Evaulation of PSI and CURB-65 scoring systems which patients were diagnosed as community-acquired pneumonia at emergency department

Acil serviste toplum kökenli pnömoni tanısı alan hastalarda PSI ve CURB-65 pnömoni skorlama sistemlerinin değerlendirilmesi

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SUMMARY

Objective: The aim of study is to determine the correlation between pneumonia severity index (PSI) and CURB-65 according to the indications for hospitalization or discharge of patients with pneumonia referred to our emergency department.

Method: This retrospective study was performed on 150 patients with pneumonia cases admitted to our emergency department between June 2013 and June 2014. Demographic properties, clinic, radiologic and laboratory findings of cases were recorded from the files. All cases were grouped according to PSI and CURB-65 respectively. The correlation of these groups with each other according to the indications for hospitalization and dischargement was examined.

Results: 47 (31.3%) female, 103 (68.7%) male 150 pneumonia cases aged 69.15±13.34 (min: 19; max: 92) years were included in the study. CURB-65 and PSI correlated in terms of hospitalization in 109 cases. CURB-65 and PSI were statistically correlated with each other *(κ=0,602, p<0,001)* .We found that, determining the probability of intensive care unit indication, PSI more significant than CURB-65 (p=0,011, p=0,045, p<0,05).

Conclusions: It is seen that currently used two pneumonia severity classifications (CURB-65, PSI) were correlated with each other according to the assessment of the indications for hospitalization. Since the scoring criteria of CURB-65 is fewer and easy to application even at the first line medical centers, of these pneumonia scoring systems it can be the first choice in the assessment of need of hospitalization indication in pneumonia.

Keywords: Community-acquired pneumonia, PSI, CURB-65, Emergency Department

ÖZET

Amaç: Bu çalışmadaki amacımız, hastanemiz acil servisine başvuran toplum kökenli pnömoni tanılı hastalarda, pnömoni ciddiyet indeksi (PSI) ve CURB-65 pnömoni skorlama sistemlerinin hastaneye yatış ya da taburculuk açısından uygunluklarının karşılaştırılmasıdır.

Yöntem: Bu retrospektif çalışmaya Haziran 2013-Haziran 2014 tarihleri arasında acil servise başvuran ve pnömoni tanısı alan 150 olgu dahil edildi. Olguların demografik özellikleri, klinik, radyolojik ve laboratuar bulguları kayıt edildi. Tüm olgular PSI ve CURB-65 skorlamasına göre gruplandırıldı ve hastaneye yatış ya da taburculuk açısından uygunlukları incelendi.

Bulgular: Çalışmaya yaş ortalamaları 69.15 ± 13.34 (min: 19; max: 92) olan 47 (%31.3) kadın, 103 (%68.7) erkek, toplam 150 olgu dahil edildi. Toplam 109 olguda CURB-65 ile PSI arasında yatarak tedavi gerekliliği açısından

uyumluluk mevcuttu (κ=0,602, p<0,001). Yoğun bakım yatış olasılığı ele alındığında, PSI, CURB-65'e göre daha anlamlı bulundu (p=0,011, p=0,045, p<0, 05).

Sonuç: Güncel pratikte kullanılmakta olan iki pnömoni ağırlık gruplamasının (CURB- 65, PSI) hastaneye yatarak tedavi endikasyonunu değerlendirmek açısından birbirleri ile korele olduğu görüldü. CURB-65, değerlendirme kriterlerinin az olması ve bunların birinci basamak merkezlerde dahi kolaylıkla uygulanabilecek kriterler olması nedeni ile pnömoni olgularında yatarak tedavi gerekliliğini değerlendirmede tercih edilecek yöntem olabilir.

Anahtar sözcükler: Toplum Kökenli Pnömoni, PSI, CURB-65, Acil Servis

INTRODUCTION

Respiratory tract infections are the most common infectious diseases, and pneumonia tends to be more serious and has a higher mortality rate. Community-acquired pneumonia (CAP) is a common infectious disease that has a high treatment cost and can be fatal. It is the 6th leading cause of death and is ranked 1st among infection-related deaths in the United Kingdom and the United States. The mean mortality rate is 1-5% in patients treated in outpatient clinics, but is 12% in patients treated in hospitals. It reaches 40% especially in patients requiring intensive care unit support. In our country, lower respiratory tract infection is the 5th leading cause of death by 4.2%[1].

Various indexes have been defined in order to minimize diagnosis and treatment difficulties and to assess the severity of pneumonia and hospitalization indications in the presence of objective criteria. The pneumonia severity index (PSI), which was developed based on the demographic, clinical and laboratory findings of patients, and the CURB-65 scoring system, which was calculated according to the physical examination and vital findings of patients, are recommended by many studies [2-5].

This study aimed to compare the correlation of pneumonia severity scoring systems (PSI, CURB-65) with each other in terms of inpatient treatment or discharge and to determine the easiest and most effective grouping system that can be used in clinical practice.

MATERIAL AND METHODS

Study design

This study included 150 cases of community-acquired pneumonia who referred to the Emergency Department, Ataturk Training and Research Hospital, Izmir Katip Çelebi University between June 30, 2013 and June 30, 2014. The records of these cases were retrospectively examined.

Study group

Patients who were older than 18 years of age, who had no history of hospitalization within the last 1 month, who were found to have infiltration compatible with pneumonia on chest X-ray at admission, and who had clinical manifestations of pneumonia (fever, cough, sputum production) were included in the study. Patients who had missing clinical data on the files (according to PSI and CURB-65 scoring criteria), who were under 18 years of age, who were diagnosed with pulmonary embolism, who had aspiration pneumonia, who had a history of hospitalization, who were diagnosed with pneumonia and were treated for pneumonia in an external center, and who underwent trauma were excluded from the study.

Data Collection

In order to group all cases included in the study according to the PSI and CURB-65, the required information were screened according to the ICD-10 classification (the International Statistical Classification of Diseases and Related Health Problems). Parameters were recorded retrospectively from patient files. Patients' age, gender, history of living in nursing homes, comorbid diseases, physical examination findings (such as conscious state, respiratory rate, systolic and diastolic blood pressure, fever, and pulse), laboratory findings (such as blood gas, BUN, sodium, glucose, and hematocrit values) and chest X-ray findings were recorded. PSI and CURB-65 scores of all cases were calculated.

When the PSI score was calculated, we used the gender, place of residence, presence of tumor, liver disease, congestive heart failure, cardiovascular and cerebrovascular disease, kidney disease, conscious state, respiratory rate, arterial blood pressure, body temperature, heart rate, blood BUN, Na, glucose, hematocrit values, pulmonary radiographic findings, presence of pleural effusion, arterial blood gas pH, partial arterial oxygen pressure (PaO2), and (SaO2) oxygen saturation measured by pulse oximetry from the information on the patient follow-up form (Table 1).

Table 1. Pneumonia severity index (PSI) parameters and scoring used in the study

Parameters			Score	
Age Male Female	YEAR YEAR-10	**Laboratory findings** BUN >30 mg/dl Na <130 Glucose >250 Hematocrit <%30		30 20 10 10
Living in a nursing home	10	**Radiological changes** Pleural fluid		10
Comorbid disease Malignancy Liver disease CHF SVD Renal disease	30 20 10 10 10 10	**Oxygenation parameters** Arterial pH <7.35 PaO2<60 mmHG SO2 <90%		30 10 10
Physical examination findings Unconsciousness Respiratory rate >30 Systolic blood pressure <90 mmhg Fever< 35, >40°C Tachycardia (>125/min)		20 20 20 15 10		

BUN: Blood Urea Nitrogen**, PaO2:** partial arterial oxygen pressure**, SaO2:** oxygen saturation
CHF: Congestive Heart Failure**; SVD:** Cerebrovascular Disease

Risk classes: Class 1: age <50 and no cancer, congestive heart failure, cardiovascular and cerebrovascular disease, liver and kidney disease**; Class II**: <70 points**; Class III:** 71-90 points**; Class IV:** 91-130 points**; Class V**:> 130 points

The conscious state, BUN level, respiratory rate, age, and arterial blood pressure were used in the calculation of CURB-65 score (Table 3). Patients with a CURB-65 score <2 were recommended to be treated in outpatient clinic, and patients with a CURB-65 score ≥ 2 were recommended to be treated in hospital[6] (Table 2).

Table 2. CURB-65 parameters and scoring used in the study

Parameters	Score
Mental Confusion	1
Blood Urea Nitrogen >20mg/dl (7mmol/l) or urea >42.8mg/minl	1
Respiratory rate ≥30/minutes	1
Systolic Blood Pressure <90mmHg or Diastolic Blood Pressure <60mmHg	1
Age ≥65	1

Risk classification: 0-1: low risk, mortality 1.5%; 2: moderate risk, mortality 9.2%; 3-5: high risk, mortality 22%.

The hospitalization or discharge decision was given by physicians who did not use both scoring systems. The hospitalization or discharge decision was determined according to these scoring systems and then was compared with the decision of the physician.

Statistical analysis

Statistical evaluation was performed after all data of the patients were collected. The SPSS 15.0 fort Windows package program was used for statistical analysis. The Pearson's chi-square and Fisher's exact tests were used to compare the categorical data between the groups. The correlation between the rate of patients requiring hospitalization according to the CURB-65 and PSI scores and the rate of patients decided to be hospitalized by the physician was evaluated by the Kappa test.

The correlation between the radiological involvement and the admission to intensive care unit was assessed by the logistic regression analysis. The correlation between the hospitalization decision of the physician and the CURB-65 and PSI scores was assessed by the ROC analysis. $P<0.05$ was considered statistically significant.

RESULTS

Of the patients, 47 (31.3%) were female and 103 (68.7%) were male. The patients were between the ages of 19 and 92, and the mean age was calculated as 69.15±13.34 years. 104 (69.3%) of 150 patients were 65 years of age or older. The comorbid diseases, complains at admission, living place, radiologic findings and final outcomes of the patients have been summarized in Table 3.

Table 3. The general characteristics of the patients

Patients	Total n	(%)
Gender		
Female	47	(31.3)
Male	103	(68.7)
Living Place		
Home	135	(90)
Nursing Homes	15	(10)
Comorbid disease		
CAD+CVD	67	(44.7)
Renal Failure	56	(37.3)
COPD	54	(36)
Heart Failure	47	(31.3)
Diabetes Mellitus	30	(20)
Liver Disease	13	(8.7)
Malignancy	33	(22)
Symptoms at admission		
Dyspnea	64	(42.7)
Cough	61	(40.7)
Sputum production	46	(30.7)
Radiologic Findings		
Lober	69	(46)
Multilober	42	(28)
Segmenter	39	(26)
Final Outcome		
Hospitalized	120	(80)
Discharge	30	(20)
Exitus	4	(2.7)

COPD: Chronic Obstructive Pulmoner Disease
CAD: Coronary artery Disease
CVD: Cerebrovasculer Disease

When the correlation between the lobar, segmental and multilobar pulmonary involvement and the admission to intensive care unit was assessed by the logistic regression analysis in terms of prognosis, there was a statistically significant relationship between the radiological involvement and the admission to intensive care unit ($p<0.05$). When lobar pulmonary involvement was considered as a reference, multilobar pulmonary involvement was statistically significantly more effective on the admission to intensive care unit (Odds Ratio=51.0 95% CI=6.46-402.75 $p<0.05$).

80% were treated in the hospital and 20% were treated in the outpatient clinic. 4 (2.7%) of the patients died. While 30 (20%) were treated in the outpatient clinic, 68 (45.3%) were treated in the clinic of chest diseases, 18 (12%) were treated in the emergency clinic, 5 (3.3%) were treated in the clinic of internal medicine, and 22 (14.7%) were treated in the intensive care unit. 7 (4.7%) were referred to other hospitals.

When the patients' CURB-65 score was examined, 40 (26.7%) were detected to be between 0-1 and 110 (73.3%) were detected to be between 2-5. According to the CURB-65, of the patients diagnosed with pneumonia admitted to the emergency clinic, 110 (73.3%) were recommended to be treated in hospital and 40 (26.7%) were recommended to be treated in outpatient clinic.

According to the PSI, 4 (2.7%) were class 2, 18 (12%) were class 3, 32 (21.3%) were class 4 and 96 (64%) were class 5. As a result of these classifications, according to the PSI, 128 (85.3%) were recommended to be treated in hospital and 22 (14.7%) were recommended to be treated in outpatient clinic.

When we compare the CURB-65 and PSI scores in terms of indications for inpatient treatment, 19 patients without any indication for inpatient treatment according to the CURB-65 required inpatient treatment according to the PSI. 1 patient with any indication for inpatient treatment according to the CURB-65 did not require inpatient treatment according to PSI. In a total of 109 cases, there was a correlation between the CURB-65 and PSI in terms of the necessity of inpatient treatment. The CURB-65 and PSI were statistically significantly compatible with each other (κ=0.602, $p<0.001$). Comparisons of the CURB-65 and PSI in terms of indications for inpatient treatment are shown in Table 4.

Table 4. The comparisons of the CURB-65 and PSI in terms of indications for inpatient treatment

		PSI				Total	
		Outpatient treatment		Inpatient treatment			
		n	(%)	n	(%)	n	(%)
CURB-65	Outpatient treatment	21	(95.5)	19	(14.8)	40	(26.7)
	Inpatient treatment	1	(4.5)	109	(85.2)	110	(73.3)
Total		**22**	**(14.7)**	**128**	**(85.3)**	**150**	**(100.0)**

When the correlation between the rate of patients requiring hospitalization according to the CURB-65 score and the rate of patients decided to be hospitalized by the physician was evaluated by the Kappa test, the kappa coefficient was calculated to be 0.667 between "the hospitalization decision of the physician" and "the hospitalization according to the CURB-65 score". The calculated coefficient was statistically significant ($p<0.05$). There was a significant correlation between the hospitalization decision of the physician and the hospitalization according to the CURB-65 score (Table 5).
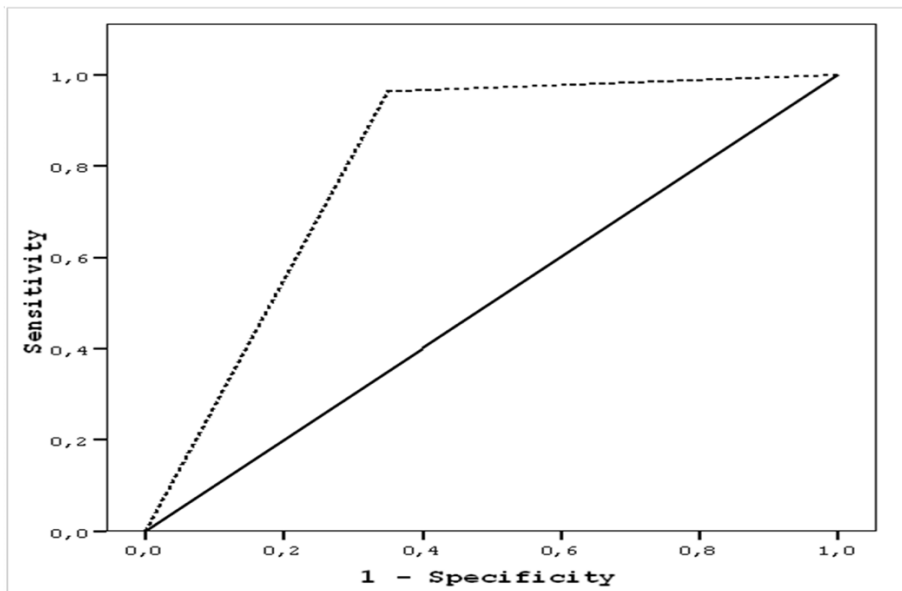
Table 5. The rate of patients requiring hospitalization according to the CURB-65 score and the rate of patients decided to be hospitalized by the physician

		CURB-65				Total		Kappa Value	p
		Inpatient treatment		Outpatient treatment					
		n	(%)	n	(%)	n	(%)		
Hospitalization decision of the physician	Yes	106	(96.4)	14	(35.0)	120	(80.0)	0.667	<0.001
	No	4	(3.6)	26	(65.0)	30	(20.0)		
Total		110	(73.3)	40	(26.7)	150	(100.0)		

The correlation between the hospitalization decision of the physician and the hospitalization according to the CURB-65 score was also evaluated by the ROC analysis. According to the result of analysis, the area under the curve (AUC) was 0.807 (95% Confidence Interval (CI): 0.713-0.901) and was statistically significant (p<0.001) (Figure 1).

Figure 1. ROC curve for the correlation between the hospitalization decision of the physician and the hospitalization according to the CURB-65 score

When the correlation between the rate of patients requiring hospitalization according to the PSI score and the rate of patients decided to be hospitalized by the physician was evaluated by the Kappa test, the kappa coefficient was calculated to be 0.630 between "the hospitalization decision of the physician" and "the hospitalization according to the PSI score". The calculated coefficient was statistically significant (p<0.05). There was a significant correlation between the hospitalization decision of the physician and the hospitalization according to the PSI score (Table 6).
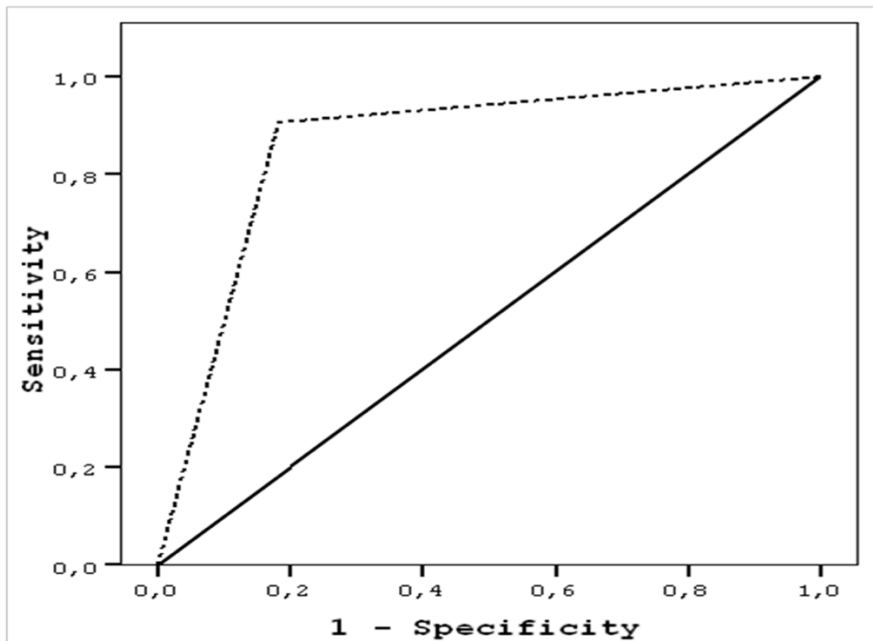
Table 6. The rate of patients requiring hospitalization according to the PSI score and rate of patients decided to be hospitalized by the physician

		PSI				Total		Kappa Value	p
		Inpatient treatment		Outpatient treatment					
		n	(%)	n	(%)	n	(%)		
Hospitalization decision of the physician	Yes	116	(90.6)	4	(18.2)	120	(80.0)	0.630	<0.001
	No	12	(9.4)	18	(81.8)	30	(20.0)		
Total		128	(85.3)	22	(14.7)	150	(100.0)		

The correlation between the hospitalization decision of the physician and the hospitalization according to the PSI score was also evaluated by the ROC analysis. According to the result of analysis, the AUC was 0.862 (95% CI: 0.764- 0.961) ve istatistiksel olarak anlamlı bulundu (p<0.001) (Figure 2).

Figure 2. ROC curve for the correlation between the hospitalization decision of the physician and the hospitalization according to the PSI score

Considering the likelihood of indication for admission to intensive care unit, there was a significant difference between the cases with and without any indication for admission to intensive care unit according to the CURB-65 and PSI scoring systems (p=0.011, p=0.045, p<0.05). The PSI was found to be more significant than the CURB-65 (Table 7).

Table 7. The rate of patients requiring hospitalization according to the CURB-65 and PSI scores and the rate of patients decided to be hospitalized by the physician

| | Hospitalization decision of the physician | Admission to Intensive Care Unit | | | | Total | | P |
| | | No | | Yes | | | | |
		n	(%)	n	(%)	n	(%)	
Indication for hospitalization according to the CURB-65 score	Inpatient treatment	89	(69.5)	21	(95.5)	110	(73.3)	*0.011*
	Outpatient treatment	39	(30.5)	1	(4.5)	40	(26.7)	
Indication for hospitalization according to the PSI score	Inpatient treatment	106	(82.8)	22	(100.0	128	(85.3)	*0.045*
	Outpatient treatment	22	(17.2)	0	0,0	22	(14.7)	
Total		**128**	**(85.3)**	**22**	**(14.7)**	**150**	**(100.0)**	

DISCUSSION

Community-acquired pneumonia is more common especially in developing countries. Its incidence is 20-30% in developing countries and 3-4% in developed countries. The incidence changes with age, markedly increases in very young and elderly people [2].

Since pulmonary elasticity and respiratory muscle tension decrease with age, functional residual capacity decreases and air trapping increases. Because mucociliary clearance and cough reflex and its effectiveness are reduced, it is difficult to remove microorganisms from the airways. Bacterial colonization is more common in the respiratory tract of elderly people [7]. Pneumonia is more common in elderly people and those with comorbidities than in young people, and more than 90% of them require hospitalization [8, 9].

In a study involving 1068 patients, 58% of cases were reported to be 65 years of age or older [10]. Of the patients included in our study, 69.3% were 65 years of age or older, and the mean age was 69.15 years.

Of the patients included in our study, 68.7% were male and 31.3% were female. The majority of the patients being male can be explained by cigarette use or history of smoking more common in male patients. This can be explained by the fact that cigarette smoking can lead to comorbid diseases such as COPD and cardiovascular diseases for a long time and causes the changes in the oropharyngeal flora [11].

The most common complaints in our patients were dyspnea, fatigue, and cough. In a study of Metlay et al. involving 1812 patients with CAP, it was reported that fatigue was 91%, cough was 86%, and high fever was 84% [12].

In studies conducted in the literature, pneumonia is more common and may be more severe in people over 65 years of age who have comorbid diseases such as COPD, DM, CAD, chronic neurological disorders, liver diseases, and malignancy [13]. In our study, pneumonia was more frequent in patients with one or more comorbid diseases in accordance with the literature. In a study of Luna et al., they found that the most common comorbid diseases were, respectively, respiratory diseases (28%) and CAD (27%) and to a lesser extent DM [13]. In a study of Bircan et al. from our country, the comorbid diseases were detected in 41 (44.1%) cases including COPD (23.7%), DM (17.2%), and CHF (15.1%) [14]. In a study of Fukuyama et al., they showed that the most common comorbid diseases were, respectively, chronic respiratory diseases (39.6%), heart diseases (25%) and cerebrovascular diseases (23.8%) [15].

In a study of Ozol et al. conducted on cases of community-acquired pneumonia, the extension of lesions in the radiological evaluation of the cases was found to be related to poor prognosis. Multilobar involvement, which was detected in 19 (81%) cases, and pleural effusion, which was found

in 17 (35%) cases, were evaluated as mortality-related parameters [4]. In a study of Fidan et al., they reported that bilateral involvement was associated with increased mortality rate but was not an independent risk factor [5].

In our study, the relationship between the extension of lesions in the radiological evaluation and the mortality could not be evaluated because of the low number of mortal cases.

The CURB-65 score was defined to distinguish patients at high risk of mortality and can be easily applied even in primary healthcare centers. This score is significantly easier to remember and use than the PSI score. Although the CURB-65 criteria are quite helpful in avoiding unnecessary hospitalizations in low-risk patients, another important task of these criteria may be to identify high-risk patients who will benefit from hospitalization [16].

Hospitalization is required in 20-40% of cases with CAP, and 5-10% of these are hospitalized in intensive care units. While the mortality rate is low (1%) in patients treated in outpatient clinics due to CAP, it can reach 30% in hospitalized patients [17].

In our study involving patients diagnosed with CAP, in accordance with the literature, 14.7% were followed up in the intensive care unit while 65.3% were followed up in some clinics. In a study of Buising et al., 77.8% were hospitalized in some clinics while 4.3% were hospitalized in the intensive care unit [18].

In a study of Cömert et al., it was determined that 60.4% did not require inpatient treatment when cases of CAP were grouped according to the CURB-65 and that 41.7% did not require inpatient treatment when cases of CAP were grouped according to the PSI. It was seen that these cases could be treated in outpatient clinics[19].

In our study, among pneumonia cases admitted to the emergency department, it was determined that 26.7% did not require inpatient treatment when cases of CAP were grouped according to the CURB-65 and that 14.7% did not require inpatient treatment when cases of CAP were grouped according to the PSI. It was seen that these cases could be treated in outpatient clinics. Dean et al. also reported a 50% reduction in admission to the hospital with adherence to the guide [20].

In a retrospective study of Arnold et al. involving 3087 patients, the PSI and CURB-65 were investigated in predicting the mortality, the length of hospital stay, and the duration of clinical stability. As a result of the study, it was found that the PSI was superior to the CURB-65 in predicting the mortality and the length of hospital stay, but both of them were correlated with each other. They also reported that both of them had moderate predictive power and were correlated with each other in predicting the duration of clinical stability[21]. Saldias et al. found that as the PSI and CURB-65 scores increased, the length of hospital stay increased and that the PSI and CURB-65 scores predicted complication development and 30-day mortality [22].

In our study, the PSI and CURB-65 were found to be correlated with each other. Many studies have shown that the CURB-65 score is comparable to the PSI score in predicting pneumonia-related death rates in patients treated inpatiently and outpatiently [23, 24]. The validity of the PSI has been strongly confirmed in many studies. It allows for securely distinguishing patients with a mortality risk of up to 3% (PSI class I-III) from patients with a mortality risk of 8% (PSI class IV) and patients with a mortality risk of 35% (PSI class V) [25].

In a meta-analysis of 40 studies between 1980 and 2009, Chalmers et al. reported that there was no significant difference between PSI and CURB-65 scores in determining prognosis in CAP [26]. In another study, there was a correlation between PSI and CURB-65 scores in terms of mortality and admission to hospital and intensive care unit. In a prospective study performed in 3181 patients with CAP by Aujesky et al., they reported that the PSI, which is more complex, was slightly superior to the CURB-65 in predicting short-term mortality of most patients in the low-risk group and in identifying low-risk patients. They showed that these two scores were correlated with each other [27].

In a study of Shah et al. evaluating the validity of the PSI and CURB-65 scoring systems in cases of CAP in India, the PSI and CURB-65 were found to be equally sensitive in detecting the likelihood of death, but the specificity of the CURB-65 was higher than that of the PSI [2].

The first decision to be made for community-acquired pneumonia cases is whether the patient has to be hospitalized. This is a decision to be given clinically by the physician. Many treatment guidelines updated in recent years have suggested the PSI and CURB-65. The hospitalization decision should not just be based on scoring. In addition, the physician can hospitalize his/her patient by taking into account the patient's clinical condition and social indications. For example, patients who are homeless, who are addicted to drugs, who have psychiatric disorders, who have physical and mental disabilities, who live alone,

who have no care support, who have poor oral intake or transportation difficulties, who have uncontrolled comorbid disease, and who are unresponsive to previous treatment must be hospitalized even if hospitalization is not required according to the PSI and CURB-65 scoring systems [28].

Limitations of the study

The low number of patients and the low mortality rate in existing patients have prevented the comparison of these scoring systems in terms of mortality. There is a need for larger prospective multi-center studies.

RESULT

It has been observed that two pneumonia scoring systems, which are used in the current practice, were correlated with each other in terms of evaluating indications for inpatient treatment.

Despite the fact that the PSI is a scoring system that is more detailed and is hard to keep in mind, it was more effective in determining the likelihood of admission to intensive care unit in our study. Among these grouping systems, the CURB-65 may be the preferred method to assess the necessity of inpatient treatment in pneumonia cases because it has few evaluation criteria and these criteria can be easily applied even in primary healthcare centers.

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