Original Investigation

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Costs of the Patients Hospitalized with Acute Exacerbations of Chronic Obstructive Pulmonary Disease in a University Hospital

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Abstract

Objective: Chronic obstructive pulmonary disease (COPD), although a preventable and treatable disease continues to be a major health problem. Acute exacerbations of COPD is a major cause of hospitalization of patients and it constitutes a significant portion of COPD-related health care costs. In this study, we aimed to determine the cost of patients hospitalized with acute exacerbations of COPD in a university hospital.

Methods: Data of the patients that were hospitalized due to COPD exacerbation between 1 September 2013-1 September 2014 in Hospital of Gazi University Medical Faculty were retrospectively analyzed. Cost data were gathered from data processing department. Costs were identified for drugs, laboratory tests, bed costs and other materials.

Results: A total of 790 patients were hospitalized during twelve months. Among these patients 181 (23.0%) patients had COPD and 99 (12.5%) were hospitalized due to acute exacerbation of COPD. Of these 99 patients 77 (77.8%) were male and 22 (22.2%) were female. Forty-nine (49.5%) patients were hospitalized from the emergency department, 50 (50.5%) patients were from the outpatient clinic. The median age was 70 (64-77) years old and median length of hospital stay was 8 (6-13) days. Ninety-one (91.9%) of them were discharged from the service. Eight (8.1%) patients were transfered to the intensive care unit (ICU) due to respiratory failure, and 7 of these patients (7.4%) hospitalized back to the service after treatment at ICU, 2 (2.1%) patients died. The median cost per patient was 1.064 (726-1.866) Turkish Lira (TL). Drug costs accounted the largest portion (36.0%) of the median cost, followed by bed cost (26.0%). Two (2.1%) of patients died in hospital. Although the number of patients without antibiotic usage is less (17.2% vs 82.8%); the median cost per patient in the antibiotic using group was higher than that were without antibiotic using (median 643 vs 1.162 TL p=0.001). Presence of a comorbidity, hypoxemia, noninvasive mechanical ventilation (NIMV) requirement were existing factors that didn't increase the cost of patients (p>0.05). Only the use of antibiotics was detected as independent factors that increase the total cost (95% CI 0.487 to 12.984, p=0.030).

Conclusion: Acute exacerbation of COPD continues to be an important cause of mortality and economic burden in the hospitalized COPD patients in pulmonary clinics.

Keywords: Acute exacerbation, chronic obstructive pulmonary disease, cost, hospitalization

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) still remains an important cause of mortality and morbidity worldwide, although it is a preventable and treatable disease that is related to smoking. The prevalence of COPD is becoming higher because of increasing lifespans and COPD risk factors. It is estimated that this disease affects 26.8 million people, and 12 million people are undiagnosed in the USA. With this increase in prevalence, COPD-related health costs are also increasing. Although the direct cost of COPD was $18 billion in 2002 in the USA, this increased to $29.5 billion in 2010. It is stated that the annual cost of COPD is $49.9 billion and that 59% of this cost constitutes direct costs, including physician or emergency service visits, the use of additional drugs, and hospital stays (1). Acute exacerbation is the primary cause of hospitalization in COPD patients and accounts for 50%–75% of COPD-related direct health costs (2, 3). The cost of serious exacerbations is higher. In a study conducted in the USA in 2008, it was specified that the cost of hospitalization due to exacerbation of COPD was $7,242 for a standard COPD exacerbation, but this increased to $44,909 when the need for intubation and intensive care arose (4).

In Turkey, data on the prevalence, mortality, and cost of COPD are limited. According to the results of two studies conducted in two different regions of Turkey, the prevalence of COPD varies between 19% and 28% among males and between 9% and 10% among females (5, 6). Considering the data obtained from the program, which was conducted by the General Directorate of Basic Health Services at the Ministry of Health and titled "Prevention and Control of Chronic Airway Diseases (COPD-Asthma)", COPD is the third most common cause of death and leads to 26,000 deaths in a year (7).

In this study, it was aimed to determine the costs of patients who were hospitalized for acute COPD exacerbation in a university hospital and who did not need recent invasive or non-invasive mechanical ventilation or intensive care.

METHODS

Data on the costs of patients who were hospitalized because of a diagnosis of COPD in the Clinic of Thoracic Diseases in Gazi University Medical Faculty between September 1, 2013 and September 1, 2014 were obtained from the data processing unit and evaluated retrospectively.

The diagnosis of COPD was established in accordance with the criteria of the Global Initiative for Chronic Obstructive Lung Disease (GOLD). In patients who complained of progressively increasing dyspnea and/or cough and sputum, a diagnosis of COPD was made when the post-bronchodilator FEV_1/FVC rate was <70% in spirometric examination (8). Patients who had previously undergone a respiratory function test (RFT), had a COPD diagnosis, and were hospitalized because of an attack were included in the study.

Although there are no universal criteria for the definition of exacerbation, the GOLD criteria were used. A sudden increase in the symptoms of cough, sputum, and dyspnea, which caused a change or increase in the use of regular medications, apart from normal daily variations, was defined as exacerbation. The Anthonisen criteria were taken as a basis for the use of antibiotics during exacerbation. An antibiotic was initiated in the presence of two cardinal symptoms on condition that one of the cardinal symptoms (dyspnea, sputum purulence, and amount of sputum) was increased sputum purulence (9).

Patients who were diagnosed with COPD but hospitalized for other causes rather than exacerbation were excluded from the study. Patients who were included in the study and underwent non-invasive mechanical ventilation (NIMV) were those who had used NIMV at home. Because package pricing was used in the intensive care unit, patients who were monitored in the intensive care unit were not included in the study.

Patients with comorbidities had these under control with oral medication. Patients whose hospitalizations were prolonged because of their comorbidities were not included in the study.

Patients' demographic data, places of hospital admission, health insurances, and durations of hospitalization were recorded. Cost data were grouped as the costs of all drugs, including oxygen therapy, costs of imaging and laboratory examinations, bed fees, and other costs (consumables). All costs were given in Turkish Lira (TL).

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows (version 17.0, Chicago, IL, USA). Non-normally distributed data were evaluated with the Mann–Whitney U-test and presented as the median and 25^{th}-75^{th} percentile range. For evaluating normally distributed data, Student's t-test was used. Categorical variables were given as percentages and evaluated with a chi-square test or Fisher's exact test. The effect of age, gender, social insurance, place of hospitalization, duration of hospitalization, presence of comorbidity, presence of hypoxemia, use of antibiotics, and use of NIMV on the total increase in cost was assessed using linear regression analysis. Variables with the value of $p<0.05$ were included in univariate analysis.

RESULTS

In a 12-month period, a total of 790 patients were hospitalized in the Clinic of Thoracic Diseases and treated. Of these patients, 181 (23.0%) were hospitalized because of COPD. Ninety-nine patients (12.5%) who conformed to the criteria of the study were analyzed.

The median age of these 99 patients was 70 (64–77) years. Seventy-seven (77.8%) were male and 22 (22.2%) were female. Of these patients, 68 (68.8%) had stopped smoking, 19 (19.2%) were active smokers, and 12 (12.1%) had never smoked. The median use of cigarettes was 40 (25–64) packs/year. Forty-nine patients (49.5%) were transferred from the emergency unit for hospitalization, and 50 patients (50.5%) were transferred from the outpatient clinic. Considering their health insurances, 43 patients (43.5%) were hospitalized on behalf of the Social Security Institution, 31 patients (31.2%) on behalf of the Retirement Fund, 24 patients (24.2%) on behalf of Bağ-kur, and 1 patient (1.1%) on behalf of private insurance. No statistically significant difference was found between their social insurances and durations of hospitalization and the total cost per patient ($p>0.05$). Although 80 patients (80.8%) had at least one comorbidity, 19 patients (19.2%) had no comorbidity (Table 1).

Table 1. General features of patients

Feature	n=99 (%)
Age (median) (25^{th}–75^{th} percentiles)	70 (64-77)
Gender	
Male	77 (77.8)
Female	22 (22.2)
Cigarettes (packs-year) (median) (25^{th}–75^{th} percentiles)	40 (25-64)
Comorbidity	
Yes	80 (80.8)
None	19 (19.2)
Place of hospitalization	
Emergency unit	49 (49.5)
Outpatient clinic	50 (50.5)
Health insurance	
Bağ-kur	24 (24.2)
SII	43 (43.5)
Retirement Fund	31 (31.2)
Other	1 (1.1)

SII: Social Insurance Institution

Table 2. Hospitalization features of patients

Feature	n=99 (%)
Use of antibiotics	
Yes	82 (82.8)
None	17 (17.2)
Hypoxemia	
Yes	77 (77.8)
None	22 (22.2)
Use of NIMV	
Yes	15 (15.2)
None	84 (84.8)
Duration of hospitalization (days) (median) (25^{th}–75^{th} percentiles)	8 (6-13)
Result	
Discharge from the clinic	91 (91.9)
Transfer to the intensive care unit	8 (8.1)
Deaths	2 (2.1)

NIMV: Non-invasive mechanical ventilation

Table 3. Distribution of costs per patient

Costs	Median (25^{th}–75^{th} percentiles) TL
Grand total	1,064.0 (726.0–1,866.0)
Drug costs	383.0 (134.0–689.0)
Bed costs	270.0 (180.0–450.0)
Examination costs	230.1 (155.7–384.5)
Consumables and other costs	169.2 (94.9–332.2)

The median duration of hospitalization was found to be 8 (6–13) days. With respect to the duration of hospitalization, no statistically significant difference was detected between the groups using and not using NIMV due to chronic respiratory failure (11.1±6.4 days vs. 12.1±12.1 days; p=0.257) or between the groups having and not having hypoxemia (10.1±4.6 days vs. 11.5±8.6 days; p=0.466).

Although antibiotic therapy was used in addition to exacerbation treatment in 82 patients (82.8%), no antibiotic was used in 17 patients (17.2%). Hypoxemia was observed in 77 patients (77.8%), and 22 patients (22.2%) were hospitalized because of severe COPD exacerbation. Although 15 patients (15.2%) were administered NIMV during hospitalization, 84 patients (84.8%) were not. Of the patients, 91 (91.9%) were discharged from the clinic after treatment, but 8 patients (8.1%) were taken to the intensive care unit because of respiratory failure. Seven of these patients (7.4%) were transferred to the clinic, but two patients (2.1%) died (Table 2).

The median total cost per patient was 1,064.0 (726.0–1,866.0) TL; the median total drug cost per patient was 383.0 (134.0–689.0) TL; the median bed cost was 270.0 (180.0–450.0) TL; the median examination cost was 230.1 (155.7–384.5) TL; and the median cost of consumables and other expenses was 169.2 (94.9–332.2) TL. Drug costs constituted the largest part of the total cost (36%). Bed costs accounted for 25.4%, examination costs for 21.6%, and consumables and other costs for 15.9% (Table 3, Figure 1).

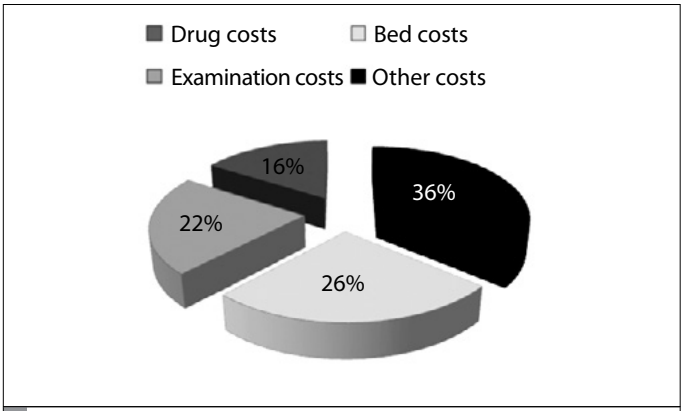

Figure 1. Distribution of costs

Although the number of patients not using antibiotics was low (17.2% vs. 82.8%), the median total cost per patient was found to be 1,162.0 (863.0–2,295.8) TL in the group using antibiotics and 643.0 (272.0-1,189.5) TL in the group not using antibiotics. The total cost was higher in the group using antibiotics (p=0.001).

Effects of age, gender, social insurance, duration of hospitalization, presence of comorbidity and hypoxemia, and application of NIMV on the increase in total cost were not detected (p>0.05). Only the use of antibiotics was found to be an independent factor that increased the total cost [95% confidence interval 0.487–12.984, p=0.030] (Table 4).

DISCUSSION

Chronic obstructive pulmonary disease is a disorder that increases clinical and economic burdens. Acute exacerbations of COPD, which cause an increase or change in regular therapies and generally require hospitalization, account for a major part of COPD-related health costs (85%) (10, 11) and are an important cause of COPD-induced mortality (12). In this study, which aimed to determine the cost for patients with COPD exacerbation in a university hospital, the total cost per patient was 1,064.0 (726.0–1,866.0) TL. The use of antibiotics was found to be a factor that increased the cost in our study group, which did not have severe respiratory failure, invasive mechanical ventilation, or the need for intensive care.

Although there are many studies that investigated the cost of COPD in health expenses in the literature, there are a few studies on the cost of COPD exacerbation in particular.

Toy et al. (13) evaluated 11 original studies in their review and reported that the cost of COPD exacerbation varied between $88.0 and $7,757.0. In the studies that they reviewed, it was stated that hospitalization constituted a great part of the cost of COPD (between 38% and 93%).

In the analysis of Perera et al. (14), which was conducted within the scope of the Agency for Healthcare Research and Quality (AHRQ) Healthcare Cost and Utilization Project (HCUP) Nationwide in the USA, a total of 1,254,703 hospitalized cases of COPD exacerbation were evaluated. In this study, the mean total cost was found to be

Table 4. Linear regression analysis of factors affecting the total cost of patients

	Univariate analysis		Multivariate analysis	
Features	**95% Confidence interval**	**p**	**95% Confidence interval**	**p**
Age (<65/≥65)	−1819.924–292.066	0.152		
Gender (female/male)	1194.607–1011.198	0.868		
Social insurance (SSI/other)	−1042.783–914.225	0.895		
Place of hospitalization (emergency unit/outpatient clinic)	1569.203–276.772	0.165		
Duration of hospitalization (median, above/below 8 days)	249.174–3197.228	0.023	−13.562–2.403	0.329
Presence of comorbidity (yes/none)	−1484.791–901.868	0.625		
Presence of hypoxemia (yes/none)	−2098.223–4448.434	0.473		
Use of antibiotics (yes/none)	97.633–2124.453	0.032	0.487–12.984	0.030
NIMV (yes/none)	−574.610-1726.219	0.319		

NIMV: Non-invasive mechanical ventilation; SSI: Social Security Institution

$9,545.0±12,700.0 and hospital mortality was reported to be 4.3%. Compared with other countries, the fees paid by the government for hospitalization and treatment are lower in Turkey. Therefore, the total cost of COPD exacerbation per patient seems low.

Considering the studies performed in Turkey, the mean total cost was found to be 1,833.85 TL in a study conducted by Varol et al. (15), in which 376 patients with COPD exacerbation who were hospitalized in the Clinic of Thoracic Diseases during 12 months between 2005 and 2006 were evaluated. Also, in their study, the total cost per patient was found to be higher in the group using antibiotics than in the group not using antibiotics. In our study, the median total cost was found to be 1,064.0 TL. The low total cost in our study might have resulted from the fact that the patients with a COPD attack who were included in our study did not have any comorbidities that required a change in medical treatment and that patients needing intensive care, except those that had used NIMV previously, were excluded from the study.

Similarly to our study, the mean total cost per patient was reported to be $1,765.0±2,139.0 in the study of Ornek et al. (16), in which they determined the costs for patients with COPD exacerbation who were hospitalized in the clinic of thoracic diseases in a tertiary-care university hospital. A need for NIMV occurred because of acute respiratory failure in half of the patients in that study. Moreover, patients that needed intensive care, underwent invasive mechanical ventilation, or died were also included in the study. The duration of hospitalization was longer than in our study [mean 11.4±7 (1–49) days]. Considering all these factors, the total cost per patient is significantly higher than in our study.

In the study of Ozkaya et al. (17), 7,832 patients who were hospitalized because of acute exacerbation of COPD between 2005 and 2009 were evaluated. During a 5-year follow-up period, the mean cost of hospitalization per attack was found to be $718±364. The greatest part of this cost was constituted by drug costs, with a rate of 53.5%, which was followed by bed costs at 19.6% and then the costs of laboratory and imaging techniques at 16%. In this study, 2.2% of patients died. In our study, drug costs (36%) constituted a major part of the total cost and were followed by bed costs (26%), which was similar to the results of the study of Ozkaya et al. (17) the mortality rate was found to be 2.1% in our study.

In the study of Hacievliyagil et al. (18), it was reported that 33.4% of patients who were hospitalized in the clinic of thoracic diseases within a 4-month period had acute exacerbation of COPD. The mean cost of hospitalization was found to be 1,978.0 TL for lung cancer, 1,479.0 TL for pneumonia, 1,336.0 TL for COPD, and 925.0 TL for asthma.

In another study recently conducted by Çeldir Emre et al. (19), the clinical factors that affected hospital cost were examined in 241 cases that were hospitalized because of COPD exacerbation. Although the mean total cost was found to be 1,103.2±557.3 TL, the presence of comorbidity increased the duration of hospital stay and direct costs significantly, but gender, age, and the type of social insurance did not increase the cost.

In our study, although the use of antibiotics was determined to be a factor that increased the cost, the factors of the presence of comorbidity and hypoxemia and administration of NIMV did not affect the cost. The cause of hospitalization was hypoxemia in most of our patients (77.8%). The patients who were administered NIMV were those who underwent NIMV using their own devices. The patients with comorbidities had these under control with oral medication. Therefore, it was thought that unchanged medications for comorbidities did not increase the cost.

Similarly to the studies mentioned above, the median duration of hospitalization was found to be 8 days in our study. We had no patient who was hospitalized for more than 14 days.

CONCLUSION

This study is valuable because it evaluated the costs of patients with a COPD attack who were hospitalized in a tertiary-care university hospital. It was emphasized that the use of antibiotics increased the cost in this patient group. Also, in university hospitals, COPD attacks continue to be an important economic burden and cause of mortality in patients who are hospitalized in the clinic of thoracic diseases.

Ethics Committee Approval: Because all the data was retrospective and there was no intervention to patients' diagnosis and treatments, permission from the chief physician has been obtained but no ethical committee approval.

Informed Consent: Because the study was retrospective, based on cost data and there was no intervention to patients's diagnosis and treatments, informed consent was not obtained.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - F.Y., M.T., C.Ö.; Design - F.Y., M.T., C.Ö.; Supervision - C.Ö.; Data Collection and/or Processing - F.Y., M.T.; Analysis and/or Interpretation - F.Y., M.T.; Literature Review - F.Y., M.T.; Writer - F.Y., M.T.; Critical Review - C.Ö.

Conflict of Interest: No conflict of interest was declared by the authors.

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