Hospitalization costs of lung cancer diagnosis in Turkey: Is there a difference between histological types and stages?*

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SUMMARY

Hospitalization costs of lung cancer diagnosis in Turkey: Is there a difference between histological types and stages?

Introduction: To establish the direct costs of diagnosing lung cancer in hospitalized patients.

Materials and Methods: Hospital data of patients who were hospitalized and diagnosed as lung cancer between September 2013 and August 2014 were retrospectively analyzed. Patients who underwent surgery for diagnosis and who were initiated with cancer treatment during the same hospital stay were excluded from study. Histological types and stages of lung cancer were determined. Expenses were grouped as laboratory costs, pathology costs, diagnostic imaging costs, overnight room charges, medication costs, blood center costs, consumable expenditures' costs and inpatient service charges (including consultants' service, electrocardiogram, follow-up, nursing services, diagnostic interventions).

Results: Of the 68 patients, 55 (81%) had non-small cell lung cancer (NSCLC), 13 (19%) had small cell lung cancer (SCLC). 47% of patients with NSCLC had stage 4 disease and 86% of patients with SCLC had extensive stage disease. Median total cost per patient was 910 (95% CI= 832-1291) Euros (€). Of all costs, 37% were due to inpatient service charges and 22% were medication costs. Median total cost per patient was 912 (95% CI= 783-1213) € in NSCLC patients and 908 (95% CI= 456-2203) € in SCLC patients (p> 0.05). In NSCLC group, total cost per patient was 873 (95% CI= 591-1143) € in stage 1-2-3 diseases and 975 (95% CI= 847-1536) € in stage 4 disease (p> 0.05). In SCLC group total cost per patient was 937 € in limited stage and 502 (95% CI= 452-2508) € in extensive stage (p> 0.05).

Conclusion: There is no significant difference between costs related to diagnosis of different lung cancer types and stages in patients hospitalized in a university hospital.

Key words: Lung cancer, cost analysis, health expenditures

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ÖZET

Türkiye'de akciğer kanseri tanısında hastane yatış maliyetleri: Hastalığın histolojik tipi ve evresi maliyeti etkiler mi?

Giriş: *Bu çalışmada hastanede yatan hastalarda akciğer kanseri tanısının doğrudan maliyetlerinin belirlenmesi amaçlanmıştır.*

Materyal ve Metod: *Eylül 2013 ve Ağustos 2014 tarihleri arasında hastaneye yatış yapılarak akciğer kanseri tanısı alan hastalara ait hastane verileri retrospektif olarak tarandı. Cerrahi ile tanı alan ya da ilk yatışı içerisinde tedavisi başlanan hastalar çalışma dışı bırakıldı. Akciğer kanserlerinin histolojik tipleri ve evreleri belirlendi. Harcamalar laboratuvar maliyetleri, patoloji maliyetleri, tanısal görüntüleme maliyetleri, ilaç maliyetleri, kan merkezi maliyetleri, günübirlik yatış harcamaları, sarf maliyetleri, hizmet harcamaları (konsültasyon, takip, hemşirelik, tanısal girişimler dahil) olarak gruplandırıldı.*

Bulgular: *Toplam 68 hastadan 55 (%81)'i küçük hücreli dışı akciğer kanseri (KHDAK), 13 (%19)'ü küçük hücreli akciğer kanseri (KHAK) idi. KHDAK hastalarının %47'si evre 4 idi, KHAK hastalarının %86'sı yaygın evre idi. Hasta başına medyan toplam maliyet 910 (%95 GA= 832-1291) Euro (€) idi. Tüm maliyetlerin %37'sini hizmet maliyetleri ve %22'sini ilaç maliyetleri oluşturmaktaydı. KHDAK hastalarında hasta başına medyan toplam maliyet 912 (%95 GA= 783-1213) €, KHAK hastalarında 908 (%95 GA= 456-2203) € idi (p> 0.05). KHDAK grubunda evre 1,2,3 hastalarda hasta başına toplam maliyet 873 (%95 GA= 591-1143) € ve evre 4 hastalarda 975 (%95 GA= 847-1536) € idi (p> 0.05). KHAK grubunda sınırlı evrede hasta başı toplam maliyet 937 €, yaygın evrede 502 (%95 GA= 452-2508) € idi (p> 0.05).*

Sonuç: *Üniversite hastanesinde hastaneye yatarak tanı alan akciğer kanseri hastalarında tanı maliyetlerinde farklı histolojik tipler ve evreler arasında istatistiksel olarak anlamlı fark bulunmamıştır.*

Anahtar kelimeler: *Akciğer kanseri, maliyet analizi, sağlık harcamaları*

INTRODUCTION

Lung cancer is the most common type of cancer and the leading cause of cancer death in Turkey, as it is all around the world. In Turkey, the incidence of lung cancer in 2012 was 34.7/100.000 (1,2). The budget reserved for cancer treatment has a significant place among all healthcare expenditures. In European Union, €126 billion was spent on all cancer types in 2009 and lung cancer had the greatest share of this expenditure, accounting for 15% (€18.8 billion) (3). Lung cancer accounts for 11% of all hospital costs in European Union, and the loss of disability-adjusted life years (DALY) has been shown to average €350,000 per patient (4). There is no specific data about lung cancer costs in Turkey; however it was reported that approximately €3 billion was spent for cancer treatment in 2013 and 4.1% of all hospitalizations were caused by neoplasia in 2012 (5). Since the greatest part of all costs relating to cancer consists of the treatment and follow-up expenses, the respective cost analyses usually include data on such expenses. On the other hand, cost data of the diagnosis is limited.

Diagnosis of lung cancer, as in all other cancer types, can be established in outpatient or inpatient settings, depending on the diagnostic method and the clinical status of the patient. Although there are differences in diagnostic methods and infrastructure level between institutions in Turkey, healthcare charges are standard in the public healthcare facilities and the cost analyses to be made can reflect the situation throughout the country. For this reason, the present study aimed to make the cost analyses for the patients who were admitted and diagnosed with primary lung cancer at a university hospital.

MATERIALS and METHODS

Patient Selection

The present study retrospectively evaluated the patients who were admitted and followed-up in a university hospital thoracic diseases clinic between September 2013 and August 2014. Among these patients, those who were hospitalized due to any indication and diagnosed with primary lung cancer during the hospital stay, and who continued to receive non-cancer treatments during that stay were included in the study. Pathology results are reported in 5 to 10 days at our hospital, and therefore, patients are discharged without waiting for the pathology results if there is no clinical indication. For all patients, demographics, histological type and stage of lung cancer, diagnostic methods, and length of stay were recorded. The patients with non-small cell lung cancer (NSCLC) were staged based on the American Joint Committee on Cancer (AJCC) Seventh TNM staging system, the patients with small-cell lung cancer (SCLC) were staged based on the Veterans Administration Lung Study Group (VALG) classification system as limited or extensive stage (6,7). The patients who were diagnosed with surgical intervention (mediastinoscopy, thoracotomy,

videothoracoscopy), who were initiated with cancer treatment during the same hospital stay, and who were not covered by social security were excluded.

Cost Analysis

Data related to the costs of the patients were obtained from the data processing unit of our hospital for assessment. The cost analysis of 68 patients in total was made by establishing all direct medical costs during the hospitalization. The cost types were classified into laboratory costs, pathology costs, diagnostic imaging costs, overnight room charges, medication costs, blood center costs, consumable expenditures' costs, and inpatient service charges (including consultants' service, electrocardiogram, follow-up, nursing services, diagnostic interventions). The exchange rate was 1€= 2.88 TL at the time of the study.

Statistical Analysis

Data recording and statistical analyses were performed using SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Distribution of the data was established using Kolmogorov-Smirnov test. Since all data were not normally distributed, all cost results were expressed as median (CI= confidence interval). Between-group comparisons were made using the Mann-Whitney U-test. p< 0.05 was considered significant.

RESULTS

The mean age of 68 patients was 64.3 ± 9.9 years. There were 11 (16.2%) female and 57 (83.8%) male patients. Fifty-five (80.9%) patients were diagnosed with NSCLC (21 with squamous cell carcinoma, 22 with adenocarcinoma and 12 with other types or unclassified), and 13 (19.1%) patients were diagnosed with SCLC. Diagnoses were established via fiberoptic bronchoscopy (FOB) in 47 (69.1%) patients, EBUS (endobronchial ultrasound)-FOB in 9 (13.2%) patients, pleural fluid analysis in 5 (7.4%) patients, and radiological imaging-guided biopsy in 7 (10.3%) patients. Ninety-two point three percent of the SCLC-diagnosed patients were diagnosed via FOB. There was no difference in diagnostic methods between SCLC and NSCLC. Twenty six (47.3%) of NSCLC were stage IV disease and 11 (84.6%) of SCLC were extensive stage (Table 1).

Median length of stay was 13 (range: 6.25-22) days for all patients. The length of stay for NSCLC-diagnosed patients was 14 (range= 6-22) days compared to 12 (range= 7-20.5) days in SCLC-diagnosed patients (p> 0.05).

Table 1. General characteristics of all patients	
	n= 68 (%)
Mean age ± SD	64.3 ± 9.9
Gender; n (%)	
Female	11 (16.2)
Male	57 (83.8)
Cancer type; n (%)	
NSCLC	55 (80.9)
Squamous cell carcinoma	21 (30.9)
Adenocarcinoma	22 (32.4)
Other types/unclassified	12 (17.6)
SCLC	13 (19.1)
Stage; n (%)	
NSCLC	
Stage I-II-III	25 (45.5)
Stage IV	26 (47.3)
SCLC	
Limited stage	2 (15.4)
Extensive stage	11 (84.6)

SD: Standard deviation, NSCLC: Non-small cell lung cancer, SCLC: Small cell lung cancer.

Total cost of 68 patients during the hospital stay was 72,168 €, and the median total cost of all types per patient was 910 (95% CI= 832-1291) € (Table 2). Among all costs, 37% were inpatient service charges (26,862 €), 22% were medication costs (15,500 €), 13% were overnight room charges (9623 €), 9% were laboratory costs (6555 €), 8% were consumable expenditures' costs (5797 €), 6% were diagnostic imaging costs (4240 €), 4% were pathology costs (2779 €), and 1% were blood center costs (812 €) (Figure 1).

The median total of all cost types per patient was 912 (95% CI= 783-1213) € for NSCLC, and 908 (95% CI= 456-2203) € for SCLC (p> 0.05). Inpatient service charges were 263.5 € for NSCLC compared to 518 € for SCLC (p= 0.028). There were no statistically significant differences in other cost types between both cancer types (Figure 2). For NSCLC, total cost per patient was 873 (95% CI= 591-1143) € for stages I-II-III diseases and 975 (95% CI= 847-1536) € for stage IV disease (p> 0.05). For SCLC, total cost per patient was 937 € for limited stage and 502 (95% CI= 452-2508) € for extensive stage (p> 0.05). There was no significant difference in costs between genders and age groups of above and below 65.

Table 2. All types of hospitalization costs of lung cancer diagnosis (in terms of €)

	Total	Mean ± SD	Median	25. - 75. percentile
Inpatient service charges	26,862	395 ± 338.6	436.1	101-593.9
Medication	15,500	228 ± 537.6	66.3	19.6-152.3
Overnight room charges	9623	141.5 ± 109	135.4	65.1-208.3
Laboratory	6555	96.4 ± 98.5	63.2	39.5-115.5
Consumable expenditures	5797	85.2 ± 92	58.3	4.5-125.5
Diagnostic imaging	4240	62.4 ± 62.2	54.5	21.6-82
Pathology	2779	40.7 ± 40	35.1	11.5-50.3
Blood center*	812	12 ± 78.4	-	-
General total	72,168	1061.3 ± 947.7	910.2	457.6-1404.3

SD: Standard deviation.
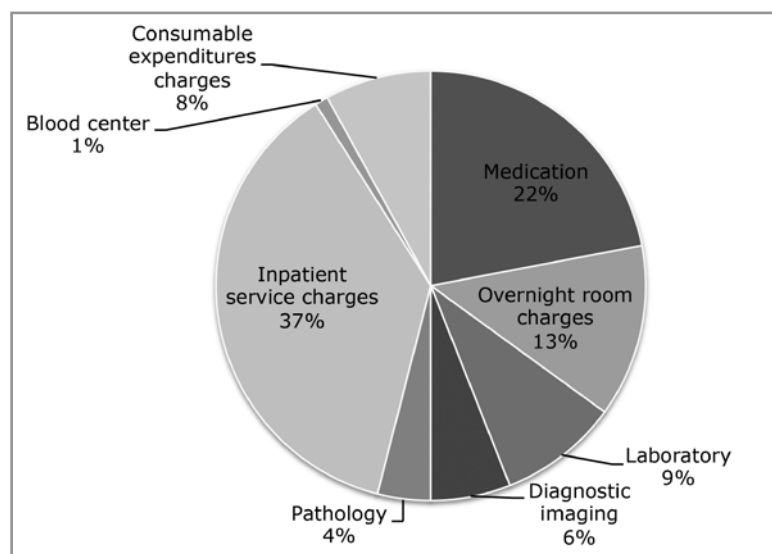* Blood products were needed for 9 patients.

Figure 1. Distribution of all types of costs.

DISCUSSION

In the present study, we assessed hospitalization costs of lung cancer diagnosis in 68 patients at a university hospital. Total cost per patient was found 910 €, and there were no statistically significant difference in total costs per patient between different stages and cancer types.

Lung cancer is the leading cause of cancer death all around the world, and economic burden of the disease is extremely high, which makes the cost analysis studies popular. This type of studies usually consists of costs related to diagnosis and treatment of lung cancer. Treatment related costs makes up the greatest portion of all expenses. Costs differ among the type of treatment chosen-surgery, chemotherapy or radiotherapy- according to the type and stage of the disease. In this study, we analysed only costs related to diagnosis. Inpatient service charges had the greatest share among all cost types, accounting for 37%. It costs about 50% higher in SCLC than NSCLC. Even though study designs are different, in their study Corral et al. showed that other inpatient care costs make up 19.9% of all types of costs in patients with NSCLC and 28.7% in patients with SCLC (8). In our study, inpatient service charge consisted of costs due to consultants' service, electrocardiogram, follow-up, nursing services and diagnostic interventions. Costs of consultants' service, electrocardiogram and diagnostic interventions were not significantly different between the two cancer types. And also we found no difference in length of hospitalization between the two cancer types. Difference in inpatient service charges might only be the costs related to acute or chronic illnesses or complications. The mean age was 65.6 ± 10 in NSCLC patients and 58.5 ± 9 in SCLC patients (p< 0.05). Chronic illnesses and also costs related to them are expected to be higher in older age group but unfortunately we didn't have the exact data of our study population. As SCLC patients were younger, we could suggest that the difference in inpatient service charges might be due to complications or higher percentage of acute illnesses at admission rather than chronic illnesses.
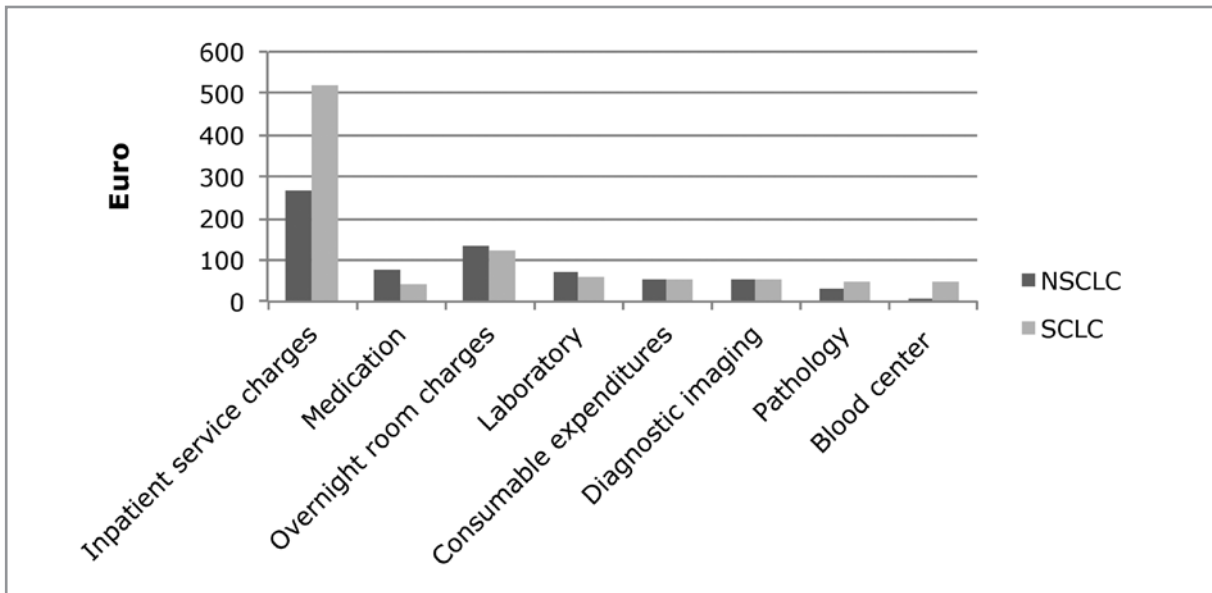
Figure 2. Distribution of costs in NSCLC and SCLC. The difference in inpatient service charges was statistically significant between two cancer types (p< 0.05).

As far as we know, this is the first study that showed the effects of cancer type and stage on hospitalization costs of lung cancer diagnosis in Turkey. In a different study, Esin et al. analyzed all costs generated due to lung cancer in 78 patients between 1998 and 2002 and found the diagnosis cost as 1.451 TL ($1.015; Exchange rate $1= 1.43 TL). Healthcare expenses, including medication, care and overnight room charges, accounted for 34% of this cost (9). That study showed that the diagnosis cost accounted for 13% of the cost generated throughout the follow-up of the patient.

The study by Arca et al., which was conducted at a tertiary healthcare facility in Spain in 2003, established that the cost per patient was 6579 € (exchange rate: 1€= 1.73 TL) for the patients diagnosed upon hospitalization. The same study found the diagnosis cost as 7555 € for NSCLC and 5140 € for SCLC (p< 0.05). Additionally, advanced disease was shown to cause higher costs compared to early stages for both cancer types (10). The studies by Wolstenholme and Whynes found the cost to diagnose lung cancer as 7618 TL (exchange rate £1= 2.57 TL) for NSCLC and 7082 TL for SCLC in United Kingdom (11). We found no difference in total costs between the two cancer types. Costs were higher in stage-IV disease than stages I-II-III in NSCLC and extensive stage than limited stage in SCLC; however,

these differences were not statistically significant. Since these differences will be affected by factors such as treatment patterns, diagnostic techniques, health care system, unit costs, and study designs, it would be inappropriate to compare the results of these studies.

In our study, the length of stay was 14 days for NSCLC and 12 days for SCLC diagnosed upon hospitalization. Similarly, Wolstenholme and Whynes found the mean length of stay as 13.1 and 11.2 days for NSCLC and SCLC, respectively, at diagnosis (11). Hacıevliyagil et al. reported 9.3 days as the mean length of stay for patients diagnosed with lung cancer who were admitted for any reason (12). In Turkey, the mean length of stay was 3.9 days for all disease groups based on the data for 2013 (13). Although there were none in our study, inappropriate admissions to accelerate the process at diagnosis will cause extra costs and prolonged occupancy of beds as shown by the present study. Carrasquer et al. found the rate of inappropriate admissions as 68% (14).

The results of "The National Lung Screening Trial" (NLST), which is the most extensive study conducted recently for lung cancer screening via low-dose computed tomography, suggest that earlier diagnosis and lower mortality rates can be achieved by screening designated risk groups (15). When the

screening programs become widespread, there will be more interventions for diagnosing lung cancer and the share of diagnostic costs among the general health budget would be expected to increase. In order to show variations in diagnostic costs over years, when we compare our findings to the study by Esin et al, the diagnosis cost per patient was $1.015 13 years ago and $1.213 in our study (using the US Dollar instead of Euro under the conditions of Turkey with an average annual inflation rate of 8%) (9). These results suggest that healthcare charges of Turkey have not increased significantly over the years and also are far below than those in the European Union countries.

Although the present study has not aimed to provide the costs of the patients diagnosed without hospitalization, we believe that this is a limitation for the study. Comparison of the costs with and without hospitalization might reduce inappropriate admissions. Secondly, although we couldn't reach the main reason of the difference in inpatient service charges between two cancer types, we showed that this difference did not effect the overall results. Lastly, this study only represents data from a single center.

In conclusion, this study provides information about hospitalization costs of lung cancer diagnosis in a university hospital. There was no difference in cost of lung cancer diagnosis between different types and stages of disease. As healthcare charges are standard in all public healthcare facilities in Turkey, we can say that our results may reflect the situation throughout the country.

CONFLICT of INTEREST

All authors declare that there are no personal or professional conflict of interest regarding any aspect of this study.

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