Original Article

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Course of Patients with Pneumonia Hospitalized After Outpatient Treatment: A Two-year Single-center Experience

Ayaktan Tedavi Sonrası Hastaneye Yatırılan Pnömoni Hastalarının Seyri: İki Yıllık Tek Merkez Deneyimi

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ABSTRACT

Objective: This study evaluated the demographic characteristics of patients treated for lower respiratory tract infections. We also examined patients who were initially hospitalized and those who received outpatient treatment before being hospitalized. We investigated the effects of CURB-65 scores at presentation or at the time of transfer to intensive care unit (ICU), use of invasive or non-invasive oxygen supplementation, comorbidities, and repeated hospital admissions.

Methods: This single-center, retrospective study was conducted at the Emergency Department of University of Health Sciences Türkiye, Trabzon Kanuni Training and Research Hospital. Using hospital automation records, we analyzed pneumonia cases admitted and hospitalized between January 1, 2022, and December 31, 2023. The study included non-pregnant adult patients aged 18 and older, based on specific inclusion and exclusion criteria.

Results: A total of 625 patients were included. Of these, 27.8% were hospitalized after a second admission. No significant differences were found between first and second admission groups in terms of age, gender, comorbidities, CURB-65 scores, ICU requirement, or invasive ventilation ($p>0.05$). However, mortality was significantly higher among patients who required intubation ($p<0.01$). There was no significant association between the number of admissions and mortality ($p=0.784$).

Conclusion: The number of hospital admissions was not found to be a primary predictor of mortality in patients with

ÖZ

Amaç: Bu çalışmada, alt solunum yolu enfeksiyonu nedeniyle tedavi edilen hastaların demografik özellikleri değerlendirildi. Ayrıca, ilk başvuruda hastaneye yatırılan ve öncesinde ayaktan tedavi alıp hastaneye yatırılan hastalar incelendi. Hastaların başvuru anındaki veya yoğun bakıma transfer anındaki CURB-65 skorları, invaziv ya da non-invaziv oksijen desteği kullanımı, eşlik eden hastalıkları ve tekrarlayan hastane başvurularının etkisi araştırıldı.

Yöntemler: Bu tek merkezli, retrospektif çalışma Sağlık Bilimleri Üniversitesi, Trabzon Kanuni Eğitim ve Araştırma Hastanesi Acil Servisi'nde yürütüldü. 1 Ocak 2022 ile 31 Aralık 2023 tarihleri arasında acil servise başvurarak hastaneye yatırılan pnömoni olguları, hastane otomasyon sistemi kullanılarak analiz edildi. Çalışmaya, belirlenen dahil etme ve dışlama kriterlerine göre seçilen, 18 yaş ve üzerindeki gebe olmayan erişkin hastalar dahil edildi.

Bulgular: Toplam 625 hasta çalışmaya alındı. Bu hastaların %27,8'i ikinci başvurularında hastaneye yatırılmıştı. İlk ve ikinci başvuru grupları karşılaştırıldığında; yaş, cinsiyet, eşlik eden hastalıklar, CURB-65 skorları, yoğun bakım ihtiyacı ve invaziv ventilasyon gereksinimi açısından anlamlı fark saptanmadı ($p>0,05$). Ancak, entübasyon gerektiren hastalarda mortalite anlamlı olarak daha yüksekti ($p<0,01$). Başvuru sayısı ile mortalite arasında anlamlı bir ilişki bulunmadı ($p=0,784$).

Sonuç: Pnömoni hastalarında hastane başvuru sayısı mortalite için birincil belirleyici değildir. Sadece invaziv mekanik ventilasyon ihtiyacı ile mortalite arasında anlamlı bir ilişki bulunmuştur. Bu bulgular, pnömoni yönetiminde ve

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ABSTRACT

pneumonia. Only the need for invasive mechanical ventilation showed a significant association with mortality. These findings indicate that clinical severity, rather than readmission frequency, may be more critical in determining outcomes in pneumonia management.

Keywords: Community-acquired pneumonia, CURB-65, readmission

ÖZ

prognozunda tekrar başvuru sayısından ziyade klinik şiddetin daha belirleyici olduğunu göstermektedir.

Anahtar Kelimeler: Toplum kökenli pnömoni, CURB-65, tekrar başvuru

Introduction

Although community-acquired pneumonia (CAP) is one of the most frequently encountered infectious diseases universally, it is a very serious global health problem in terms of mortality and morbidity (1). "Typical'' cases of CAP usually present with classical symptoms such as fever, productive cough, dyspnea and pleuretic ribcage pain, while "atypical'' CAP is characterized by subacute onset, diffuse lung infiltration and extrapulmonary symptoms (1). Symptoms and clinical findings are not sufficient to reliably differentiate the exact etiologic agent (2).

Prognostic factors associated with unfavorable clinical course in CAP include cardiovascular diseases, chronic liver disease, splenic dysfunction, advanced age, multiple lobar lung involvement, history of previous tuberculosis disease and delayed treatment approaches (3). Since the 19th century, many evaluations have been made about the disease in terms of different clinical presentations and its effects on immunocompromised elderly individuals (4).

A meta-analysis published in 2024 examined the risk factors affecting mortality in patients with severe pneumonia. According to the results of the study, male gender and advanced age, malignancy, septic shock and renal failure were among the factors that significantly affected mortality (5). Secondary bacterial pneumonia also causes an increase in the risk of mortality, but patients over 65 years of age and in need of mechanical ventilation are in the risky group (6).

Various scoring systems have been developed to assess the severity of CAP and to determine the treatment strategy. Pneumonia severity index (PSI) and CURB-65 are the main scoring systems used. In CURB-65 scoring, the patient's state of consciousness, urea level in the blood, respiratory rate per minute, blood pressure and age are used (Table 1) (7). A score of 0-1 indicates a low risk of death (1.5%) and requires outpatient treatment, a score of 2 indicates a moderate risk of death (9.2%) and requires hospitalization, a score of 3 indicates a high risk of death (22%) and requires hospitalization, and a score of 4-5 indicates a very high risk of death and requires intensive care unit (ICU) follow-up (8). Patients who need mechanical ventilation are in the risky group (6).

A cohort study in Colombia evaluated the use of 16 different risk scores in predicting mortality at 3, 6, and 12 months; the PSI, CRB-65, and CURB-65 scores were found to be effective in predicting short-term mortality but limited in long-term prediction (9). Other studies also showed that the PSI and CURB-65, although limited in accuracy, were effective in predicting 30-day mortality (10). In a study of emergency departments, the CURB-65 score predicted mortality risk for patients scoring 1 or more points with 38% specificity and 92.8% sensitivity (11). A study in Iran reported that the CURB-65 score was similarly accurate to the PSI scores, but the CURB-65 score was more easily applicable (12).

With an ageing population and increasing burden of comorbidities, hospital admissions for CAP are expected to increase. In addition to individual health problems, this has serious implications for resource management in the health system. Although currently used scoring systems are effective in early mortality risk prediction, they have limited predictive power in terms of recurrent hospital admissions and long-term outcomes. When we look at the literature, comprehensive studies on the demographic characteristics, clinical course and mortality of patients with recurrent hospital admissions due to lower respiratory tract infection are very limited. This study aims to fill this knowledge gap from a different perspective and aims to contribute to making patient treatment strategies more effective by examining the demographic characteristics, differences in treatment processes and mortality rates of this patient group hospitalized with readmission.

Methods

Our study was conducted in the adult emergency department, and the cases admitted to the emergency department and diagnosed with pneumonia were retrospectively screened. Approval for the study was obtained from the Ethics Committee of the University of Health Sciences Türkiye, Trabzon Kanuni Training and

Table 1. CURB-65 scoring system

	Definition
Unconsciousness, confusion	Yes=1 point or No=0 point
Urea (blood urea nitrogen)	>19 mg/dL=1 point
Respiration rate	>30 /min=1 point
Blood pressure	Systolic <90 mmHg or diastolic <60 mmHg=1 point
Age	Age ≥65=1 point

Research Hospital (decision no: 2024/97, date: 26.06.2024). Patients admitted to the emergency department and hospitalized in a retrospective 24-month period were included in the study. Patients under 18 years of age, patients who refused treatment, and patients with missing data in their files were excluded from the study as part of the exclusion criteria. Necessary laboratory and imaging tests, vital signs, demographic data, and the course of treatment during hospitalization were obtained from the hospital automation system.

Statistical Analysis

All data were recorded in Microsoft Excel file and evaluated. Analyses were performed using Jamovi v.1.6 statistical software [The Jamovi Project (2021)] Computer Software, version 1.6. Sydney, Australia). Categorical data were expressed as frequency (n) and percentage. Normally distributed continuous data were expressed as mean plus standard deviation and non-normally distributed data were expressed as median and interquartile range (IQR). Normality of distributions was evaluated by Shapiro-Wilk test. Student's t-test was used to compare continuous variables in the presence of normal distribution and Mann-Whitney U test was used in the absence of normal distribution. Chi-square test was used to compare categorical variables between groups.

Table 2. The patients' demographic data and baseline characteristics

Characteristics	All patients (n=625)
Gender	
Male, n (%)	340 (54.4%)
Female, n (%)	285 (45.6%)
Age (years), median (IQR)	77 (IQR: 67-84)
Hospital admission	
First admission	451 (72.2%)
Median age	78 (IQR: 68-85)
Second admission	174 (27.8%)
Median age	74 (IQR: 66.5-83)

IQR: Interquartile range (25^{th}-75^{th} percentile)

Results

A total of 625 patients who presented to the emergency department with complaints of lower respiratory tract infection and were diagnosed with pneumonia and hospitalized between January 1, 2022, and December 31, 2023, were examined. Of the 625 patients hospitalized with a diagnosis of pneumonia, 340 (54.4%) were male and 285 (45.6%) were female (Table 2). The median age of all patients was determined to be 77 years (IQR: 67-84). One hundred seventy-four (27.8%) of the patients had previously received treatment and were hospitalized after a second hospital admission. The median time to readmission for patients admitted on a second admission was calculated as 3 days (IQR: 2-5). The median age of 451 patients hospitalized on their first visit was 78 (IQR: 68-85), and the median age of 174 patients hospitalized on their second visit was 74 (IQR: 66.5-83) (Table 2).

When the ages of patients hospitalized on repeat visits after outpatient treatment were compared with those of patients hospitalized on their first visit, no statistically significant difference was found between the groups (p=0.071) (Table 3).

Of the patients who were hospitalized at the readmission, 99 were male and 75 were female. In the comparison by gender, no statistical difference was observed in terms of hospitalization rates at repeat admission (p=0.491). When the CURB-65 scores of all patients calculated at the time of admission were analyzed, it was observed that 280 (44.8%) patients were most frequently evaluated with a score of 2, followed by 137 (21.9%) patients with a score of 1. Other score distributions were observed at decreasing rates (Table 4). The median CURB-65 score of the entire patient group at admission was 2 (IQR: 1-2).

Of the 451 patients hospitalized at their first presentation, 209 (46.3%) and 71 (40.8%) of the 174 patients hospitalized

Table 3. Statistical analysis of the first and second hospital admissions

Characteristics	All patients (n=625)	First admission	Second admission	p-value
Gender				
Male, n (%)	340 (54.4%)	241 (70.8%)	99 (29.2%)	0.491^
Female, n (%)	285 (45.6%)	210 (73.7 %)	75 (26.3%)	
Age (years), median (IQR)	77 (IQR: 67-84)	78 (IQR: 68-85)	74 (IQR: 66.5-83)	0.071*
CURB-65	2 (IQR: 1-2)	2 (IQR: 1-2)	2 (IQR: 1-2)	0.128*
Ward admission	397 (63.5%)	293 (73.8%)	104 (26.2%)	0.264^
Intensive care unit admission	228 (36.5%)	158 (69.3%)	70 (30.7%)	
Invasive oxygenation	151 (24.2%)	109 (72.2%)	42 (27.8%)	1.000^
Non-invasive oxygenation	474 (75.8%)	342 (72.2%)	132 (27.8%)	
Death	180 (28.8%)	128 (28.4%)	52 (29.7%)	0.784^

IQR: Interquartile range (25^{th}-75^{th} percentile), *: Mann-Whitney U test, ^: x^2 test

at their second presentation had a CURB-65 score of 2. No statistically significant difference was found between the groups in terms of CURB-65 score distribution (p=0.128) (Table 3). However, when the mortality group and the recovery discharged patient groups were compared, a significant difference was found between the mean CURB-65 values (p<0.001). Of the patients, 246 had diagnosed lung disease, and 173 (70.3%) were hospitalized at their first presentation. Eighty-eight patients had a history of malignancy, and 66 (75%) were hospitalized at their first presentation. One hundred fifty eight (70.8%) of the 223 patients with congestive heart failure (CHF), 154 (77%) of 200 patients with a prior diagnosis of cerebrovascular disease (CVD), 102 (76.6%) of 133 patients with chronic kidney disease (CKD), and 17 (80.9%) of 21 patients with liver disease were initially hospitalized. Additionally, 225 patients had diabetes mellitus (DM) and 401 patients had hypertension (HT), and 159 (70.6%) and 296 (73.8%) of these patients were initially hospitalized, respectively.

When comorbid diseases were analyzed, no statistically significant difference was found between the need for hospitalization at the first and second admissions in terms of DM (p=0.591), HT (p=0.141), chronic lung disease (p=0.465), malignancy (p=0.382), CHF (p=0.746), CVD (p=0.054), CKD (p=0.170) and liver disease (p=0.181) (Table 5).

A total of 228 patients (36.5%) required follow-up in the ICU during hospitalization, with a median length of stay of 7 days (IQR: 3-14.5). Treatment in ICU was needed in 158 (69.3%) of the patients hospitalized at the first admission and 70 (30.7%) of the patients hospitalized at the second admission. There was no significant correlation between the number of admissions and follow-up in ICU (p=0.264) (Table 3).

Table 4. Frequencies of CURB-65

Levels	Counts	% of total	Cumulative %
0	56	9	9
1	137	21.9	30.9
2	280	44.8	75.7
3	57	9.1	84.8
4	59	9.4	94.2
5	36	5.8	100

One hundred fifty one (24.2%) patients required invasive mechanical ventilation support during the treatment process. When the need for intubation was analyzed according to the number of admissions, 109 (72.2%) of the patients hospitalized at the first admission and 42 (27.8%) of the patients hospitalized at the second admission were intubated. There was no statistically significant relationship between the number of admissions and the need for invasive ventilation (p=1.000).

During the treatment, 137 (90.7%) of the patients who needed intubation and 43 (9.3%) of the patients who did not need this support died. When the relationship between the need for intubation and mortality was analyzed, a correlation was found between intubation and mortality (p<0.01). This suggests that the need for invasive oxygenation may be an indicator of poor prognosis. One hundred eighty (28.8%) hospitalized patients died. Of these patients, 128 (71%) were hospitalized at the first admission and 52 (29%) were hospitalized at the second admission. When the mortality rates of the patients were compared with the number of admissions, no statistical significance was found between the number of admissions and mortality (p=0.784) (Table 3).

Discussion

A meta-analysis of 101 different studies analyzing data on approximately 17 million hospitalizations in the United States revealed that advanced age was a significant parameter in hospital admissions and in-hospital mortality. In developed countries, hospitalization rates due to pneumonia were recorded as 17.3/1.000 in men and 12.9/1.000 in women, while in-hospital mortality rates were reported as 11.6-11.9% in men and 9.8-10.2% in women (13). In contrast, in our study, no statistical difference was observed in terms of age (p=0.071) and gender (p=0.491) distributions between patients who were hospitalized at initial admission and who were hospitalized at recurrent admission.

According to our study, comorbidities did not make a difference between the rates of hospitalization at initial and repeated admissions in patients with pneumonia; however,

Table 5. Statistical analysis of hospital admission rates at first and second hospital presentations according to comorbidities

Comorbidity	Number of patients	First admission	Second admission	p-value*
Pulmonary disease	246 (39.4%)	173 (70.3%)	73 (29.7%)	0.465
Malignancy	88 (14.1%)	66 (75%)	22 (25%)	0.382
Congestive heart failure	223 (35.7%)	158 (70.8%)	65 (29.2%)	0.746
Cerebrovascular disease	200 (32%)	154 (77%)	46 (23%)	0.054
Chronic kidney disease	133 (21.3%)	102 (76.6%)	31 (23.4%)	0.170
Hepatic disease	21 (3.4%)	17 (80.9%)	4 (19.1%)	0.181
Diabetes mellitus	225 (36%)	159 (70.6%)	66 (29.4%)	0.591
Hypertension	401 (64.4%)	296 (73.8%)	105 (26.2%)	0.141
*: x^2 test				

it has been reported in the literature that malignancy, CHF, CKD, DM with complications and dementia have negative effects on mortality (14). Especially the fact that malignancy and CKD have a strong correlation with mortality suggests that comorbidities affect patient prognosis rather than hospitalization decisions.

In a retrospective study conducted on the CURB-65 score, patients were scored from 0 to 4 and 52.31% of the patients were scored 3 points and 35.38% were scored 2 points during hospitalization. In terms of mortality, a significant increase in mortality was observed as the score obtained from the scoring increased, and the patient group with a score of 4 had the highest mortality with a mortality rate of 33.33% (15). In our current study, the median CURB-65 score of the patients hospitalized in both the first and second admissions was 2 (IQR: 1-2). As expected, a significant difference was found between the discharged patients and pneumonia-related deaths in terms of score ($p<0.001$). This result suggests that the CURB-65 score is a reliable marker of pneumonia prognosis.

In the literature, it is emphasized that patients with a CURB-65 score of 2 or above should be treated as inpatients and patients with a score of 3 or above should be evaluated for ICU hospitalization (16). In our study, the fact that the group of patients who presented for the second time and received inpatient treatment consisted of individuals who were followed up as outpatients after the first presentation and presented again was important especially in terms of observing the critical deterioration period after discharge. When the initial and repeat presentations were compared in terms of the need for ward and ICU hospitalization, no significant difference was found ($p=0.264$).

A study conducted during the coronavirus disease 2019 pandemic reported that of 56,715 suspected cases, 20.7% were hospitalized, 2.9% were intubated, and the total mortality rate was 8.1% (17). Our findings were consistent with these data, and while there was no statistical difference between the need for invasive mechanical ventilation ($p=1.000$) and mortality and outcome rates ($p=0.784$) in patients admitted for their first and repeated admissions, there was clearly a strong and significant relationship between ventilator use and mortality ($p<0.01$). Similarly, Joya-Montosa et al. (18) reported that patients with severe CAP who required mechanical ventilation within the first 24 hours of ICU admission had a significantly higher mortality rate compared to those who did not require intubation (47.2% vs. 19%, $p=0.002$).

Study Limitations

This study has several limitations that should be acknowledged. First, the single-center, retrospective design limits the external validity of our findings, as the results may not fully represent the heterogeneity of patient populations, healthcare systems, and clinical practices in other settings. Retrospective analyses are also inherently vulnerable to selection bias, and they preclude definitive conclusions about causality between predictors and outcomes.

Second, reliance on electronic medical records may have introduced information bias due to incomplete or inconsistent documentation. Important clinical variables, such as the timing of symptom onset, delays in initiation of antibiotic therapy, vaccination history, socioeconomic status, and access to outpatient care, were not systematically captured, which restricted our ability to evaluate their influence on patient outcomes.

Third, although we examined individual clinical and laboratory parameters, we did not perform multivariable analyses such as logistic regression, which could have helped identify independent predictors and adjust for potential confounders. The absence of such analyses may have limited the robustness of our conclusions regarding risk factors.

Finally, the relatively modest sample size reduced statistical power, particularly for subgroup analyses, and may have limited the precision of effect estimates. For these reasons, our findings should be interpreted with caution, and future large-scale, multicenter, prospective studies with standardized data collection and the application of advanced statistical methods are necessary to validate and extend these observations.

Future Research

Future research will be critical to achieving a more comprehensive understanding of the clinical course and mortality risk factors in patients with CAP. First, multicenter and prospective studies are needed to capture differences across diverse patient populations and healthcare systems, thereby improving the generalizability of findings. Larger sample sizes will also increase statistical power and strengthen the reliability of results.

In addition, incorporating variables such as the timing of symptom onset, treatment delays, socioeconomic status, vaccination history, and access to outpatient care into future study designs will provide a more holistic view of the determinants of disease progression. The application of advanced statistical approaches, including logistic regression and multivariable modeling, will help identify independent predictors and support the development of more targeted clinical decision-making strategies.

Moreover, prospective evaluation of the association between invasive mechanical ventilation and mortality may contribute to optimizing intensive care management in these patients. Similarly, long-term follow-up studies investigating the relationship between repeated hospital admissions and clinical outcomes would help clarify the natural course of the disease and treatment responses.

Ultimately, larger, multicenter, and methodologically rigorous studies are essential to validate current findings and to generate robust evidence that can guide clinical practice in the management of CAP.

Conclusion

In our study, in which we evaluated the past two-year period in a single-center, no significant difference was found between the first and second admissions with the diagnosis of CAP in terms of age, gender, comorbidities, CURB-65 score, need for intensive care and need for invasive mechanical ventilation. Mortality rates of patients who required only invasive mechanical ventilation were significantly higher than those of patients who did not require intubation ($p<0.01$). The fact that no direct correlation was found between the number of hospital admissions and mortality suggests that repeated hospital admissions do not always result in an unfavorable disease course. However, the fact that our data are the product of a single-center study and are based on a limited sample size limits the generalizability of the study results.

Ethics

Ethics Committee Approval: Approval for the study was obtained from the Ethics Committee of the University of Health Sciences Türkiye, Trabzon Kanuni Training and Research Hospital (decision no: 2024/97, date: 26.06.2024).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.N., F.G., Concept: E.N., Design: E.N., Data Collection or Processing: F.G., Analysis or Interpretation: E.N., Literature Search: E.N., F.G., Writing: E.N.

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