ORIGINAL INVESTIGATION

Hospital Treatment Costs and Factors Affecting These Costs in Community-Acquired Pneumonia

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Abstract

OBJECTIVES: Community-acquired pneumonia (CAP) accounts for an important part of hospital admissions and health expenses worldwide. The cost increases when treated in a hospital, and reports on this issue are limited in Turkey. This study aimed to investigate direct hospital costs and factors affecting these costs for patients who were hospitalized in our clinic because of the diagnosis of CAP.

MATERIAL AND METHODS: The records of patients who had been hospitalized for the diagnosis of CAP were retrospectively reviewed. Demographic features, radiological features, pneumonia severity index (PSI), CURB-65 scorings, duration of hospitalization, treatments, and the results of treatments were examined. Total hospitalization costs and the expenses for intervention, medication, examinations, and additional services were recorded. The effect of data on the cost was evaluated.

RESULTS: The study was conducted with 87 patients with CAP. The mean duration of hospitalization was 15.6 days and nine patients (10.3%) were exitus. The median total hospital cost was 2062 (451–11690) TL [952 euros (€), 1305 dollars (\$)], and the median hospitalization expense per day was 148 Turkish Lira (TL) (68.3 €, 93.7 \$). Medication expenses and total cost were higher in male patients than in female patients. Abscess/necrotizing pneumonia increased the cost depending on the infiltration that occurred either alone or with parapneumonic pleurisy. Whereas an increase in the PSI stage increased the total cost and expenses for intervention and medication, medication expenses increased in patients with CURB-65 score of 3 and 4 ($p<0.05$). Age, smoking, and low oxygen saturation level did not affect the cost. No statistically significant difference was found between the expenses of exitus patients and the expenses of patients who recovered.

CONCLUSION: CAP can lead to high costs and result in death. In our study, it was concluded that the cost increased in male patients, patients with abscess/necrotizing pneumonia, and patients with high PSI scores.

KEYWORDS: Cost, pneumonia, smoking

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INTRODUCTION

Community-acquired pneumonia (CAP) is an important cause of hospital admissions, treatment costs, loss of work or school time, and deaths [1]. The incidence of CAP per year is reported to be 0.5%–1.1% in Europe [2]. According to the health statistics of the Ministry of Health, patients with pneumonia constituted 1.9% of all hospitalizations in 2004 [3]. It was calculated that CAP cost for a year was 8.4 billion in the United States of America (USA), and 52% of this cost was for the 1.1 million patients treated at a hospital and the rest was for the 4.4 million patients who underwent an outpatient treatment [4]. In our country, there are a few studies conducted on the cost of CAP. This study aimed to determine the direct hospital costs and effects of the patients' clinical, laboratory, and radiological features on these costs in patients who were hospitalized in our clinic because of the diagnosis of CAP.

MATERIAL AND METHODS

The approval for this study was received from the ethics committee of Dr. Lütfi Kırdar Training and Research Hospital (89513307/1009/411). Eighty-seven patients who were diagnosed with CAP in accordance with the Turkish Thoracic Society Guidelines and who were hospitalized between 2009 and 2012 for monitoring were included in the study. The patients who were discharged from the hospital in the last 72 h were excluded from the study. The patients' demographic features, complaints at admission, laboratory findings at admission, radiological features, pneumonia severity index (PSI), CURB-65 scorings, antibiotic treatments, and their results were recorded. The hospital automation system was reviewed, and total cost during hospitalization and other expenses for intervention, medication, examination, and additional services

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(such as hospital bed fee) were recorded. After obtaining written informed consents from the patients, hospitalization costs were compared according to the recorded data.

The costs were recorded in Turkish Lira (TL). In accordance with the mean 3-year selling rate of exchange of the Istanbul Central Bank, it was calculated as 2.164 TL in the currency of euro (€) (2.160 TL in 2009 on average, 1.998 TL in 2010 on average, and 2.333 TL in 2011 on average) and 1.579 TL in the currency of American dollar (\$) (1.554 TL in 2009 on average, 1.507 TL in 2010 on average, and 1.678 TL in 2011 on average).

Statistical Analysis

The data obtained were statistically analyzed using Statistical Package for Social Science (SPSS Inc., Chicago, IL, USA) 16.0 software. Statistics were stated as mean values±standard deviation, and the expenses were presented as a mean and median. In comparative statistics, t-test was used for paired comparisons and ANOVA analysis was performed for comparing more than two data. The value of $p<0.05$ was accepted to be significant.

RESULTS

This study included a total of 87 cases comprising 66 male (76%) and 21 (24%) female patients. The mean age of the study group was 69 ± 14 (25–91) years, and there was no significant difference between the age groups according to gender ($p=0.569$). The most common symptoms at admission were reported to be cough, phlegm, and shortness of breath, and the mean duration of complaints was approximately 4 days. Of the total number of patients, 10% were active smokers. Eighty-two percent of patients had at least one comorbid disease, and the most common one was chronic obstructive pulmonary disease (COPD) (64%). While the mean number of comorbid diseases was 1.6 ± 1.0 (0–5), it was significantly higher in male patients ($p=0.005$) (Table 1). Although the median oxygen saturation that was recorded with a fingertip probe was 91% (66%–98%), it was below 88% in 32 patients. Radiologically, pneumonic infiltration and parapneumonic effusion were detected in 26 patients (30%), and abscess or necrotizing pneumonia was found in six (7%) patients.

The median pneumonia severity index score was 108 (32–193, mean 105 ± 35), and the median CURB-65 score was 2 (0–4) (Table 1). In the treatment, the most frequently used drugs were single ampicillin–sulbactam or its combination with macrolide group (40%) and moxifloxacin (21%). Three patients were transferred to the intensive care unit (ICU) because of clinical progression. For these patients, antibiotic therapy was switched with respect to the cultures that were newly taken. Of 87 patients, 9 (10.3%) were exitus. Seven of these patients had been followed up in the clinic and two had been followed up after being transferred to ICU. Healing was observed in other patients.

cost per day was calculated to be 148 TL (68.3€, 93.7\$). The median total hospital cost was 2062 TL (451–11690 TL, 952€, 1305\$) and the mean was 2368 TL (1093€, 1498\$). Of the cost, 43% was for medication expenses, 22% for intervention expenses, 12% for examination expenses, and 23% for extra services such as hospital bed fee (Table 2).

The mean duration of hospitalization was 16 ± 7 days in male patients and 14.6 ± 6.8 days in female patients ($p=0.310$). The rate of medication expenses and total cost were higher in male patients ($p=0.017$, 0.030, respectively).

When the patients were divided into two groups considering the age of 65 years, 58 (67%) of them were included in the advanced age group. The cost did not differ between these two groups. In elderly patients, the mean duration of hospi-

Table 1. Demographic features of patients

Features	
F/M, (n)	21/66
Mean age	69 ± 14 (25–91)
	Male:69.1, Female:67.5
Non-smoker/ones who quitted smoking/active smoker, (n)	23/55/9
Comorbid diseases	
COPD, (n)	56 (64%)
Malignancy, (n)	14 (16%)
DM, (n)	14 (16%)
CHF, (n)	14 (16%)
Number of comorbid diseases (mean)	1.6 ± 1.0 (0–5)
	Male: 1.8 Female: 0.9
SpO ₂ (mean, %)	90.1 ± 4.2
<88%/>88%, (n)	32/55
Radiological features	
Parapneumonic effusion, (n,%)	26 (30)
Abscess/necrotizing pneumonia, (n,%)	6 (7)
PSI (mean)	105 ± 35
Stage 1, (n)	6
Stage 2, (n)	10
Stage 3, (n)	18
Stage 4, (n)	30
Stage 5, (n)	23
CURB-65 (mean)	2.1 ± 0.8
0 (n)	1
1 (n)	17
2 (n)	44
3 (n)	19
4 (n)	6
Duration of hospitalization (day)	15.6 ± 7 (median:14)

DM: diabetes mellitus; M: male; F: female; CHF: congestive heart failure; COPD: chronic obstructive pulmonary disease; SpO₂: oxygen saturation with fingertip probe in room air

The mean duration of hospitalization was found to be 15.6 ± 7 (5–32, median 14) days. The median hospitalization

talization, total cost, and cost units did not display any significant difference (Table 3).

The mean duration of hospitalization was 14 ± 4 days for active smokers, 15 ± 6 days for patients who never smoked, and 16 ± 7 days for patients who quit smoking ($p=0.187$). No significant difference was observed among active smokers with regard to total cost and other expenses (Table 4).

The mean duration of hospitalization was one day longer for patients whose oxygen saturation was below 88% than for patients whose oxygen saturation was above 88% (16 and 15 days, respectively). No significant difference was observed in terms of the duration of hospitalization ($p=0.639$), total cost ($p=0.429$), and cost units.

Among the patients with radiological features, including abscess/necrotizing pneumonia, pneumonic infiltration, and

parapneumonic pleurisy accompanying pneumonic infiltration, no difference was found in the duration of hospitalization ($p=0.663$). Total hospitalization cost and the expenses for medication and extra services were significantly different in three groups ($p=0.000$, 0.000 , and 0.001 , respectively). There was no difference in the costs between patients with pneumonic infiltration with and without pleural effusion. The expenses of patients with abscess/necrotizing pneumonia were significantly higher than those of other patients with regard to total hospitalization cost, medication expenses, and extra service expenses ($p=0.000$) (Table 5).

Difference in total hospitalization cost was observed in the 5-stage cost analysis of pneumonia severity index scoring ($p=0.029$). When PSI scores were put in two groups as the scores below 90 (Stage 1, 2, 3–34 patients) and the scores above 90 (Stage 4, 5–53 patients), it was found that total hospitalization cost, intervention expenses, and medication expenses were higher in patients with advanced stages ($p=0.01$, 0.026 , and 0.02 , respectively) (Table 6).

According to CURB-65 scoring system, there was no difference in terms of total cost and cost units for all scores. When the scores were divided into two groups as (0, 1, and 2) and (3, 4), it was observed that medication expenses were high ($p=0.025$) (Table 7).

In our series, comorbid malignancy was detected in three of the exitus patients. In comparison with patients who recovered and patients who died, it was found that CURB-65 and PSI scores of exitus patients were higher ($p=0.000$) at advanced age ($p=0.003$). Although total cost was higher in the exitus patients, the difference was statistically insignificant (Table 8).

Table 2. Total costs

	Mean (TL)	Median (TL)	Min-max (TL)
Medication expenses	1040 $\pm$ 1094 (416€, 558\$)	638	40-7132
Intervention expenses	522 $\pm$ 318 (209€, 288\$)	457	43-1612
Examination expenses	272 $\pm$ 215 (109€, 150\$)	215	14-1456
Extra services	533 $\pm$ 305 (214€, 294\$)	450	120-2260
Total cost	2.368 $\pm$ 1750 (952€ 1305\$)	2062	451-11690

Min: minimum; max: maximum

Table 3. Mean costs according to gender and age

	Costs according to gender			Costs according to age		
	Male (n=66)	Female (n=21)	p	<65 (n=29)	>65 (n=58)	p
Intervention	545 $\pm$ 301	450 $\pm$ 364	0.233	408	470	0.401
Examination	261 $\pm$ 168	303 $\pm$ 327	0.446	246	213	0.156
Medication	1197 $\pm$ 1189	547 $\pm$ 461	0.017	671	610	0.956
Extra services	548 $\pm$ 323	485 $\pm$ 240	0.411	510	450	0.957
Total	2584 $\pm$ 1829	1687 $\pm$ 1260	0.030	1793	2062	0.560

Table 4. Mean costs according to smoking status

	Active smoker (n=8)	Quitted smoking (n=57)	Never smoked (n=22)	p
Intervention	441 $\pm$ 408	550 $\pm$ 284	478 $\pm$ 368	0.500
Examination	262 $\pm$ 158	257 $\pm$ 171	313 $\pm$ 317	0.577
Medication	847 $\pm$ 826	1138 $\pm$ 1155	856	0.520
Extra services	435 $\pm$ 172	573 $\pm$ 345	466 $\pm$ 200	0.242
Total	1961 $\pm$ 1105	2572 $\pm$ 1732	1984 $\pm$ 1564	0.284

Table 5. Mean costs according to radiological features

	Pneumonia (n=55)	Pneumonia and parapneumonic pleurisy (n=26)	Abscess/necrotizing pneumonia (n=6)	p
Intervention	508±274	504±364	728±452	0.262
Examination	230±176	324±273	417±174	0.041
Medication	798±719	1068±819	3132±2397	0.000
Extra services	486±218	533±243	973±731	0.001
Total	2106±1310	2303±1279	5029±3378	0.000

Table 6. Costs according to PSI score

	PSI <90 (n=34)	PSI >90 (n=53)	p
Intervention	428±307	582±312	0.026
Examination	263±269	276±174	0.787
Medication	701±691	1257±1246	0.020
Extra services	487±214	563±350	0.256
Total cost	1800±1884	2703±1814	0.010
Duration of hospitalization (day)	15.0	16.6	0.296

PSI: pneumonia severity index (benefitted from the primary source)

Table 7. Costs according to CURB-65 score*

	CURB-65: 0, 1, 2 (n=62)	CURB-65: 3, 4 (n=25)	p
Intervention	482±300	622±344	0.062
Examination	289±239	227±134	0.220
Medication	873±766	1453±1596	0.024
Extra services	517±228	574±446	0.433
Total cost	2214±1414	2746±2276	0.176
Duration of hospitalization (day)	14.6	16.5	0.230

CURB-65: confusion, urea, respiratory rate, blood pressure, age scoring (Benefitted from the primary source)

DISCUSSION

The costs of illnesses are evaluated in two groups as direct and indirect costs. While indirect costs cover the expenses caused by labor loss associated with disease, direct expenses include the expenses for diagnosis and treatment, monitoring, polyclinic, emergency unit, and hospitalization. Hospitalization costs constitute the most important part of direct health costs [5,6].

CURB-65 and PSI indices are recommended to be considered while deciding on hospitalization, and the place of hospitalization (clinic or intensive care unit) for patients with pneumonia. PSI system evaluates age, place of living, comorbidity, vital findings, laboratory findings, and radiological findings. In CURB-65 system, the presence of confusion, serum urea value, respiratory rate, blood pressure, and the

age of patient are evaluated. It is recommended to hospitalize patients with CURB-65 score of ≥ 2 or PSI score of 4 and 5; however, the decision of hospitalization is made by the physician considering social indication and clinical picture of the patient [1,7-9]. Indeed, some studies have revealed that these indices vary in clinical practice. For instance, in a series regarding patients hospitalized because of CAP, 42% of inpatients could receive ambulatory treatment according to PSI. This rate was reported to be 60% according to CURB-65 [10]. In our study, the median PSI scoring was 108 (32–193, mean 105 ± 35); however, the median CURB-65 score was 2 (0–4). According to PSI, 34 patients were in the first three stages. In contrast, the number of patients whose CURB-65 score was lower than 2 was 18.

The most important factor for the cost is the duration of hospitalization. There are also other factors, including the treatment that is administered and patient compliance to treatment [11,12]. In international studies, the duration of hospitalization has been reported to range from 5 to 11 days [13-16]. Gökırmak et al. [17] reported the mean duration of hospitalization as 14 ± 8 days for 148 pneumonia cases. The mean duration was reported to be 13.5 ± 7.1 days in Yedikule Training and Education Hospital, 14.9 ± 8.3 days in Uludağ University, 10.8 days in a series regarding CAP cases at the age of 60 years and over, and it ranged up to 16 days in various series [18-21].

In the United Kingdom, it is estimated that the annual direct cost of hospital-acquired pneumonia cases is £441 million, the cost of an outpatient is £100, and the cost of an inpatient varies between £1700 and £5100, and hospitalization constitutes 87% of annual cost [22]. The median hospital cost was reported to be 1683 euros in Spain and 1333 dollars in Germany in 2008 [12,23]. In a prospective study conducted with four hospitals in the USA, the median total cost was found to be 4468 euros [24]. In the series performed in our country, it was observed that the costs differed in a wide range. In the province of Eskişehir, the mean cost per patient was calculated to be \$2045 and the daily cost was found to be \$118 in an ICU follow-up for CAP in 2001. In contrast, in patients who were hospitalized and who had a high score of PSI, the mean cost was \$586 and daily cost was \$63 [25]. In Süreyyapaşa Hospital, the treatment cost was \$382 per patient who was hospitalized because of the diagnosis of CAP in 2001 [26]. Doruk et al. [27] found the mean hospital cost as 1630 euros in their study, and 47% of the expenses

Table 8. Comparison of exitus patients and patients who recovered

	Patients who recovered (n=78)	Exitus patients (n=9)	p
Gender (F/M)	20/58	1/8	0.406
Mean age	67.2	81.4	0.003
CURB-65 (mean)	2.0	3.2	0.000
SpO ₂	88.8	89.3	0.860
PSI (mean)	100.7	144.6	0.000
Never smoked/smoked	56/22	9/0	0.104
Pneumonia/other	53/25	2/7	0.011
Hospitalization cost	2325±1798	2733±713	0.485
Medication cost	992±1118	1457±778	0.229
Intervention	518±329	559±208	0.711
Examinations	275±224	237±117	0.613
Extra services	544±314	439±200	0.329

F: female; M: male; CURB-65: confusion, urea, respiratory rate, blood pressure, age scoring; PSI: pneumonia severity index; SpO₂: oxygen saturation with fingertip probe in room air

comprised examinations and 30% comprised medications. In our series, the mean duration of hospitalization was 15.6 days, median was 14 days, mean cost was 2368 TL (€1093, \$1498). We noticed that the duration of hospitalization in our study was longer for several days particularly compared with the series from other countries and the cost was higher than some series. It was thought that this may have resulted from the high number of patients with COPD and with low oxygen saturation. Of our patients, 37% had low oxygen saturation and 64% were diagnosed with COPD. The rate of pneumonia cases with comorbid COPD was reported to be 56% in Sivas and 15% in İnönü University [17,28]. In a series in which pneumonia patients older than 70 years were evaluated, the rate of patients with the diagnosis of COPD was 33% [29]. In 144 pneumonia series, the rate of patients whose oxygen saturation was below 90% was reported to be 30% [10].

In some studies, various features that could affect treatment results and costs depending on the heterogeneous structure of patient groups were determined. For instance, while some studies did not reveal any difference in comparisons between age groups and genders [23,27], our study did not find a significant difference in the cost with regard to age; however, health costs were detected to be higher in male patients. Although the presence of single diseases, such as COPD and DM, did not display a significant difference between genders in our study, the significantly higher number of comorbidities in male patients may have caused this result. In some studies, it was reported that treatment success of CAP did not differ between smoking and non-smoking patients, and smoking status did not significantly change the duration of hospitalization [25,29]. Furthermore, in our study, smoking status did not affect mortality, duration of hospitalization, and cost.

It appears that complications that develop during the course of disease in pneumonia cases also increase both the duration of hospitalization and cost. The most common complication encountered in pneumonia is parapneumonic effusion [30]. In our patients with pneumonia who developed complications, antibiotic therapy was changed, and the treatments were administered for complications. In the patients with parapneumonic effusion, from whom clinical and radiological responses to antibiotic therapy were obtained, effusion was followed up. In contrast, for patients from whom no response was received, the fluid was sampled because of the possibility of empyema. In the patients with abscess/necrotizing pneumonia, clinical and radiological follow-up was conducted, and some techniques, such as abscess drainage, were not used; however, fiberoptic bronchoscopy was implemented in one patient.

Lung abscess is a suppurative lung infection accompanied by parenchymal breakdown and then cavities, including one or more air-fluid level, occur as a result. Similarly, when many cavities smaller than 2 cm occur, it is called necrotizing pneumonia [31]. In our series, no statistically significant difference was observed with regard to PSI and CURB-65 scores between the patients with abscess/necrotizing pneumonia and other patients. All of these patients underwent computerized tomography to evaluate the lung parenchyma in detail. The expense unit that increased the cost the most was for medications. Antibiotic therapies that were empirically initiated as dual were switched to methicillin-resistant *Staphylococcus aureus* in the sputum cultures of two patients, *Pseudomonas aeruginosa* in one patient, and extended-spectrum beta-lactamase (+) producing *Escherichia coli* in one patient. In these patients, four antibiotic therapies were administered during hospital stay and an increase in expenses, particularly for medications, was observed with longer duration of hospitalization.

As the severity and stage of the disease increases in pneumonia cases, the burden of the disease and the cost also accordingly increase. Doruk et al. [27]. found that the cost increased in parallel to the stage of disease. In another series, it was specified that as PSI stage increased, the expenses of medications and examinations and extra expenses, and total cost significantly increased [23]. In our study, it was demonstrated that medication cost in particular was apparently high in the group with high PSI and CURB-65 scores.

Mortality differs depending on the series and study groups. The rates of 8%–16% can reach 50% in cases requiring to be followed up in the intensive care unit [12,23,32,33]. Fine et al. [34] conducted a meta-analysis and evaluated more than 30000 patients in 127 studies. They found the mean mortality rate was 13.7%, and they stated the mortality rate was 5.1% for outpatients or inpatients and 36.5% for patients who required intensive care support. In the study of Fidan et al. [35], this rate was 8.1% in hospitalized patients with CAP, 16% in patients requiring intensive care, and 3.7% in other patients. In our study, the mortality rate was found to be 10.3% in patients hospitalized because of CAP. There was a

significant relationship between the mortality rate and PSI and CURB-65 scores in advanced age. In a multi-center analysis, including >3000 patients with pneumonia, 30-day short-term mortality rate was reported to be associated with male sex, advanced age, and high PSI score [36]. The absence of a relationship between gender and mortality rate in our study may have been because of the low number of patients.

In conclusion, pneumonia, which is quite common in the society, can lead to high costs and mortality, particularly in case of inpatient treatment. In our study, the cost increased in male patients, patients with abscess/necrotizing pneumonia, and patients with high PSI scores. Furthermore, it was found that advanced age and increased CURB-65 and PSI scores affected mortality rate.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Dr. Lütfi Kırdar Kartal Training and Research Hospital (89513307/1009/411).

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