scores compared to ward treated patients.**(Table 2, figure 1)**

Table 3: Mortality and severity scores.

Regarding mortality of the studied patients; 18(30%) patients died while 42(70%) patients survived.The non-survivors demonstrated significantly higher severity scores than the survivors. **(Table 3,figure 2)**

Table 4:Vasopressor use and severity scores.

Regarding the vasopressor use in the studied patients; 20 (33.3%) patients had vasopressor need, while no need for vasopressor use in the other 40 (66.6%) patients.Patients who needed vasopressor demonstrated significantly higher severity scores**.(Table 4, figure 3)**

Table 5: Mechanical ventilation and severity scores.

Patients who needed mechanical ventilation demonstrated significantly higher percentages of severity scores. **(Table 5, figure 4)**

Table 6: ROC analysis of studied scores

SMART-COP score was the most sensitive in predicting ICU admission with a sensitivity of 83.3% and specificity of 66.7%, while the most specific was CURB-65

score with a sensitivity of 60.4% and specificity of 91.7%. SCAP score was the most sensitive in predicting mortality with a sensitivity of 77.80% and specificity of 61.90%.while SMART-COP score was the most specific with a sensitivity of 33.30% and specificity of 97.60%.As regard vasopressor use, SCAP score was the most sensitive in predicting its use with a sensitivity and specificity were 80.00% and 62.50%.Regarding prediction of MV, PSI was the most sensitive score with a sensitivity of 94.10% and a specificity of 41.90% , SMART-COP score was the most specific with a sensitivity of 69.80% and a specificity of 70.60%. **(Table 6)**

Discussion

Community acquired pneumonia remains one of the leading causes of death worldwide, thus a successful management requires an accurate assessment of disease severity [12]. The aim of this study was to evaluate the predictive value of the most commonly used severity scoring systems in patients with community acquired pneumonia.

The ICU admission was higher in the severe score group than non-severe score group with the highest percentage was for PSI; 45 (93.8%), followed by SCAP score 43 (89.6%) and the least 28 (58.3%) was for SMART COP. From the 12 patients admitted to ward 9 (75%) were severe by PSI and SCAP score , 1 (8.3%) were severe by CURB 65 and CRSI, 3 (25%) were severe by CORB and SMART COP. ICU patients demonstrated significantly higher PSI score compared to ward treated patients . This was similar to Eldaboosy et al., study where ICU admisions and scores were higher for the high risk PSI class IV and V also CURB65 score was higher in the ICU admitted group mean (2.5 vs .9) with 97% sensitivity, 45.5% specificity and AUC 0.83. [13]

in *Spindler et al., 2006* , study, the need for ICU treatment was remarkably higher (p,0.0001) in high-risk than in low-risk patients for all three severity scores: PSI, CURB and mATS [14]

In the current work, number of smokers was significantly higher in ward patients (75%) than in ICU patients (33.3%) (p = 0.038), while the smoking index was significantly higher in ICU patients than in ward patients (median = 93.8 vs. 60, respectively, P = 0.007. *Liapikou et al., 2016* studied the effect of smoking on CAP. Smoking increase CAP severity on admission (RR>30, and Pao2/FiO2 <250) and during hospitalization in the form of more ICU admission (p = 0,028), MV and longer hospital stay(12 days vs. 10, p = 0,05) During hospitalization, smokers were more often treated with corticosteroids (p <0,001).[15]

ICU patients showed significantly higher cardiac affection (27.1%) compared to ward patients (0%) (P = 0.042). *Mortensen et al.2002* declared that nearly 50% of deaths in cases with CAP was due to aggravation of a pre-existing condition. [16]

In the current study, ICU patients demonstrated a significantly higher confusion rate (41.7% vs. 8.3%, P = 0.03) and lower AMT scores (median = 9 vs. 10, P = 0.041). also, the non-survivors showed a significantly higher confusion rate than survivors (66.7% vs. 21.4%, respectively, P < 0.001) and a lower AMT score (median = 4 vs. 10, P = 0.002). Mental status whether new or altered at hospital admission, independently predicts death. [6].

Regarding prediction of ICU admission in the current study, the most sensitive score was SMART COP (83.3%) with an AUC of 0.750 (0.577 - 0.923) and best cut off >2. This was

followed by the PSI (81.2%) best cut off > 115, with an AUC of 0.825 (0.671 - 0.978). SCAP showed an AUC of 0.747 (0.580 – 0.913). The least sensitive score was CURB-65 (60.4%) which showed an AUC of 0.767 (0.620 - 0.915)**.**This was in concordance with Patel et al.,2021 study in that CURB-65 score might not distinguish those who need ICU admission compared to pneumonia severity index (PSI). [17] Similar to our study, Memon et al., study detected that SMART-COP score uses accesible data from patients which can identify who needs ICU admission, sensitivity was 92.3%, specificity 62.3%, and (AUC) of 0.87, leading to better resources apportion and treatment introduction. [18] In terms of specificity, CURB 65 and CRSI has specificity of 91.7% followed by PSI 83.3%, CORB and SCAP score (75%), the least specific was SMART COP (66.7%).

Regarding mortality of the studied patients; 18(30%) patients died while 42(70%) patients survived. Most of the non-survivors were lying in the severe score group with highest percentage for PSI 17 (94.4%) followed by SCAP score 16 (88.9%) and the least percentage was for CURB 65 and SMART COP 12 (66.7%). While of the survivors; 37 (88.1%) were severe by PSI , 36 (85.7%) by SCAP, and least percentage was for CURB65{ 18 (42.9%) }**.**

In spindler et al.,2006 study a significantly higher mortality (p,0.01) was noticed in high-risk compared to low-risk patients: 13 out of 53 (24.5%) Vs 0 out of 61 for PSI; 8 out of 22 (36.4%), VS 5 out of 92 (5.4%) for CURB-65; and 11 out of 27 (40.7%) Vs 2 out of 87 (2.3%) for mATS.[14]

Non survivors demonstrated significantly lower systolic blood pressure (106 ±34 vs. 126 ±37mmhg, P = 0.044), pH (7.31 ±0.11 vs. 7.39 ±0.09, P = 0.004), ESR (median = 40 vs. 93%, P = <0.001) , and length of stay (median = 11 vs. 18 days, P = 0.005**.** ***kolsuz et al., 2001*** studied the relation between acute phase reactants and severity of CAP on 100 patients and found that the disease severity was correlated with admission levels of CRP and leucocytic count , but not with ESR and fibrinogen[19].

As regard Mortality prediction in the current study, the most sensitive score was SCAP which showed an AUC of 0.710 (0.579 - 0.820), indicating good discriminative ability with a sensitivity of 77.80%, . This was followed by PSI, CORB and CRSI with a sensitivity 50%;. The least sensitive were CURB-65 showed an AUC (95% CI) of 0.693 (0.561 - 0.806) with a sensitivity of 44.40%. The p-value of 0.017 and SMART COP revealed an AUC of 0.697 (0.565 - 0.809) with a sensitivity (33.30%) . In terms of specificity, the most specific score was SMART COP (97%) then PSI (95.2%), CURB 65(92.9%), CRSI (90.5%) then CORB (88%) the lease specific was SCAP score (61.9%)**.**

on the contrary, In a 2018 study by Williams et al., of 618 patients with community-acquired pneumonia who were deemed eligible for invasive therapy, 75 (12.1%) were admitted to the intensive care unit or passed away at 30 days. The ideal sensitivity for the SMARTCOP and CURXO scores was 85% (95% confidence interval (CI) 75-92), whereas the CORB and CURB-65 scores had the maximum specificity (93% and 94%, respectively). [20] Williams et al. conducted a second analysis in which they found that the 2014 CORB, CURB65, and SMART COP have high NPVs for mortality (92%, 90%, and 90%, respectively). [21]

Patel etal. found that The CURB-65 score was equal PSI regarding

mortality prediction. specially, CURB-65 has a higher specificity (74.6) than the PSI(52.2). So he recommended that for patients with high CURB-65 score, sepsis and systemic inflammatory response syndrome should not be missed during initial Evaluation for these cases. [17].

Regarding the vasopressor use in the studied patients; 20 patients needed vasopressor, 20 (100%) were severe by SCAP, 19 of them (95%) were severe by PSI, 16 (80%) were severe by CORB, 15 (75%) were severe by CRSI 65 and SMART COP, 14 (70%) were severe by CURB 65**.**

In terms of sensitivity, the highest score in predicting vasopressor use were CORB and SCAP; The CORB score AUC of (0.674 : 0.541-0.790), a score greater than 1 was the best cutoff point, which provided a sensitivity of 80.00%. The P-value was statistically significant (P = 0.015)**.** SCAP score AUC of 0.711 (0.580-0.821). The optimal cutoff value was > 21, at which sensitivity 80.00%, The P-value was statistically significant (P = 0.002)**.** The SMART COP score showed good predictive performance for vasopressor use with an AUC of 0.750 (0.621-0.853). A score greater than 5 was the best cutoff point, which provided a sensitivity of 70.00% (P <0.001). the least sensitive scores were PSI, CURB65 and CRSI 65 with sensitivity 40%.

In terms of specificity; the most specific of the scores was PSI; 95%, this was followed by CURB65; 92.50%, the least specific was CORB 47.5 % **.**

These results were consistent with a study on 1,811 subjects ,15.1 (273) deceased in hospital, 8.78 needed IMV(159) and 9.77(177) required vasopressor support. CORB had an AUC of 0,660 (95 CI 0,623- 0,697) for in-hospital mortality; an AUC of 0,657(95 CI 0,621- 0,692) for 30- day mortality; an AUC of 0,637(CI 95 0,589- 0,685) for IMV requirememnt ; and an AUC of 0,635(95 CI 0,589-0,681) for vasopressor support. CORB performance is better when the SpO2/ FiO2 rate< 300 is used as oxygenation standard in predicting the demand for IMV and vasopressor support. CURB-65 score confers an in- hospital mortality AUC of 0,727(95 CI 0,695-0,759) and 30- day mortality AUC of 0,726(95 CI 0,695- 0,756). CURB-65 score is superior in the vaticination of mortality. [22]

CORB score was proposed by Buising et al in 2007, it did not bear the use of invasive measures in its construction, it comprisess consciousness level, oxygen saturation by pulse oximetry, respiratory rate, and blood pressure, reaching a sensitivity of 72.2 and a specificity of 70.1 for a compound outcome of mortality and demand for invasive mechanical ventilation(IMV) and vasopressor support. [23] .

Chen, 2021 in his prospective study at 6 Australian hospitals over 28- months which involved 865 CAP cases , with a mean patient age of 65.1 years. The SMART-COP score was evolved to detect patients who need ICU admission based on risk for IRVS. ICU admission rate was 13.4 , IRVS rate was 10.3, and 30-day mortality rate was 5.7. The SMART-COP score had 92.3 sensitivity and 62.3 specificity (AUC = 0.87) for prognosticating the need for IRVS, relative to 73.6 sensitivity for PSI classes IV and V, and 38.5 sensitivity for CURB-65 group 3 patients.[24]

Regarding mechanical ventilation in the current study 17 patients needed MV while 43 did not need MV, patients with severe score were mo``re in the mechanically ventilated than non MV group ; CURB 65 (76.5% vs. 39.5%, P = 0.01), CORB (88.2% vs. 51.2%, P = 0.008),

CRSI 65 (82.4 vs. 48.8, P = 0.018). Additionally, they showed higher percentages of severe SCAP (100% vs. 81.4%) and severe SMART COP (70.6% vs. 44.2%) but with borderline significance (P = 0.056 and 0.065, respectively). No significant difference was observed regarding severe PSI (P = 0.170)**.**

Patients who needed mechanical ventilation demonstrated significantly high PSI score (median = 146 vs. 121, P = 0.006), CURB 56 (median = 3 vs. 2, P = 0.01), CRSI 65 (median = 2 vs. 1, P = 0.033), SCAP (median = 27 vs. 19, P = 0.001), and SMART COP (median = 6 vs. 4, P = 0.004). Although patients who needed and those who did not need mechanical ventilation had the same median CORB, the score range was higher in those who needed mechanical ventilation (1 – 4 vs. 0 – 3) (P = 0.001)**.**

In ***Diwakar et al., 2013*** study, 33 patients required MV among them 17 (58.6%) were in PSI class IV and 12(85.7%) in PSI class V with a significant p value. PSI class>III has sensitivity of 87.88% and specificity of 48.15 % in predicting ventilation with a significant p value. Among those patients who needed mechanical ventilation 13 (44.8%) had CURB65 score I and 12 (60.9%) had CURB65 score 2. CURB65 >2 has sensitivity of 60.61% and specificity of 66.67% with a significant p value. PSI >III has better sensitivity in predicting need for ventilator [25].

The most sensitive predictor for MV use in the current study was the PSI score with an AUC of 0.727 (0.597-0.834). A score greater than 115 was considered the best cutoff point, which provides a sensitivity of 94.10% (P = 0.001) this was followed by CORB and SCAP scores with sensitivity (88.20%) AUC was 0.762 (0.634-0.862). A CORB score greater than 1 is considered the best cutoff point. (P = 0.004), for SCAP AUC was 0.763 (0.636-0.864). The best cutoff was > 20 (P < 0.001). The least sensitive score was SMART COP with an AUC of 0.737 (0.608-0.843). A score greater than 5 was considered the best cutoff point which provided a sensitivity of 70.60% (P < 0.001). In terms of specificity; the most specific score was SMART COP (69.8%) and the least specific was PSI (41.9%) **.**

There are several other scores that were assessed by several studies for prediction of severity of CAP; The CRB-65 score can safely decide patients with (CAP) who can be treated as outpatients. it does not require blood urea [26]. Rider and Frazee evaluated SAPS II (Simplified Acute Physiology Score), SOFA (Sequential Organ Failure Assessment Score) and MPM (Mortality Prediction Model) for CAP severity and found a good discriminative ability [27]. Systolic blood pressure, respiration rate, heart rate, fever, degree of awareness, and Sao2 level are all components of the National Early Warning Score (NEWS), which is a relatively new score. NEWS-lactate (NEWS-L) is an alternative scoring system that assess both the NEWS score and the lactate level . [25].

Conclusion

The severity scoring systems, including PSI, CURB-65, CORB, CRSI 65, SCAP, and SMART COP, are valuable tools for predicting the severity, mortality, ICU admission, and the requirement for mechanical ventilation and vasopressors in patients with CAP. SCAP score was the most valuable. These scoring systems provide clinicians with a standardized approach to assess the severity of the disease, enabling risk stratification and informed decision-making regarding appropriate treatment and level of care required for CAP patients.

Limitation

This study had a fairly small sample size, which may limit the generalizability of the findings, the focus was on comparing severity scoring systems without considering other implicit prognostic factors, the lack of investigation into the impact of different treatment strategies on issues, potentially impacting the predictive value of the severity scores, and limited assessment of long- term outcomes, as the study only concentrated on short- term issues during the hospitalization period.

There was no source of fund from any agency or body.

Author contribution

It was equal between authors.

Conflicts of interest

There were no conflicts of interest.

References

1.Liapikou A, Ferrer M, Polverino E, Balasso V, Esperatti M, Piñer R, Mensa J, Luque N, Ewig S, Menendez R, Niederman MS. Severe community-acquired pneumonia: validation of the Infectious Diseases Society of America/American Thoracic Society guidelines to predict an intensive care unit admission. Clinical Infectious Diseases. 2009 Feb 15;48(4):377-85.

2.Garnacho-Montero J, Barrero-Garcia I, Gómez-Prieto MD, Martin-Loeches I. Severe community-acquired pneumonia: current management and future therapeutic alternatives. Expert review of anti-infective therapy. 2018 Sep 2;16(9):667-77.

3. Cillóniz C, Dominedo C, Garcia-Vidal C, Torres A. Community-acquired pneumonia as an emergency condition. Current opinion in critical care. 2018;24:531-9.

4. Lim WS, Macfarlane JT. Importance of severity of illness assessment in management of lower respiratory infections. Current opinion in infectious diseases. 2004 Apr 1;17(2):121-5.

5. Buising KL, Thursky KA, Black JF, MacGregor L, Street AC, Kennedy MP, et al. A prospective comparison of severity scores for identifying patients with severe community acquired pneumonia: reconsidering what is meant by severe pneumonia. Thorax. 2006;61:419-24.

6.Fine, M. J., Auble, T. E., Yealy, D. M., Hanusa, B. H., Weissfeld, L. A., Singer, D. E., et al.,: A prediction rule to identify low-risk patients with community-acquired pneumonia. *New England journal of medicine*, 1997, *336*(4), 243-250.

7.Lim, W. S., Van der Eerden, M. M., Laing, R., Boersma, W. G., Karalus, N., Town, G. I., et al.,: Defining community acquired pneumonia severity on presentation to hospital: an international derivation and validation study. *Thorax*, 2003,*58*(5), 377-382.

8. Myint, P. K., Musonda, P., Sankaran, P., Subramanian, D. N., Ruffell, H., Smith, A. C., et al.,: Confusion, Urea, Respiratory Rate and Shock Index or Adjusted Shock Index (CURSI or CURASI) criteria predict mortality in community-acquired pneumonia. *European Journal of Internal Medicine*, 2010,*21*(5), 429-433.

9. España, P. P., Capelastegui, A., Gorordo, I., Esteban, C., Oribe, M., Ortega, M., et al., Development and validation of a clinical prediction rule for severe

community-acquired pneumonia. *American journal of respiratory and critical care medicine*, 2006, *174*(11), 1249-1256.

10. 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):375-84.
11. Peacock, J., & Peacock, P. (2020). Oxford handbook of medical statistics(2nd ed.). Oxford university press.Published: March 2020 https://doi.org/10.1093/med/9780198743583.001.0001
12. Spasovska K, Grozdanovski K, Milenkovic Z, Bosilkovski M, Cvetanovska M, Kuzmanovski N, Kapsarov K, Atanasovska E. Evaluation of severity scoring systems in patients with severe community acquired pneumonia. Rom J Intern Med. 2021 Nov 20;59(4):394-402. doi: 10.2478/rjim-2021-0025. PMID: 34182618.
13. Eldaboosy SA, Halima KM, Shaarawy AT, Kanany HM, Elgamal EM, El-Gendi A-A, et al. 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;3:37-44.
14. Spindler C, Örtqvist Å. Prognostic score systems and community-acquired bacteraemic pneumococcal pneumonia. European Respiratory Journal. 2006 Oct 1;28(4):816-23.
15. Liapikou A, Makrodimitri S, Deskata K, Katsaras M, Triantafillidou C, Dimakou K, Dimitroulis I, Toumbis M. The impact of smoking on community acquired pneumonia course and outcomes. Eur Respir J 2016; 48: Suppl. 60, 596
16. Mortensen EM, Coley CM, Singer DE, Marrie TJ, Obrosky DS, Kapoor WN, Fine MJ. Causes of death for patients with community-acquired pneumonia: results from the Pneumonia Patient Outcomes Research Team cohort study. Archives of internal medicine. 2002 May 13;162(9):1059-64.
17. Patel S. Calculated decisions: CURB-65 score for pneumonia severity. Emergency medicine practice. 2021 Feb 1;23(Suppl 2):CD1-2.
18. Memon RA, Rashid MA, Avva S, Anirudh Chunchu V, Ijaz H, Ahmad Ganaie Z, et al. The Use of the SMART-COP Score in Predicting Severity Outcomes Among Patients With Community-Acquired Pneumonia: A Meta-Analysis. Cureus. 2022;14:e27248
19. Kolsuz. M, Ucgun. I, Metintas. M, Erginel. S, Alatas F (Eskisehir, Turkey). The relations between levels of acute phase reactants and severity of community acquired pneumonia. Eur Respir J 2001; 16: Suppl. 31, 3094
20. Williams JM, Greenslade JH, Chu KH, Brown AF, Lipman J. Utility of community-acquired pneumonia severity scores in guiding disposition from the emergency department: Intensive care or short-stay unit?. Emergency Medicine Australasia. 2018 Aug;30(4):538-46.

21.Williams E, Girdwood J, Janus E, Karunajeewa H. CORB is the best pneumonia severity score for elderly hospitalised patients with suspected pneumonia. Internal Medicine Journal. 2014 Jun;44(6):613-5.
22. Reyes LF, Bastidas AR, Quintero ET, Frías JS, Aguilar Á F, Pedreros KD, et al. Performance of the CORB (Confusion, Oxygenation, Respiratory Rate, and Blood Pressure) Scale for the Prediction of Clinical Outcomes in Pneumonia. Can Respir J. 2022;2022:4493777.
23. Buising KL, Thursky KA, Black JF, MacGregor L, Street AC, Kennedy MP, Brown GV. Identifying severe community-acquired pneumonia in the emergency department: a simple clinical prediction tool. Emergency Medicine Australasia. 2007 Oct;19(5):418-26.
24.Chen J. Calculated decisions: SMART-COP score for pneumonia severity. Emergency Medicine Practice. 2021 Feb 1;23(Suppl 2):CD3-4.
25. Diwakar TN, Ravish KS, Hussain GZ, Kulkarni A. Comparative study of Pneumonia Severity Index and CURB65 in assesing the severity of Community Acquired Pneumonia. Journal of Evolution of Medical and Dental Sciences. 2013 Feb 25;2(8):836-51.
26. Ebell MH, Walsh ME, Fahey T, Kearney M, Marchello C. Meta-analysis of calibration, discrimination, and stratum-specific likelihood ratios for the CRB-65 score. Journal of General Internal Medicine. 2019 Jul 15;34:1304-1313
27. Rider AC, Frazee BW. Community-acquired pneumonia. Emergency Medicine Clinics. 2018 Nov 1;36(4):665-83.

Table 1:		**Site of care**			**mortality**		
		Ward	**ICU**		**yes**	**No**	
		(n = 12)	**(n = 48)**	**P-value**			**P value**
Demographics							
Age (years)	**Mean ±SD**	**52 ±13**	**59 ±16**	**0.172**	**58 ±21**	**58 ±13**	**0.989**
Sex	**Males**	**9 (75)**	**28 (58.3)**	**0.288**	**13 (72.2)**	**24 (57.1)**	**0.271**
	Females	**3 (25)**	**20 (41.7)**		**5 (27.8)**	**18 (42.9)**	
Addiction	**n (%)**	**1 (8.3)**	**1 (2.1)**	**0.363**	**1 (5.6)**	**1 (2.4)**	**0.514**
Smoking							
Smoker	**n (%)**	**9 (75)**	**16 (33.3)**	**0.038***	**8 (44.4)**	**17 (40.5)**	**0.899**
Ex-smoker	**n (%)**	**0 (0)**	**3 (6.3)**		**1 (5.6)**	**2 (4.8)**	
Smoking index (pack/year)	**Median (min-max)**	**60 (22.5 - 100)**	**93.8(50 - 165)**	**0.007***	**90 (30 - 120)**	**80 (22.5 - 165)**	**0.588**
AMT score	Median (min-max)	**10 (0 - 10)**	**9 (0 - 10)**	**0.041***	**12 (66.7)**	**9 (21.4)**	**<0.001***

Confusion	n (%)	**1 (8.3)**	**20 (41.7)**	**0.03***	**4 (0 - 10)**	**10 (1 - 10)**	**0.002***
Co-morbidities							
Diabetes mellitus	**n (%)**	**4 (33.3)**	**11 (22.9)**	**0.456**	**5 (27.8)**	**10 (23.8)**	**0.745**
Hypertension	**n (%)**	**3 (25)**	**21 (43.8)**	**0.236**	**6 (33.3)**	**18 (42.9)**	**0.490**
Cardiac affection	**n (%)**	**0 (0)**	**13 (27.1)**	**0.042***	**5 (27.8)**	**8 (19)**	**0.452**
Neurological affection	**n (%)**	**0 (0)**	**11 (22.9)**	**0.067**	**n (%)**	**5 (27.8)**	**6 (14.3)**
Renal disease	**n (%)**	**1 (8.3)**	**8 (16.7)**	**0.470**	**n (%)**	**2 (11.1)**	**7 (16.7)**
Vitals							
Temperature	**Mean ±SD**	**37.8 ±1**	**38.4 ±1**	**0.057**	**38.3 ±1.2**	**38.3 ±1**	**0.799**
Systolic bl.pressure	**Mean ±SD**	**128 ±41**	**118 ±36**	**0.446**	**106 ±34**	**126 ±37**	**0.044***
Diastolic bl.pressure	**Mean ±SD**	**82 ±26**	**73 ±23**	**0.237**	**67 ±25**	**78 ±22**	**0.114**
Heart rate	**Mean ±SD**	**100 ±16**	**107 ±21**	**0.273**	**113 ±28**	**102 ±15**	**0.157**
Respiratory rate	**Mean ±SD**	**29 ±4**	**32 ±8**	**0.333**	**32 ±9**	**31 ±7**	**0.936**
Labs							
PH	**Mean ±SD**	**7.39 ±0.07**	**7.36 ±0.11**	**0.252**	**7.31 ±0.11**	**7.39 ±0.09**	**0.004***
PaO_2	**Mean ±SD**	**68 ±13**	**56 ±13**	**0.008***	**58 ±15**	**58 ±13**	**0.924**
SO_2	**Mean ±SD**	**91 ±8**	**84 ±9**	**0.021***	**83 ±11**	**86 ±9**	**0.420**
TLC	**Median (min-max)**	**13.3 (7.8 - 27.5)**	**13.4(2.9-27.2)**	**0.760**	**12.9 (2.9 – 27.2)**	**13.6 (5 – 27.5)**	**0.974**
Neutrophils	**Median (min-max)**	**10.8 (6 - 25)**	**10.5(1.8-24.2)**	**0.861**	**10.4 (1.8 – 23.3)**	**11.5 (3.2 – 25)**	**0.885**
Lymphocytes	**Median (min-max)**	**1.65 (0.7 - 2.7)**	**1.75(0.3- 3.5)**	**0.926**	**2.15 (0.4 – 3.1)**	**1.65 (0.3 – 3.5)**	**0.129**
Platelets	**Median (min-max)**	**179 (75 - 291)**	**239 (76- 658)**	**0.053**	**255 (109 – 528)**	**214 (75 – 658)**	**0.205**
CRP	**Median (min-max)**	**48 (<6 - 96)**	**48 (3 - 297)**	**0.992**	**48 (0 – 96)**	**48 (0 – 297)**	**0.093**
ESR	**Median (min-max)**	**43 (5 - 130)**	**80 (10 - 155)**	**0.289**	**40 (10 – 100)**	**93 (5 – 155)**	**<0.001***
AST	**Median (min-max)**	**33 (14 - 74)**	**43 (17 - 558)**	**0.1**	**51 (14 - 558)**	**35 (17 - 135)**	**0.053**
ALT	**Median (min-max)**	**25 (10 - 182)**	**38 (8 - 442)**	**0.056**	**50 (10 - 442)**	**32 (8 - 182)**	**0.153**
Serum albumin	**Mean ±SD**	**3.2 ±0.5**	**3.3 ±0.8**	**0.624**	**3.3 ±0.8**	**3.3 ±0.7**	**0.654**
Serum glucose	**Median (min-max)**	**168 (96 - 429)**	**163 (44 - 588)**	**0.782**	**151 (44 - 350)**	**164 (60 - 588)**	**0.513**

Serum Na	**Mean ±SD**	**139 ±3**	**138 ±5**	**0.377**	**138 ±6**	**138 ±5**	**0.748**
Urea	**Median (min-max)**	**24 (15 - 32)**	**28 (8 - 154)**	**0.505**	**23 (8 - 59)**	**27 (9 - 154)**	**0.366**
BUN	**Median (min-max)**	**66 (43 - 89)**	**79 (22 - 430)**	**0.477**	**65 (22 - 165)**	**75 (24 - 430)**	**0.379**
Hospital stay							
Length of stay (days)	**Median (min-max)**	**16 (4 - 20)**	**18 (6 - 34)**	**0.055**	**11 (4 - 30)**	**18 (10 - 34)**	**0.005***

Score		**Ward**	**ICU**	**P-value**
PSI	Median (range)	97 (55 - 189)	135 (46 - 223)	**<0.001***
CURB-65	Median (range)	2 (1 - 4)	3 (1 - 5)	**0.003***
CORB	Median (range)	0 (0 - 4)	2 (0 - 3)	**0.002***
CRSI-65	Median (range)	1 (0 - 3)	2 (0 - 4)	**0.001***
SCAP	Median (range)	10 (5 - 54)	25 (0 - 50)	**0.008***
SMART-COP	Median (range)	2 (0 - 10)	5 (0 - 10)	**0.007***

Table (2) : Site of care and severity scores.

* Significant P-value

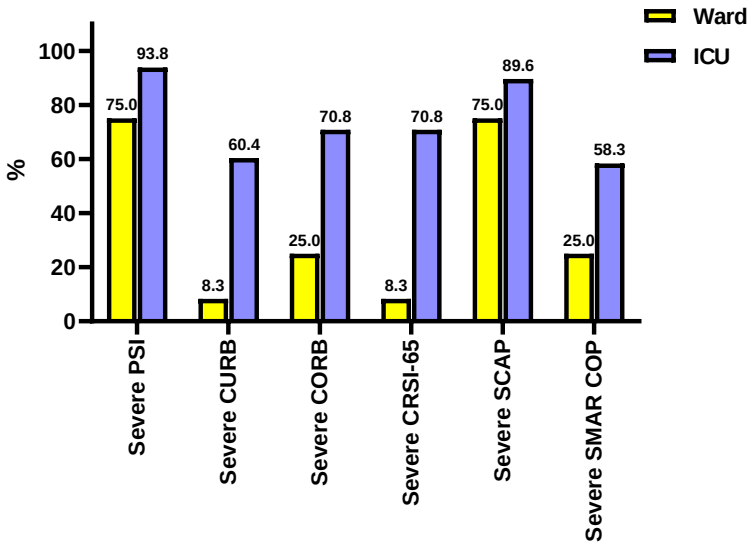

Figure (1) Site of care of the studied group in relation to severity scores

Table (3) : Mortality and severity scores.

Score		Yes (n = 18)	No (n = 42)	P-value
PSI	Median (range)	160 (81 - 223)	121 (46 - 195)	**0.004***
CURB-65	Median (range)	3 (1 - 5)	2 (1 - 5)	**0.013***
CORB	Median (range)	3 (0 - 4)	2 (0 - 3)	**0.009***
CRSI-65	Median (range)	3 (0 - 4)	2 (0 - 3)	**0.003***
SCAP	Median (range)	30 (5 - 54)	20 (0 - 36)	**0.01***
SMART-COP	Median (range)	6 (2 - 10)	4 (0 - 8)	**0.015***

* Significant P-value

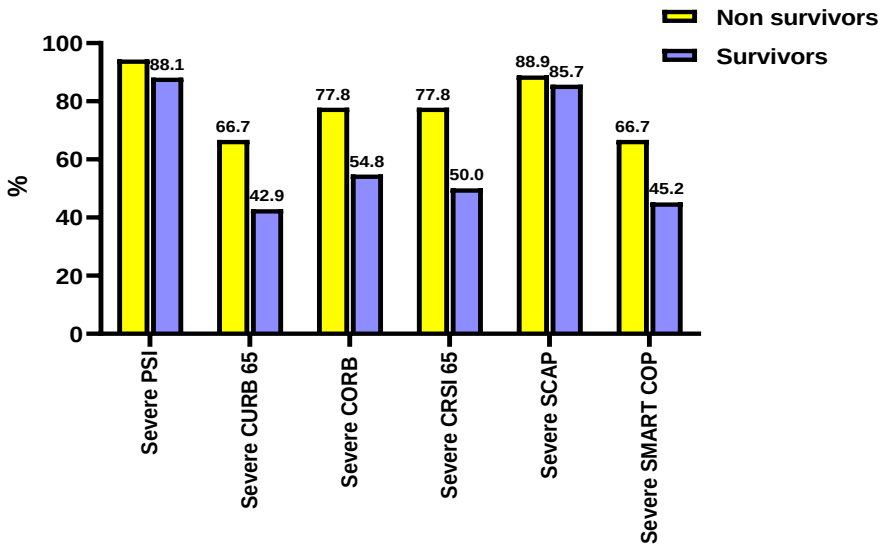

Figure (2)

patient mortality in relation to severity scores

Table (4) : Vasopressor use and severity scores.

Score		Yes (n = 20)	No (n = 40)	P-value
PSI	Median (range)	146 (81 - 223)	123 (46 - 222)	0.023
CURB-56	Median (range)	3 (1 - 5)	2 (1 - 4)	0.01
CORB	Median (range)	2 (0 - 4)	2 (0 - 3)	0.022
CRSI-65	Median (range)	2 (1 - 4)	2 (0 - 3)	0.007
SCAP	Median (range)	25 (10 - 54)	19 (0 - 49)	0.008
SMART-COP	Median (range)	6 (2 - 10)	4 (0 - 9)	0.002

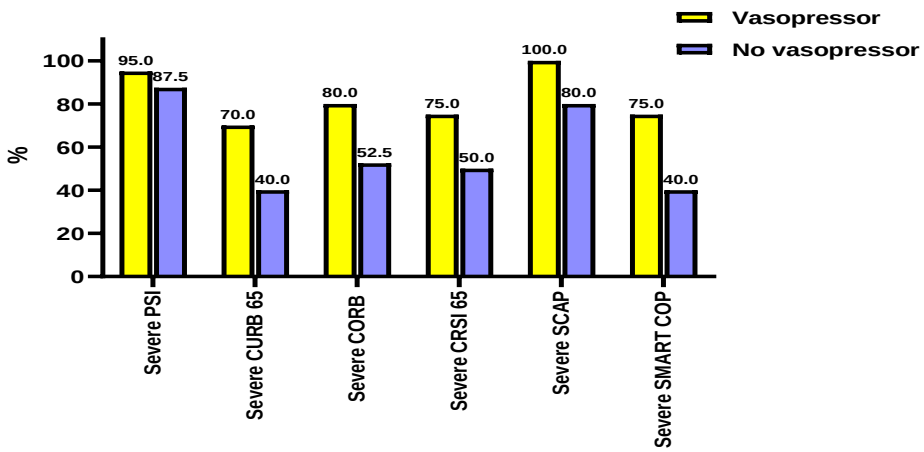

Figure (3)

vasopressor use of studied patients in relation to severity scores

Table (5) : Mechanical ventilation and severity scores.

		MV		
		Yes (n = 17)	**No (n = 43)**	**P-value**
PSI	Median (range)	146 (105 - 222)	121 (46 - 223)	0.006
CURB-65	Median (range)	3 (2 - 5)	2 (1 - 5)	0.01
CORB	Median (range)	2 (1 - 4)	2 (0 - 3)	0.001
CRSI-65	Median (range)	2 (1 - 3)	1 (0 - 4)	0.033
SCAP	Median (range)	27 (10 - 54)	19 (0 - 50)	0.001
SMART-COP	Median (range)	6 (2 - 10)	4 (0 - 8)	0.004

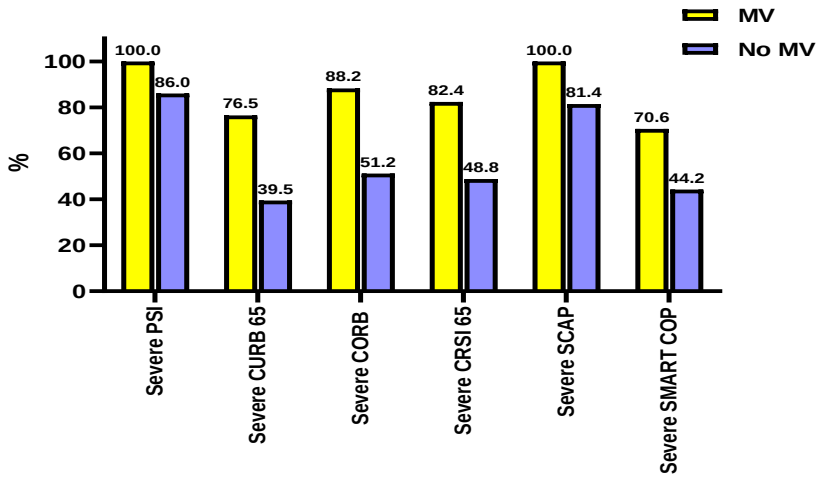

Figure (4) Severe scores according to mechanical ventilation use in the studied patients

Table (6): ROC analysis of the studied scores

ICU admission	AUC (95% CI)	Best cutoff	Sensitivity	Specificity	P-value
PSI	0.825 (0.671 - 0.978)	>115	81.2%	83.3%	**0.001***
CURB-65	0.767 (0.620 - 0.915),	>2	60.4%	91.7%	**0.004***
CORB	0.784 (0.607 - 0.960)	>1	70.8%	75%	**0.003***
CRSI 65	0.793 (0.651 - 0.936)	>1	70.8%	91.7%	**0.002***
SCAP	0.747 (0.580 - 0.913)	>14	75%	75%	**0.009***
SMART COP	0.750 (0.577 - 0.923)	>2	83.3%	66.7%	**0.008***
Mortality					
PSI	0.737 (0.607 - 0.842)	> 162	50%	95.20%	**0.002***
CURB-65	0.693 (0.561 - 0.806)	>3	44.40%	92.90%	**0.017***
CORB	0.705 (0.573 - 0.816)	>2	50%	88.10%	**0.01***
CRSI 65	0.734 (0.604 - 0.840)	>2	50%	90.50%	**0.002***
SCAP	0.710 (0.579 - 0.820)	>24	77.80%	61.90%	**0.011***
SMART COP	0.697 (0.565 - 0.809)	>7	33.30%	97.60%	**0.01***
Vasopressor use					
PSI	0.681 (0.548 - 0.795)	>163	40.00%	95.00%	**0.017***
CURB-65	0.694 (0.562 - 0.807)	>3	40.00%	92.50%	**0.014***
CORB	0.674 (0.541 - 0.790)	>1	80.00%	47.50%	**0.015***
CRSI 65	0.706 (0.575 - 0.817)	>2	40.00%	87.50%	**0.003***
SCAP	0.711 (0.580 - 0.821)	>21	80.00%	62.50%	**0.002***
SMART COP	0.750 (0.621 - 0.853)	>5	70.00%	72.50%	**<0.001***
Mechanical Ventilation					

PSI	0.727 (0.597 - 0.834)	>115	94.10%	41.90%	**0.001***
CURB-65	0.703 (0.571 - 0.814)	>2	76.50%	60.50%	**0.004***
CORB	0.762 (0.634 - 0.862)	>1	88.20%	48.80%	**<0.001***
CRSI 65	0.670 (0.537 - 0.786)	>1	82.40%	51.50%	**0.016***
SCAP	0.763 (0.636 - 0.864)	>20	88.20%	58.10%	**<0.001***
SMART COP	0.737 (0.608 - 0.843)	>5	70.60%	69.80%	**0.001***