Mortality prediction in community-acquired pneumonia requiring mechanical ventilation; values of pneumonia and intensive care unit severity scores

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ÖZET

Mekanik ventilasyon ihtiyacı olan toplum kökenli pnömoni hastalarının mortalite tahmininde pnömoni ve yoğun bakım skorlarının değeri

Ağır toplum kökenli pnömoni (TKP), yoğun bakım ünitesi (YBÜ) yatışlarının önemli bir nedenini oluşturur. YBÜ'ye yatış gerekliliğinin ve mortalite riskinin belirlenmesi amacıyla pek çok skorlama sistemi geliştirilmiştir. Ama bu skorlama sistemlerinin yararı ve doğruluğu konusunda tartışmalar halen devam etmektedir. Öte yandan bu skorlar mekanik ventilasyon ihtiyacı olan hastalarda YBÜ mortalitesini tahmin etme açısından değerlendirilmemiştir. Bunun için çeşitli YBÜ skorlama sistemleri kullanılmaktadır. Bu çalışmanın amacı; mekanik ventilasyon ihtiyacı olan ağır TKP'li hastalarda pnömoni ve YBÜ skorlama sistemlerinin etkinliğini karşılaştırmaktır. Retrospektif gözlemsel kohort çalışmasıdır. Mekanik ventilasyon uygulanan TKP'li hastaların dosyaları ve kayıtları değerlendirilmiş; demografik, laboratuvar ve klinik özellikleri kaydedilmiştir. Pnömoni skorlama sistemleri [modifiye "American Thoracic Society (ATS)" kriterleri, CURB-65, pneumonia severity index (PSI)] ve YBÜ skorlama sistemleri [Acute Physiology Assessment and Chronic Health Evaluation (APACHE) II, Sequential Organ Failure Assessment (SOFA)] mortalite tahmini açısından karşılaştırılmıştır. Yaş ortalamaları 68 ± 16 yıl olan 38'i kadın, 63'ü erkek toplam 101 TKP'li hasta çalışmaya dahil edildi. Çalışmaya katılan hastaların YBÜ mortalitesi %55 olarak değerlendirildi. Hastaların %90'ı YBÜ yatışı açısından modifiye ATS kriterlerini sağlarken, %92'si PSI skorunu sağlıyordu. Pnömoni skorlama sistemleri; CURB-65, PSI, modifiye ATS kriterleri YBÜ mortalitesini tahmin etmede değerli bulunmazken, YBÜ'lerde sıklıkla kullanılan APACHE II skorunun artmış değerleri mortalite ile ilişkili bulundu (APACHE II > 20 odds ratio: 3, %95 CI: 1.2-7, p= 0.024). Bu sonuçlar göstermiştir ki, YBÜ mortalitesini tahmin etmede pnömoni skorları değil, YBÜ'lerde sıklıkla kullanılan APACHE II skoru daha değerlidir. APACHE II skoru > 20 olan TKP'li hastaların tedavisinde ve takibinde daha dikkatli olunmalıdır.

Anahtar Kelimeler: *Ağır toplum kökenli pnömoni, yoğun bakım ünitesi, YBÜ skorlama sistemleri, toplum kökenli pnömoni skorlama sistemleri.*

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SUMMARY

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Severe community-acquired pneumonia (CAP) is an important cause of intensive care unit (ICU) admissions. Many different pneumonia scoring systems have been developed in order to assess the severity of pneumonia and to decide the ICU follow-up and treatment. But still debate is going on about their performances and also they have not been tested yet if they can predict ICU mortality in severe CAP patients requiring mechanical ventilation. The aim of this study is to evaluate the performances of pneumonia and ICU scores in predicting mortality in CAP patients requiring mechanical ventilation. A retrospective observational cohort study. The files of mechanically ventilated CAP patients were reviewed and demographic, clinic and laboratory characteristics were recorded. Scoring systems of pneumonia [revised American Thoracic Society (ATS) criteria, CURB-65, pneumonia severity index (PSI)] and ICU [Acute Physiology Assessment and Chronic Health Evaluation (APACHE) II, Sequential Organ Failure Assessment] were compared for mortality prediction. Thirty eight female and 63 male, a total of 101 severe CAP patients, with the mean age of 68 ± 16 years, were included in the study. ICU mortality rate was assessed as 55%. Ninety percent of all patients met the revised ATS criteria and 92% of them met the PSI scoring system for ICU admissions. Although the CURB-65, PSI, revised ATS criteria were not found valuable to predict mortality, the increased APACHE II score was found to be related with increased mortality rate (for APACHE II > 20 odds ratio: 3, 95% CI: 1.2-7, p= 0.024). These results suggest that instead of the pneumonia scoring systems the APACHE II score can best predict the ICU mortality. So, more attention should be paid for severe CAP patients with APACHE II score > 20.

Key Words: *Severe community-acquired pneumonia, intensive care unit, mortality, ICU scoring systems, CAP scoring systems.*

Community-acquired pneumonia (CAP) is a common and potentially life threatening illness. Up to 10% of all hospitalized patients with CAP require treatment in intensive care unit (ICU) and they are defined as having severe CAP (1). Nearly 58 to 87% of patients with severe CAP develop respiratory failure, necessitate ICU follow up and require mechanical ventilation (2-4). The mortality rate of this population ranges from 22 to 54%, whereas it is 10 to 25% for the ones who require hospitalization (2,3).

The decision to admit CAP patients to ICU is usually made by the clinical judgment of the physician. For better assessment of mortality and intensive care requirement, different scientific societies have developed various predictive rules and severity scores. The pneumonia severity index (PSI), revised American Thoracic Society (ATS) criteria and CURB-65 are most frequently used pneumonia severity scoring systems (5-11). Several studies evaluated these scores and focused mainly on their role in predicting ICU admission and mortality. But they have not been assessed yet for mortality prediction in mechanically ventilated CAP patients (12-23). On the other hand there are many ICU scoring systems, such as Acute Physiology Assessment and Chronic Health Evaluation (APACHE) II, Sequential Organ Failure Assessment (SOFA), and simplified acute physiologic score that predict mortality in general ICU patients at the time of admission. But less is known about their validity in patients with CAP who require mechanical ventilation.

In this study we aimed to assess the role of pneumonia severity scores in predicting mortality in intubated CAP patients and to compare their validity with widely used ICU scoring systems.

MATERIALS and METHODS

Setting and Study Design

This retrospective observational cohort study was conducted with the data of the mechanically

ventilated severe CAP patients who were treated in a pulmonary ICU department of a university hospital with six bed capacity between the years 2003 and 2006.

The exclusion criteria from the study were as follows;

1. Being non-intubated or receiving non-invasive mechanical ventilation,

2. Hospitalization within the last 30 days,

3. Having pneumonia acquired in nursing home i.e. health care associated pneumonia,

4. Pneumonia developing 48 hours after hospital admission i.e. hospital acquired pneumonia,

5. Being immunosuppressive i.e. receiving steroids, cytotoxic agents, immunosuppressive agents for more than one month,

6. Having radiographic abnormalities attributed solely to a disease other than pneumonia,

7. Death attributed to reasons other than pneumonia.

Patients were divided into two groups as survivors (n= 46) and non-survivors (n= 55) in order to compare factors influencing mortality.

Data Collection and Evaluation

Data needed for the calculation of severity scores were collected from the medical records and laboratory databases of the patients. Pneumonia scoring systems (i.e. r-ATS, CURB-65, and PSI) were calculated retrospectively from the medical records of the patients. ICU scoring systems [i.e. APACHE II, SOFA, clinical pulmonary infection score (CPIS)] were used directly if they had already been assessed prospectively during the ICU stay.

The following data were recorded; age, sex, origin (home, nursing home), comorbid illness, any changes in neurological and mental status stratified according to Glasgow coma scale, prior antibiotic use (within one week before admission), initial vital signs (arterial blood pressure, body temperature, respiratory rate and heart rate) and hematological and biochemical tests [whole blood count, C-reactive protein (CRP), serum blood urine nitrogen, creatinin, electrolytes, liver and renal function tests, albumin]. Arterial blood gas analysis was performed and evaluated regularly before and after admitting patients to ICU. Microbiological analysis for the identification of the responsible pathogen was made either from the sputum sample or from the endotracheal aspirate sample which was obtained immediately after intubation. Endotracheal aspiration was made via sterile technique using a 22-inch, 12F suction catheter with a mucus collection tube kit. The catheter was introduced through the endotracheal tube for at least 30 cm. The ETA samples were sent to the microbiology laboratory within 30 minutes and they were processed within one hour. Bacterial identification and antibiotic susceptibility tests were performed using standard methods. *Legionella* urinary antigen test was studied in suspected cases.

The chest X-rays were evaluated once again with a radiologist and pulmonologist.

Other factors that may influence ICU mortality such as duration of mechanical ventilation, ICU and hospital stay, presence of sepsis and septic shock, antibiotic initiation time, stay in emergency department were also taken into account in the mortality risk factor analysis together with scoring systems.

Definitions

CAP is defined by the Infectious Diseases Society of America (IDSA) as an acute infection of the pulmonary parenchyma that is associated with at least some symptoms of acute infection, accompanied by the presence of an acute infiltrate on a chest radiograph or auscultatory findings consistent with pneumonia, in a patient not hospitalized or residing in a long term care facility for ≥ 14 days before onset of symptoms (24).

Pneumonia scoring systems were defined as follows:

• Fine and colleagues developed a pneumonia specific severity of illness score (PSI). The 20 clinical variables included three demographic variables, five co-morbid conditions, five physical examination findings and seven laboratory/imaging results. For each variable present,

points are added to the score and this final score is then broken into five risk classes. Patients in classes IV and V were suggested to be hospitalized and assessed as having "severe pneumonia" (5).

• The CURB index was derived from the original British Thoracic Society (BTS) study and uses four clinical features: Confusion of new onset (or worsening of existing state for those with background cognitive impairment), serum urea > 7 mmol/L, respiratory rate ≥ 30/minute, and blood pressure (systolic blood pressure < 90 mmHg or diastolic blood pressure ≤ 60 mmHg). The presence of two or more of these criteria led to a classification as "severe" (10).

• The CURB-65 index is a further modification of the BTS prediction rules. Age ≥ 65 years is added as a fifth variable to the four core variables mentioned above. To be classed as severe, patients need to meet three or more of the five variables (11).

• Revised ATS proposed by Ewig et al. and incorporated in the ATS guidelines in 2001. This predictive rule classed a patient as having "severe pneumonia" if they met one out of two major criteria (requirement for mechanical ventilation or septic shock) or two out of three minor criteria (systolic blood pressure < 90 mmHg, multi-lobar chest X-ray changes or PaO_2/FiO_2 < 250) (6,7,9).

CPIS that is commonly used in the diagnosis of ventilator associated pneumonia (VAP) but also offered to be used to diagnose CAP in the last "International Sepsis Forum Consensus Conference on Definitions of Infection in the ICU" was also evaluated. In this conference it was recommended that for the purpose of a more specific (rather than sensitive) definition of any form of pneumonia, the patient should have a CPIS of ≥ 6 (25).

Acute respiratory distress syndrome (ARDS) was defined according to American European Consensus Conference criteria; acute onset; bilateral infiltrates on frontal chest radiograph; hypoxemia (PaO_2/FiO_2 ratio ≤ 200); and no evidence of left atrial hypertension (no congestive heart failure, or pulmonary artery wedge pressure ≤ 18 mmHg, if available) (26).

First antibiotic injection after admission to the hospital was defined as "antibiotic initiation time". Comorbid illnesses were defined as the presence of any condition for which the patient was under active medical supervision or was receiving treatment at the time of hospital admission.

Statistical Analysis

Differences in parametric and non-parametric values were tested with Student's t-test and Mann Whitney-U test. Categorical variables were compared by the chi-square test. Each variable that was found significant in these analyses was entered into a backward stepwise logistic regression model. APACHE II score was categorized into classes by selecting the best cut-offs with receiver operating characteristic analysis. All analyses were performed using SPSS software version 12.

RESULTS

Population Characteristics

Thirty-eight female, 63 male, a total of 101 patients, all intubated CAP patients, with the mean age of 68 ± 16 years, were enrolled in the study. Sixty (59.4%) of them were accepted to ICU from the emergency department, 26 (25.7%) of them from the pulmonary ward, and the remaining 15 patients from other ICUs, other wards and other hospitals. Patients from other ICUs, other wards and hospitals were included in the study if their admission diagnosis was community acquired pneumonia and if they didn't develop hospital acquired or VAP. Among the whole study group, 55 patients died and 46 patients discharged. ICU mortality rate was found as 55%.

There were no significant differences in age, sex and laboratory parameters of survivor and non-survivor groups. Table 1 shows the demographic data, vital signs and laboratory results of the patients. Ninety-two percent of the patients had one or more comorbidity. And no difference was observed between the survivors and non-survivors when comorbidities were concerned. Comparison of the comorbidities was summarized in Table 2.

Arterial blood gas analysis indicated that mean PaO_2/FiO_2 was 182 ± 70 mmHg in non-survivors and 189 ± 65 mmHg in survivors. ARDS was diagnosed in 23.9% of survivors (n= 11) and 21.8% (n= 12) of non-survivors (p= 0.47) at the time of ICU admission.

Table 1. Demographic data, vital signs and laboratory results of the patient groups on admission to the intensive care unit.

Variable	Non-survivor (n= 55) Mean (SD)	Survivor (n= 46) Mean (SD)	p
Age (years)	70 (17)	65 (15)	0.20
Sex (male), n (%)	31 (56)	32 (70)	0.12
Comorbidity, n (%)	51 (93)	42 (91)	0.61
Glasgow coma scale	12 (4)	13 (4)	0.76
Temperature (°C)	37.5 (1.3)	37.5 (1.1)	0.80
Respiratory rate (/minute)	33 (10)	32 (8)	0.78
Blood pressure systolic (mmHg)	115 (27)	117 (25)	0.71
Blood pressure diastolic (mmHg)	68 (13)	69 (14)	0.71
Blood urea nitrogen (mg/dL)	37 (22)	29 (17)	0.09
Serum creatinin (mg/dL)	2 (3.0)	1 (1.0)	0.33
Na (mg/dL)	134 (18)	139 (6)	0.104
K (mg/dL)	4 (1)	4 (1)	0.791
Albumin (mg/dL)	3 (0.7)	3 (0.5)	0.241
Hemoglobin (g/dL)	12 (2)	13 (2)	0.003
Leukocyte count (x 10^3/μL)	13.7 (6.4)	12.8 (5.7)	0.45
Antibiotic initiation time (hour)	19 (25)	24 (39)	0.49

Table 2. Comparison of the comorbidities of the patient groups.

Variable	Non-survivor (n= 55)	Survivor (n= 46)	p
Congestive heart failure, n (%)	20 (36)	14 (30)	0.339
Atherosclerotic heart disease, n (%)	9 (20)	8 (24)	0.437
Chronic renal failure, n (%)	15 (27)	6 (13)	0.064
Diabetes mellitus, n (%)	12 (22)	9 (20)	0.489
Any pulmonary disorder, n (%)	35 (64)	37 (70)	0.339
Neurological disorders, n (%)	6 (13)	5 (15)	0.519
Chronic liver failure, n (%)	7 (15)	2 (6)	0.185

In chest X-rays 43 percent of the patients [43.5% of survivors (n= 20) and 41.8% of non-survivors (n= 23)] had multilobar involvements. 27% of the patients [28.3% of survivors (n= 13) and 25.5% of non-survivors (n= 14)] had bilateral involvement. The radiological difference among survivors and non-survivors was not significant (p> 0.05).

Ninety-four percent of the patients (n= 95) received at least one empiric antibiotic. The most commonly used ones were; clarithromycin in 43 patients and second generation cephalosporin in 20 patients. Combination antibiotic therapy was preferred in 51 (51%) patients. Antibiotics used were summarized in Table 3. Mean antibiotic initiation time was 21 ± 31 hours. Although antibi-

Table 3. Comparison of the antibiotics used among the groups.

Variable	Non-survivor (n= 55)	Survivor (n= 46)	p
2nd generation cephalosporin, n (%)	9 (17)	11 (25)	0.221
3rd generation cephalosporin, n (%)	5 (9)	6 (14)	0.357
Clarithromycin, n (%)	24 (44)	19 (43)	0.532
Levofloxacin, moxifloxacin, n (%)	4 (8)	4 (9)	0.443
Beta-lactam + beta-lactamase inhibitor (amoxicilline clavulanic acid, sulbactam ampicilline, piperacilline tazobactam), n (%)	13 (24)	11 (25)	0.522
Ciprofloxacin, n (%)	10 (19)	6 (14)	0.356
Carbapenems (meropenem, imipenem), n (%)	5 (10)	2 (5)	0.349

otic treatment was initiated within 12 hours in 40% and within 24 hours in 65% of the patients, no significant difference was observed between non-survivors and survivors (p> 0.05).

In 82 (81%) patients, microbiological examination was performed within 24 hours of admission and bacterial growth was observed in 15 (14.9%) patients. The most common pathogen, methicillin susceptible *Staphylococcus aureus*, was present in 5 (6%) patients, *Streptococcus pneumoniae* in 4 (5%), *Legionella pneumophila* in 2 (2%), *Branhamella catarrhalis* in 2 (2%) and *P. aeruginosa* in 2 (2%) patients.

Comparison of Predictive Accuracy of Pneumonia and ICU Scores

PSI score was calculated in 83 patients; revised ATS criteria were evaluated in 89 patients; CURB-65 was calculated in 76 patients. Among the ICU scores APACHE II score was evaluated in 97, SOFA in 89 and CPIS in 76 patients. The mean APACHE II score was 20 ± 6, mean SOFA score was 6 ± 2 and mean CPIS score was 6 ± 2. Table 4 shows the scoring systems, comparing survivors and non-survivors.

When analyzed retrospectively, 90% of the patients met the revised ATS criteria, 92% of them met severity criteria according to PSI score by being in class IV and V and 50% of them met severity criteria by having ≥ 3 CURB-65 score. The distribution of the patients according to PSI and CURB-65 scoring systems is summarized in Figure 1,2.

In univariate analysis there were no significant difference between non-survivors and survivors

Table 4. Comparison of pneumonia and intensive care unit scoring systems.

Variable	Non-survivor Mean (SD)	Survivor Mean (SD)	p
Pneumonia severity index (PSI)	149 (39)	136 (34)	0.11
Revised American Thoracic Society criteria positive, n (%)	50 (90)	39 (90)	0.62
CURB-65	3 (1)	2 (1)	0.09
Clinical pulmonary infection score (CPIS)	6 (2)	5 (2)	0.55
APACHE II	22 (6)	18 (6)	0.001
APACHE II > 20 (%)	66%	39%	0.02
Sequential Organ Failure Assessment (SOFA)	6 (3)	5 (2)	0.08

APACHE: Acute Physiology Assessment and Chronic Health Evaluation.

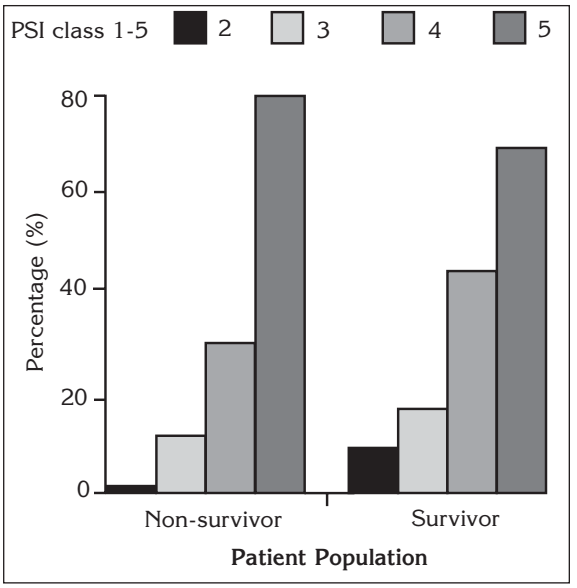

Figure 1. Distribution of survivors and non-survivors according to PSI scoring system. 92% of the non-survivors and 89% of the survivors were in PSI class IV and V. No significant difference was found between two groups (p> 0.05).

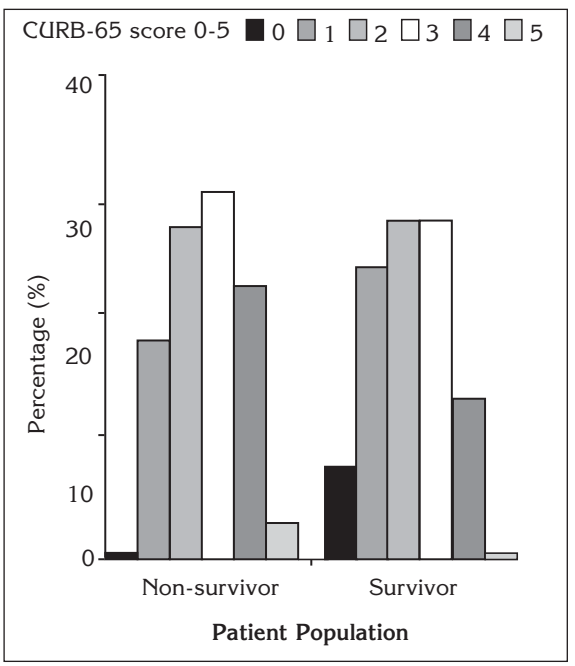

Figure 2. Distribution of survivors and non-survivors according to CURB-65 scoring system. 55% of the non-survivors and 42% of the survivors had ≥ 3 CURB-65 score. No significant difference was found between two groups (p> 0.05).

among the pneumonia scoring systems. The APACHE II score was significantly higher in non-survivors than survivors. The results of the logistic regression analysis revealed that only the APACHE II score > 20 was an independent predictor of mortality [odds ratio (OR): 3, 95% CI: 1.2-7, p= 0.024].

Assessment of Clinical End Points

Patients were examined for the duration of mechanical ventilation, length of ICU and hospital stay. Although duration of mechanical ventilation seemed to be higher in the non-survivor group, the difference was not significant (p> 0.05). Table 5 compares the clinical end points of survivors and non-survivors.

DISCUSSION

The strength of this study lies in the fact that it was performed in a selected population i.e., performances of the pneumonia and ICU scores were compared for mortality prediction among the mechanically ventilated severe CAP patients.

It is not surprising that revised ATS criteria performed well in deciding ICU admissions of our patients since we choose the specific group of mechanically ventilated CAP patients and one of the major criteria of the revised ATS score is the mechanical ventilation. PSI scoring system also performed well in deciding ICU admission, since it includes 20 clinical variables. The CURB-65 score, although mostly preferred for its simplicity, performed less well than the revised ATS and PSI scores. With CURB-65 scoring, especially younger patients were less likely to be diagnosed as severe CAP, and the other remaining four criteria (excluding age) were not enough to diagnose those patients actually requiring ICU treatment (17).

In the literature many studies examined the availability of these scoring systems and different results were reported. In a study of 1399 hospitalized patients with CAP, Angus et al. evaluated ATS, BTS and PSI scores and found that revised ATS criteria performed well in ICU admissions and BTS criteria in mortality prediction. They also pointed out that although 75% of the patients were in Class IV and V according to PSI scores, they didn't require ICU treatment (15). Similarly Valencia et al. stated in their study that a very significant proportion of hospitalized patients with CAP belong to PSI-V; while the mortality

Table 5. Assessment of clinical end points.

Variable	Non-survivor (n= 55) Mean (SD)	Survivor (n= 46) Mean (SD)	p
Duration of mechanical ventilation (day)	15 (15)	13 (9)	0.32
Duration of intensive care unit stay (day)	15 (15)	15 (10)	0.89
Length of hospital stay (day)	21 (21)	25 (15)	0.34
Length of stay in the emergency department (hour)	64 (84)	37 (42)	0.09

risk in this group was high, relatively few patients were admitted to the ICU because the PSI classification identified a very heterogeneous group of patients, many of whom did not have severe acute illness. They also concluded that despite accurately identifying severely ill patients, the PSI was not adequate to define the need for intensive care (16). On the other hand in the study of Aujesky et al. it was concluded that the PSI is both more efficient and slightly more accurate in identifying low risk patients with pneumonia who are potential candidates for outpatient care and at least as accurate as the CURB severity scores in identifying high risk patients with this illness (19). Whereas this scoring system is very complicated to use, and hence may not be practical for routine application in busy emergency departments. The advantage of the CURB-65 severity assessment tool is that it is simple to use, relying on five easily measurable variables, with all but urea being clinical observation which could be made by health care workers in primary and secondary care.

The mortality is especially higher among CAP patients requiring mechanical ventilation therapy, which is found as 55% in this study. This was higher than the overall mortality recently reported (12,13,15,18,19). But in those studies mortality rate was evaluated among the whole study group, also including many outpatients. In the study of Almirall et al., the mortality rate among the patients requiring mechanical ventilation was found as 52% which is quite similar to our mortality rate (14). The possible reasons for our high mortality rate were thought to be related with characteristics of the patient group such as older age (68 ± 16 years), all of them receiving mechanical ventilation treatment with the mean PaO_2/FiO_2 ratio 185 ± 68, having high APACHE II score (mean ± SD as 20 ± 6) and 92% of them having at least one comorbidity. Due to this high mortality, some strategies (such as administration of broad spectrum empiric antibiotics, tight blood glucose control, lung protective ventilation strategies, prevention of secondary infections) should be employed aggressively and as soon as possible to decrease mortality in severe CAP patients.

In the study of Aujesky et al., three validated rules (PSI, CURB and CURB-65) were prospectively compared for predicting prognosis in CAP. It was found that PSI had a higher discriminatory power for predicting 30 day mortality than either CURB scores. They also noted that the possibility of these three prediction rules would have performed differently in more severe patients couldn't be excluded (19). From this point of view we evaluated PSI, revised ATS, and CURB-65 scores for their predictive characteristics of prognosis in mechanically ventilated CAP patients and found that although pneumonia scores were effective in deciding ICU admission, none of them were able to predict the ICU mortality.

There are some explanations for the question "why pneumonia scoring systems could not predict ICU mortality in mechanically ventilated CAP patients?" They are usually calculated at the time of admission to hospital but not at ICU admission. It is evident that there are many fac-

tors that contribute to ICU mortality among patients who require mechanical ventilation. These factors can be related with the patient (host defences, age, comorbidity, functional status before ICU admission) or with the processes of care (appropriate antibiotic therapy, ICU complications such as renal failure, VAP or with physician. In our study many demographic, clinical and laboratory parameters were also examined as other possible risk factors of mortality but no significant difference was found between survivors and non-survivors. We thought that the antibiotic initiation time could be important for disease prognosis but again no significant difference was observed between the two groups. Another possible reason for the failure of pneumonia scores in predicting mortality may be not considering other factors that might be important in mortality, namely functional status, site of care, and processes of care. Marrie et al. found that functional status at the time of hospital admission was an independent predictor of mortality and patients who were in wheelchair or bedridden were 1.4 times and 4 times respectively, more likely to die compared to patients who walked without problems (4). Among the pneumonia scores, the CURB-65 does not score comorbidity; besides revised ATS and CPIS do not score comorbidity and age which are important predictors of mortality. Finally the small size of our study population may limit our ability to determine the validity of these scores in mortality prediction.

For predicting ICU mortality we also evaluated the most commonly used severity of illness scores such as APACHE II and SOFA score. Among them APACHE II score was higher in the non-survivor group and the difference between the two groups was significant (p= 0.001). Besides, multivariate analysis revealed that APACHE II score > 20 was an independent predictor of mortality (OR: 3, 95% CI: 1.2-7, p= 0.024). APACHE II score is a well known and validated prognostic indicator in ICU management. It was found to be useful in predicting mortality not only in mixed ICU patient populations but also in highly selected ICU populations such as chronic obstructive pulmonary disease, trauma, abdominal complications, acute pancreatitis (27-29). In the previous study of Yoshimoto and co-workers among the patients with severe CAP, a significant difference was found in univariate analysis between survivors and non-survivors with APACHE II score ≥ 23. But in multivariate analysis it was reported that not the APACHE II score but septic shock and blood urea nitrogen ≥ 30 mg/dL were associated with mortality (12). Similarly Salluh et al. found that in univariate analysis baseline cortisol, CURB-65 and APACHE II were predictors of death in severe CAP requiring ICU admission. But they have also noted that the discriminative ability of baseline cortisol for in hospital mortality was better than APACHE II, CURB-65, SOFA, D-dimer or CRP (30). Our study is also compatible with this study in the context of APACHE II; but we couldn't identify CURB-65 as a severity score predicting ICU mortality. As a missing point we have not studied the baseline cortisol, D-dimer and CRP levels so this may be the reason for APACHE II score being the best predictor of mortality in our study.

There are some other limitations of this current study. Such as; this is a retrospective study and not all the parameters could be found in the medical records. So pneumonia and ICU scores were missing in some patients and since those scores need some clinical decisions they couldn't be calculated retrospectively. Besides, the study group was smaller than the study groups of the previous studies (12,13,15-19). But in those studies many outpatients were also included and when mechanically ventilated patients were concerned it was clearly seen that our patient number was not so much lower. In addition, a very important prognostic marker i.e., procalcitonin couldn't be evaluated in this study since it was not performed routinely in our university hospital among the years 2003 and 2006.

In conclusion for the patients with severe CAP requiring mechanical ventilation, the APACHE II score is an important predictive factor for mortality. So, more attention should be paid to those patients with APACHE II score > 20 and mortality decreasing strategies should be employed as soon as possible.

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