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Original Article

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The Survival Rate in Patients with Lung Carcinomas and Its Association with Histological Type

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Abstract

Introduction: Lung cancer is the leading cause of cancer-related death worldwide. The high incidence and poor prognosis of lung cancer have made it a major public health problem associated with low survival rates. Smoking is one of the most important risk factors for lung cancer. The present study aimed to investigate survival among patients with lung cancer admitted to a referral hospital and its association with various factors, particularly histological type.

Methods: In this retrospective cohort study, patients with primary lung cancer admitted to a university referral hospital over 7 years (2016–2022) were evaluated. Data were extracted from hospital records and follow-up visits or telephone calls. The follow-up period continued until death or the end of the study. Survival analysis was performed using the Kaplan-Meier method, and survival curves were compared using the Log-Rank test. The Cox proportional hazards regression model was used to identify factors associated with survival. A p-value of less than 0.05 was considered statistically significant.

Results: Of 163 patients, 121 (74.2%) were male, and 42 (25.8%) were female. The mean age of the patients was 62 ± 13.5 years. Ninety-nine patients (60.7%) were smokers. Cough was the most common symptom. Surgery was done in 63 patients (38.7%). The most common type of cancer was adenocarcinoma (55.8%). The mean and median survival times were 11.5 ± 0.6 and 9 ± 0.3 months, respectively. The 1-, 2-, and 3-year survival rates were 34%, 9%, and 2%, respectively. Survival decreased with increasing age. Histological type was significantly associated with survival. No statistically significant associations were found between survival and smoking status, gender, clinical manifestations, or treatment type.

Conclusions: Lung cancer is associated with high mortality and low survival rates. The most common type in a referral center in Iran was adenocarcinoma. Survival rates are related to the histological type of tumor and age of the patients. There is a need to increase public awareness and education for early diagnosis and medical consultation.

Key words: Age factors, Carcinoma, Histological type, Lung neoplasms, Prognosis

Introduction

Lung cancer is a global health problem. In terms of incidence, it is the second most common cancer, whereas it is the leading cause of cancer-related mortality in both men and women (1-3). In Europe, its prevalence is listed in third place (4). The highest numbers of lung cancer cases are reported

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in North America, Europe, and East Asia, whereas the rates are lower in Africa and South and West Asia (1, 5, 6). In Iran, as in many other countries, cancer is the third leading cause of death after cardiovascular diseases and accidents (1, 6, 7). Lung cancer is also one of the five most common cancers in the country, ranking second in men and third in women in terms of mortality (5, 8). The incidence of lung cancer in Iran is increasing (2, 9), although it is decreasing in other countries (10).

Currently, lung cancer is classified into two groups: non-small cell lung carcinoma (NSCLC) and neuroendocrine carcinoma (NEC). The first group includes squamous cell carcinoma (SCC), adenocarcinoma, and large cell carcinoma. In the second group, there are Grade I NEC (carcinoid tumor), Grade II NEC (atypical carcinoid tumor), Grade III NEC (large cell), and Grade IV NEC (small cell lung cancer or SCLC). In the NSCLC group, which is larger, adenocarcinoma is a more frequent type than squamous cell carcinoma (3).

In Iran, squamous cell carcinoma (2, 11) and adenocarcinoma are reported to be the most frequent types of lung cancer (5, 12).

The main risk factor for lung cancer is smoking, and 60%–85% of patients with lung cancer have a history of current or former smoking (1, 3–5, 13). Patients may present with various clinical manifestations and complications, and most are diagnosed at advanced stages (1, 3, 5, 7, 12-14). After definitive diagnosis and staging, surgery may be feasible in approximately 20%–30% of patients with early-stage lung cancer, followed by adjuvant treatment when indicated. In advanced cases, only nonsurgical treatments such as chemotherapy, radiotherapy, and immunotherapy or multimodality combinations are used (3, 5, 7, 11, 15-17).

Survival among patients with lung cancer is an important outcome measure and varies across countries, although it remains low worldwide. The overall 5-year survival rate is about 16%, with 18.3% for women and 13.8% for men. The 5-year survival rate after surgery in stage I of the disease is about 65%, and for stage II is about 41% (3). This number is about 13% in Europe as a whole (18).

The median survival time has been reported to range from 8.4 to 28.8 months (11, 12). The 5-year survival rate of patients is also mentioned in Iranian studies from 7% to 26% (11). Survival may be associated with several variables, including age, gender, smoking status, tumor type, and disease stage. The present study was designed to investigate the survival rate of lung cancer in patients admitted to a referral hospital and its relevance to factors, especially tumor cell type.

Methods

Study Design

This retrospective cohort study included patients with primary lung cancer admitted to a university referral hospital over 7 years from 2016 to 2022.

Participants

The study was conducted as part of a medical student's thesis and was approved by the Faculty of Medicine at Baqiyatallah University of Medical Sciences (approval code: IR.BMSU.1396-1238). Consent forms were obtained from and completed by the patients and their families. A questionnaire was developed for data collection. All eligible patients were included through census sampling, and ethical considerations were observed.

Inclusion and Exclusion Criteria

Patients were included in the study if they had a histopathologically confirmed diagnosis of primary lung carcinoma, were diagnosed and admitted to a university referral hospital between 2016 and 2022, had complete medical records available for data extraction (including demographic data, clinical manifestations, smoking history, histological type, and treatment modalities), and had follow-up data available through periodic visits or telephone calls. Patients were excluded if they had carcinoid tumors (Grade I or Grade II neuroendocrine carcinoma) due to their favorable prognosis and longer survival, secondary or metastatic lung tumors from extrapulmonary primary sites, incomplete or missing essential data in their medical records, or were lost to follow-up without any survival data.

Sample Size

Since this was a retrospective cohort study, the sample size was determined by the number of eligible patients available during the study period rather than by a prospective power calculation. Nevertheless, the adequacy of the final sample (n = 163) for the survival analyses was assessed post hoc. For the multivariate Cox proportional hazards regression model, the critical determinant is the number of events per variable (EPV). The conventional rule of thumb recommends at least 10 events per covariate to ensure stable and reliable regression estimates. Our multivariate model included four covariates (age, gender, smoking, and

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histological type). With 163 patients and a censoring rate of approximately 35%, the number of observed death events was approximately 106, yielding an EPV of approximately 26.5. This substantially exceeds the recommended minimum of 10, indicating that the sample size was sufficient for the multivariate Cox regression analysis.

Data sources/measurement

Patients' demographic and clinical characteristics, including clinical manifestations, date of diagnosis, smoking history, histological type, and treatment modalities, were collected. Of the 172 patients initially identified, nine with carcinoid tumors (Grade I or Grade II neuroendocrine carcinoma) were excluded because of their favorable prognosis and longer survival. The 163 remaining patients were followed up through periodic visits and, in some cases, telephone calls to determine survival time.

Statistical Analysis

Data analysis was performed using SPSS software (version 21) (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize the demographic and clinical characteristics of the patients. Survival analysis was conducted using the Kaplan-Meier method. The log-rank test was applied to compare survival distributions across different groups. To identify independent prognostic factors, a multivariable Cox proportional hazards regression model was constructed using the Enter method, including age, gender, smoking, and histological type as covariates. A two-sided p-value of less than 0.05 was considered statistically significant for all analyses.

Results

Among the 163 patients with primary lung carcinoma, 121 (74.2%) were male and 42 (25.8%) were female. The mean age of the patients was 62 ± 13.5 years (the youngest patient was 19 years old and the oldest was 91 years old). Women were diagnosed with lung cancer 2 years earlier on average, although this difference was not significant (P=0.098). When patients were grouped into 20-year age categories, more than half of the patients (66.9%) were in the age group of 55 to 74 years, and only 2.5% of the patients were under 35 years of age (Table 1).

Table1. Gender and Age Distribution of 163 Patients with Lung Carcinoma

Age categories	Male , N (%)	Female , N (%)	Total , N (%)
15-34 years	3(2.5)	1(2.4)	4(2.5)
35-54 years	15(12.4)	12(28.6)	27(16.6)
55-74 years	86(71.1)	23(54.8)	109(66.9)
75 years and more	17(14)	6(14.3)	23(14.1)
Total	121(74.2)	42(25.8)	163(100.0)

Of all the patients, 99 (60.7%) were smokers, and the largest number of smokers was in the 55–74-year age group. Among smokers, 95 patients (96%) were men. Cough was the most common clinical symptom (76.1%). Hemoptysis was observed in 50 patients (30.7%) (Table 2).

Surgery was performed in 63 patients (38.7%). The most common procedure was thoracotomy and lobectomy, which was performed in 58 patients (92%). A total of 4 patients underwent bilobectomy (resection of the upper and middle lobes or the middle and lower lobes on the right side). In one patient, pneumonectomy was required because of the central location of the tumor. In all operations, intercostal nerve blocks were administered for pain relief using 10 mL of bupivacaine solution. Only 11 patients (6.7%) had very early-stage disease and did not receive further adjuvant therapy, whereas all other patients received chemotherapy or chemoradiotherapy.

Histopathological examination identified four types of lung carcinoma. Adenocarcinoma (55.8%) and squamous cell carcinoma (31.3%) were the most common types, respectively. Small cell lung cancer and large cell carcinoma were in the next order (Table 3).

No significant associations were found between histological type and gender (P = 0.602) or smoking status (P = 0.579).

One of the main outcomes assessed during follow-up was patient survival. The mean survival rate was 11.5± 0.6 months, whereas the median survival rate was 9± 0.3 months.

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Table 2. Frequency of Clinical Symptoms and Their Associations with Smoking Among 163 Patients with Lung Carcinoma

Clinical sign*	Frequency	Percent	Female	Male	Smoker	Non-smoker
Cough	124	76.1	31(26.2)	93(73.8)	79(64)	45(36)
Dyspnea	113	69.3	29(25.8)	84(74.2)	73(64.5)	40(35.5)
Weight Loss	81	49.7	17(21.3)	64(78.7)	59(70.8)	22(29.2)
Fever	55	33.7	17(30.6)	38(69.4)	35(62.9)	20(37.1)
Haemoptysis	50	30.7	15(27.3)	35(72.7)	23(46.2)	27(53.8)

* In cases where there are several clinical symptoms, the frequency and percentage of each of the symptoms is calculated separately.

Table 3. Frequency of Histological Types and Their Associations with Gender and Survival Among 163 Patients with Lung Carcinoma

Pathology	Frequency	Percent	Female	Male	Survival, Mean, months(±SD)	Survival, Median, months(±SD)
Adenocarcinoma	91	55.8	26 (28.6)	65 (71.4)	8.7 (±1.4)	9 (±0.4)
Squamous cell carcinoma	51	31.3	11 (21.6)	40 (78.4)	19.5 (±1.4)	18 (±0.5)
Small cell carcinoma	19	11.7	4 (21.1)	15 (78.9)	8.1 (±1.4)	8 (±0.8)
Large cell carcinoma	2	1.2	1 (50)	1 (50)	16 (±2)	16 (±2.1)
Total	163	100	42 (25.8)	121(74.2)	11.5 (±0.6)	9(±0.3)

The shortest survival time was 2 months, and the longest was 39 months. The 1-, 2-, and 3-year survival rates were 34%, 9%, and 2%, respectively.

We evaluated the associations between different variables and patient survival using the Cox proportional hazards regression model. A significant relationship was found between age and lung cancer survival rate (Table 4).

Survival differed significantly across age groups ($P < 0.001$). Considering the role of tumor histological type on the median survival rate, the highest rate was related to squamous cell carcinoma (18 months), and the lowest rate was related to small cell lung cancer (8 months), and a significant difference was found between the two types ($P= 0.000$). Survival did not differ significantly between men and women ($P = 0.737$) (Figure 1). No statistically significant associations were found between survival and smoking status ($P = 0.312$), clinical symptoms (all P values > 0.05), or treatment type ($P = 0.171$).

Table 4. Multivariable Cox Proportional Hazards Regression Analysis of Factors Associated with Survival Among 163 Patients with Lung Carcinoma

Variable	Hazard Ratio (HR)	95% CI for HR		p-value
		Lower	Upper	
Age (continuous)	1.046	1.021	1.072	≤0.001
Histological Type (ref: Adenocarcinoma)				
Squamous Cell Carcinoma	0.411	0.269	0.626	≤0.001
Small Cell Carcinoma	1.234	0.730	2.086	0.434
Large Cell Carcinoma	0.522	0.129	2.117	0.362
Gender (ref: Female)	1.089	0.686	1.728	0.737
Smoking (ref: Non-smoker)	0.840	0.570	1.239	0.312

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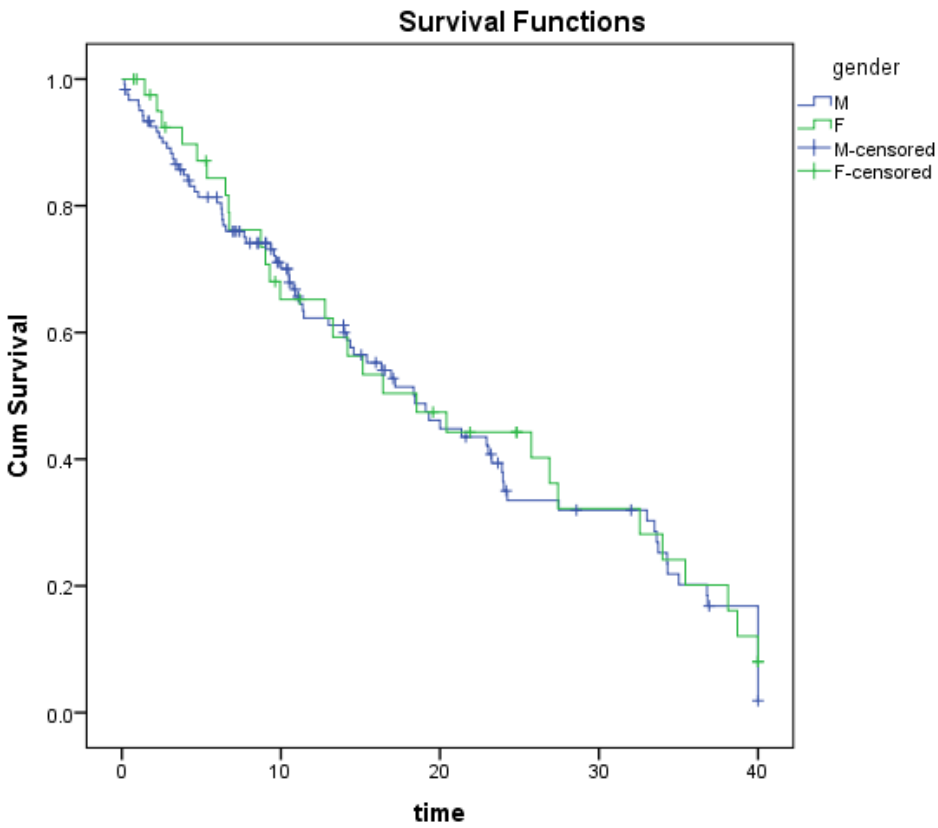


Figure 1. Kaplan-Meier curves based on gender

Discussion

In many societies, lung cancer is known as one of the deadliest cancers with a low survival rate.

In the present study, the mean age of lung cancer patients was 62 ± 13.5 years, and most of them were male. These findings are generally consistent with those of previous studies conducted in Iran and other countries.

Smoking is one of the known factors in the etiology of lung cancer. In our study, approximately 60% of patients had a history of smoking, which is consistent with findings from other studies.

In lung cancer, considering the old and new classifications, there are different data based on the cell type. In our study, the most common type of lung cancer was adenocarcinoma, which is consistent with some studies from Iran. In Khosravi et al.'s study of 1353 patients, adenocarcinoma was found to be the most common (5). The higher frequency of adenocarcinoma was also reported in Payandeh et al.'s study of 64 patients (12). In recent years, most studies and reference books have mentioned adenocarcinoma as the most common lung cancer (3, 19). In a 15-year Swedish study by Radkiewicz et al. involving 33,790 patients with NSCLC, 69.4% had adenocarcinoma (20).

On the other hand, in some of the other studies from Iran, the results were different. In a large epidemiological study, Almasi et al. analyzed data from approximately 14,400 patients in Iran between 2003 and 2007 and found that squamous cell carcinoma was the most common type (2). No specific explanation can be offered for these differences, although most of the studies reporting these findings appear to be relatively old.

Surgery was performed in approximately 40% of patients, which is an acceptable rate. One study reported a rate of up to 60% (11), whereas other reports indicated that approximately 20% of patients underwent surgery (3).

Survival after cancer diagnosis and treatment is an important outcome in clinical studies. In the present study, the mean and median survival times were 11.5 and 9 months, respectively. In another study from Iran, the 1-year survival rate ranged from 25% to 63% (11). In studies from other countries, the median survival rate was reported to be higher. In the study by Hong et al. in 2005, with 403 Korean patients, the median survival of the

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patients was 23.2 months (21). The one-year survival rate of our patients was 34%. In other study, from Iran, the one-year survival rate has been mentioned from 25 to 63% (11). In the study by Gedvilaitė et al., the one-year survival rate in Europe as a whole was 39% (18). In the study by Barranco et al. in Spain, the one-year survival rate in two different geographical areas was 26% and 35%, respectively (4). The five-year survival rate has been reported in our country as 7% to 26% (11). This variable has a wide range in foreign studies: 9, 7, 10, 12, 12.7, 13, 15, 16, 32, 41 and 58 percent (3, 14, 15, 18, 20). Most studies included carcinoid tumors, which have a favorable prognosis and longer survival, potentially accounting for their higher reported survival rates.

Several factors may be associated with survival. In our study, the survival rate was related to the age of the patients and tumor cell type. Survival decreased with increasing patient age. In most other studies, this result has been reported (2, 11, 18). Survival was higher among patients with squamous cell carcinoma, and some Iranian studies are consistent with this result (11). Several foreign studies also agree with this relationship, but in others, the highest survival rate was related to adenocarcinoma (18).

In the present study, there was no statistically significant difference in the survival rate by gender, while many studies considered gender as one of the factors affecting the survival rate (1, 2, 12, 18, 20).

The differences between the survival rates in our study and those reported elsewhere may partly be explained by the study design, which excluded patients with carcinoid tumors because of their favorable prognosis and longer survival. In addition, our hospital is a referral center to which patients with more complex disease and advanced-stage tumors are referred.

One of the major limitations of this study is the lack of comprehensive tumor staging data. Due to the retrospective design and the fact that our center serves as a tertiary referral hospital, many patients were admitted at advanced stages without complete TNM staging documentation. Consequently, we were unable to include this crucial variable in our multivariate Cox regression model, which may have affected the overall analysis. Future prospective studies with standardized staging protocols are strongly recommended to evaluate the independent role of tumor stage in survival outcomes.

Conclusions

Lung cancer remains a major public health problem because of its high mortality and low survival rates. The most common type in a referral center in Iran was adenocarcinoma. Survival is associated with patient age and tumor histological type. Public awareness of self-care and key symptoms should be increased to promote early diagnosis, timely referral, and appropriate treatment.

Ethics Approval and Consent to Participate

The study was conducted as part of a medical student's thesis and was approved by the Faculty of Medicine at Baqiyatallah University of Medical Sciences (approval code: IR.BMSU.1396-1238).

Consent for Publication

Consent forms were obtained from and completed by the patients and their families.

Data Availability Statement

The data supporting this study's findings are available upon request from the corresponding author.

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Authors' Contribution

HAM, AG, MM, and MA were responsible for the study concept and design. MA performed the data collection. MMO contributed to the pathological re-evaluation. MA, HAM, MM, BMA, and MRD were involved in data analysis and manuscript preparation. All authors contributed to the critical revision of the manuscript and approved the final version for submission.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Declaration of Generative Artificial Intelligence (AI) in Scientific Writing

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No AI tools or technologies were used in the preparation of this manuscript.

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