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Relationship Of The Procalcitonin Level on Admission With CURB-65 and SMART-COP Scores In Hospitalized Patients With Pneumonia

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Abstract

Study Objectives Know the result of disease severity and clinical results in community-acquired pneumonia (CAP) are preconditions for treatment options and management for health care resources. Various scoring systems as CURB-65 and SMART-COP have been developed to facilitate these awareness. We aimed to investigate the relationship between these two scoring systems with procalcitonin level in the diagnosis of CAP. Methods Study included hospitalized patients diagnosis CAP that had been admitted to the emergency department between 01.01.2015 - 12.31.2015. CURB-65 and SMART-COP scores were calculated. We collected measured procalcitonin levels. As described previously during the study, patients who had 2 and over values for CURB-65 and who had values 3 or more for SMART-COP were classified as high risk and groupings were structured according to these values. Results The study was conducted on a total of 124 cases. 72 of the cases had a CURB-65 score of 2 or more and 49 of the cases had a SMART-COP score of 3 or above. The cases' procalcitonin levels which had 2 ng/ml or above scores for CURB-65 had higher statistical significance than the cases that had 2 or less scores for CURB-65 (P: 0,004; p<0,05). The cases' procalcitonin levels that had 3 or above scores for SMART-COP had higher statistical significance than the cases which had 2 or less scores for SMART-COP (p: 0,001; p<0,05). Conclusions High procalcitonin levels were associated with the patients who had high scores in both scoring systems, and had a relationship with the severity and course of the disease.

Keywords: Curb-65, Procalcitonin, Smart-Cop Score

Introduction

Parallel to the current social circumstances, improved quality of life and advances in medicine, the mean survival has been extended and a related increase has been observed in the percentage of the elderly population, especially in developed countries[1]. Thus, diseases of the elderly population have gained additional importance. Pneumonia is one of these diseases and is more frequent in individuals of 65 years of age or over[2,3].

Community-acquired pneumonia (CAP) is observed during daily life. Its annual incidence has been reported as 0.5-1.1% in Europe[3]. CAPs are common diseases that are frequently observed in adult patients and is an important cause of mortality[4]. Presence of symptoms, physical examination findings and presence of infiltrates in pulmonary radiographs are sufficient for the diagnosis[5].

Prediction of the severity of the disease and clinical outcomes in CAP are the pre-conditions in the management of health sources and for the costs of the treatment. Therefore, the prediction rules were changed in the mortality risk prediction-based classification for patients with CAP[6]. The classification includes CURB-65 and SMART-COP as well. The British Thoracic Society has built up a classification system called CURB (confusion, uremia, respiration count and arterial blood pressure)[7]. Lim et al. have added age to this classification in 2003 and developed a new classification called CURB-65[8]. The SMART-COP scoring system was first developed and approved in non-trophic Australia. This system is still being recommended to evaluate the risk of pneumonia in the Australian National Clinics Guidelines[9].

S. pneumoniae has been known as the responsible microorganism for TGP in 9-36% of the patients[10]. In approximately 60% of the patients hospitalized due to pneumonia, bacteria are the agents for the disease[11]. Acute phase reactants and inflammatory cytokines are being used as potential indicators for the detection of the severity of the disease and diagnosis of multiple organ failure[12]. One of these indicators are procalcitonin (PCT). Serum PCT level has been demonstrated to increase with the increase in the severity of infection in bacterial infections[13]. Although the PCT levels significantly increase with bacterial infections, no increase is observed with non-bacterial factors such as collagen tissue diseases or viral infections[14]. Its use is indicated especially in elderly patients with non-significant symptoms and those who are not suitable for invasive tests due to the rapid increase observed in early infection, simple sampling, simple and rapid reporting[15].

The aim of this study was to investigate the relationship between the procalcitonin levels on admission and clinical scoring systems.

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Materials And Method

Study design and setting

This retrospective cross-sectional study was carried out on patients hospitalized due to CAP in the Internal Medicine Department among those who had presented to the emergency between 01/01/2015 and 31/12/2015. In our ED, patients admitted because of CAP are directed from triage room to yellow or red zones. Approximately 100.000 patients per year are admitted in the yellow and red zones of our ED and all these patients are examined by an emergency physician. This study was conducted after obtaining local ethic committee approval.

Selection of participants and Data collection

The patients included in the study were over 18 years of age and those who were diagnosed to have CAP via clinical and laboratory findings, and patients whose procalcitonin level was measured in the emergency unit or Internal Medicine Department prior to the treatment. Those with a recent pulmonary infiltration according to pulmonary X-rays or thoracic tomography accompanied by symptoms suggestive of acute lower respiratory tract infection were diagnosed as pneumonia. Patients hospitalized within the previous 14 days, pregnant women, patients younger than 18 years of age and those with the diagnosis of pulmonary tuberculosis, were excluded from the study.

According to these data, the CURB-65 and SMART-COP scores of the patients hospitalized were calculated. In accordance with the SMART-COP measurements, patients with a partial oxygen pressure of 70 mmHg and below 50 years of age, and those with a partial oxygen pressure of 60 mmHg and over 50 years of age, were accepted as hypoxic.

Patients with a CURB-65 score of 2 or more, and those with a SMART-COP score of 3 or higher were classified as the risk group as mentioned in the literature, and the grouping was made upon this risk group[8,9]. Subsequently, the patients were grouped as those with and without risk, and compared according to their PCT values. Normal range of pracalcitonin was less than 0.05 ng/ml.

Table 1. Distribution of the CURB-65 and SMART-COP scores.

CURB-65	n	%
<2	52	41.9
≥2	72	58.1
SMART-COP		
<3	75	60.5
≥3	49	39.5

Outcome measures

Primary outcome measure was the relationship between serum procalcitonin concentration and CURB-65 and SMART-COP scores. Secondary outcome measure was the relationship between serum lactate concentration and the severity and progression of the disease.

Statistical analysis

Compliance of the parameters to the normal distribution was calculated using the Shapiro Wilks test. Descriptive statistics methods were used (mean, standard deviation, frequency) and the Mann Whitney U test was used for comparison of the qualitative data. The Chi-square test was used for the quantitative data. The Spearman's rho correlation analysis was used for analysis of the relationship between the qualitative data. The ROC analysis was used for cut-off level detection. A p value of <0,05 was accepted as statistically significant. Computer analysis was performed using SPSS version 22.0 software (SPSS, Inc., Chicago, IL, USA).

Results

A total of 124 cases were included in the study; among these, 62 were male (50%) and 62 were female (50%). The

Table 2. PCT evaluation according to the CURB-65 and the SMART-COP scores.

CURB-65	Min-Max	Mean±SD	Median	P
<2	0.02-58,92	1.98±8.48	0.14	0,004*
≥2	0.03-35.82	1.65±4.54	0.41	
SMART-COP				
<3	0.03-35.82	1.35±4.75	0.14	0,001*
≥3	0.02-58.92	2.47±8,46	0.63	

Mann Whitney U Test * p<0,05

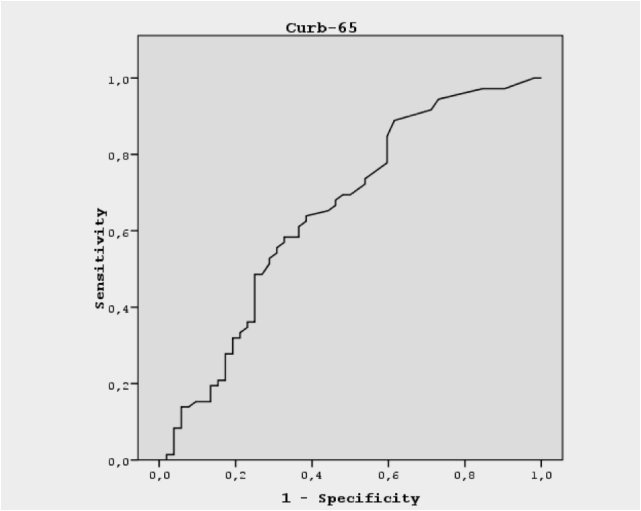

Figure 1. The ROC curve for procalcitonin according to the CURB-65 score. The area under the ROC curve was found to be statistically significantly higher than 0.5 (p<0,01) (AUC:0.651, p:0,003, p<0,05).

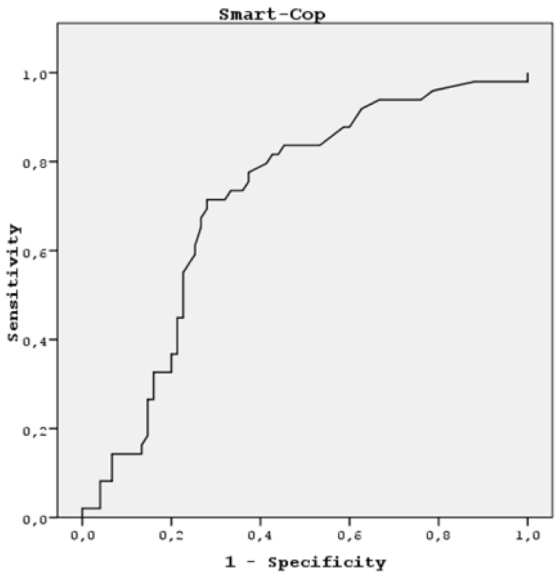

Figure 2. The ROC curve for procalcitonin according to the SMART-COP score. The area under the ROC curve was found to be statistically significantly higher than 0.5 (p<0,01) (AUC:0.713, p:0,000, p<0,05).

ages of the subjects were between 21 and 93 years old, and the mean age was 73.81±12.70. PCT on admission varied between 0.02 ng/ml and 58.92 ng/ml; the mean value was 1.79±6.46 ng/ml, and the median value was 0.26 ng/ml.

The CURB-65 scores of patients with pneumonia varied between 0 and 3, the mean value was 1.61±0.81, and the median value was 2. The SMART-COP scores mean value was 2.09±1.71, and the median value was 2 (Table 1).

CURB-65 was 2 or higher in 72 of the patients (58.1%), and the SMART-COP score was 3 or higher in 49 (39.5%) (Table 2).

The PCT levels of patients with a CURB-65 score of 2 or higher were significantly higher compared to those with a CURB-65 score lower than 2 (p:0,004; p<0,05).

The PCT levels of patients with a SMART-COP score of 3 or higher were significantly higher compared to those with a SMART-COP score lower than 3 (p:0,001; p<0,05).

The cut-off level determined for PCT according to the CURB-65 score was 0.08 ng/ml. Sensitivity and specificity at this level were found to be 88.89% (79.3-95.1) and 38.46% (25.3-53), respectively (Figure 1).

The cut-off level determined for PCT according to the SMART-COP score was 0.32 ng/ml. Sensitivity and specificity at this level were found to be 71.43% (56.7-83.4) and 72% (60.4-81.8), respectively (Figure 2).

No significant correlation was determined between CURB-65 and SMART-COP (p:0,001; p<0,05). Among patients with a CURB-65 score of 2 or higher, 52.8% had a SMART-COP score of 3 or higher (Table 3).

Table 3. Relationship between CURB-65 and the SMART-COP scores.

	CURB-65		
SMART-COP	**<2**	**≥2**	**P**
	n (%)	**n (%)**	
<3	41 (%78.8)	34 (%47.2)	0,001*
≥3	11 (%21.2)	38 (%52.8)	

Chi-square test * p<0,05

Discussion

Classification methods evaluating the severity of CAP have been developed in order to reduce the hospitalization rates due to this disease. Many studies have compared these scoring systems. Some authors have mentioned that there is no difference between the scoring systems in the evaluation of disease severity or mortality[16]. On the other hand, there are studies suggesting more and less powerful aspects of each method[17]. These findings have resulted in the belief that additional risk factors and prognostic indicators are needed to increase the prognostic performance of the present risk scores[6]. In our study, we aimed to investigate whether PCT could be used as a helper indicator to these scoring systems or not.

Among our patients, CURB-65 was 2 or higher in 58.1% and SMART-COP was 3 or higher in 39.5%. The higher number of patients at risk observed according to the CURB-65 scores was probably due to the selecting criteria in our study, which included hospitalized patients. The CURB-65 scoring system has been designed for patients to recieve therapy at home or in the hospital, whereas the SMART-COP scoring system has been designed for detection of

patients who require intensive respiratory and vasopressor support in the context of ACAPS[9].

Many cytokines and biomarkers have been studied worldwide in order to determine the severity of pneumonia. Among these, CRP and PCT had the widest investigation and approval. PCT was especially studied in order to determine the suitability of patients with pneumonia for antibiotherapy or not[18]. In the study of Viasus et al., the mortality prediction of patients with pneumonia was observed to be more significant when the pneumonia severity index (PSI) and the CURB-65 scores were combined with PCT[19]. In the study of Naderi et al., the PCT levels were determined to be higher in parients with CURB-65≥3 and SMART-COP≥3[20]. The median PCT level was observed to be higher in patients with high PSI in the study of Johansson et al.[21]. In our study, the PCT levels were found to be significantly higher in patients with CURB-65≥2 and SMART-COP≥2 (p:0.004 and p:0.001, respectively). The positive correlation of these two scoring systems with the PCT level is compatible with previous findings (p:0.001 and p:0.001, respectively).

It has been demonstrated in the study of Julian-Jimenez et al. that the rates of hospitalization and duration of hospital stay were reduced when PCT > 1 ng/ml was used as an additional score to the PSI scoring[22]. The study of Karen et al. revealed that patients with SMART-COP≥3 had high sensitivity and specificity for intensive respiratory and vasopressor support[23]. In the light of these findings, we determined a cut-off value for CURB-65 and SMART-COP in our study. The sensitivity and specificity of patients with a PCT value of 0.08 ng/ml or higher for CURB-65≥2 were 88.89% and 38.46% (AUC 0.651; p:0.003; CI: 79.3-95.1 and CI: 25.3-53, respectively), and those with a PCT value of 0.32 ng/ml or higher for SMART-COP≥3 were 71.43% and 72% (AUC 0.713; p 0.000; CI: 56.7-83.4 and CI: 60.4-81.8, respectively). However, in the meta-analysis of Liu et al., the sensitivity of the frequently used PCT value, 0.5 ng/mL, was observed to be 44%[21-66], and that this level could not be accepted as a high risk value for mortality[24]. These data suggest that, although the high PCT values observed in patients were directly related to hospitalization and prognosis, further studies are needed to determine a cut-off value including larger sample sizes.

Limitations

Our study is retrospective, the data were obtained from the information technologies department of the hospital and epicrises.

The diagnosis of hospitalization of patients is not confirmed by cultures.

Variable discharge processes due to the procedures of the units.

Conclusion

High PCT levels were related to high CURB-65 and SMART-COP scores and they were probably related to the severity and progression of the disease.

PCT may be used as an additional parameter in both scoring systems used for the hospitalization and acceptance to the intensive care unit in patients with community-acquired pneumonia.

However, we believe that the significant findings observed in our study should be supported by further studies, since we did not find any other study comparing both scoring systems in the literature.

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