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Original Article

Lung cancer in Fujian Province, China (2009-2012): a single-institute retrospective study

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Abstract: There are distinct regional differences among lung cancer patients in China. This retrospective study sought to determine the clinical characteristics and prognostic factors of lung cancer patients in Fujian Province, China. We conducted the study between January 2009 and August 2012 in Fujian Provincial Hospital. Patients were eligible if they had been diagnosed pathologically or cytologically with primary lung cancer. We extracted the following information from their medical records: sex, age, smoking status, stage, histological classification, nutritional status, treatment, and survival. We analyzed 831 patients, including 572 (68.8%) men and 259 (31.2%) women, with mean age of 60.22 ± 10.38 years. Among the study population, 9.1% had small cell lung cancer, 90.9% had non-small cell lung cancer, 26.5% had squamous cell carcinoma, and 52.5% had adenocarcinoma. The incidence of squamous cell carcinoma was higher in men, while that of adenocarcinoma was higher in women. Half of the patients with small cell lung cancer had advanced or extensive disease at diagnosis. Comorbid diseases were present in 28.2% of the patients, and included hypertension (72.8%), diabetes mellitus (20%), chronic obstructive pulmonary disease (3.4%), among others. For treatment, 13.5% of the total patients underwent surgery, 25.8% received chemotherapy, 22.5% received postoperative targeted therapy, and 29.4% were not treated at our hospital. Overall median survival was 24.60 ± 1.99 months. The 1-, 2-, 3-, and 4-year overall survival rate were 70.3%, 51%, 40.1%, and 32.2%, respectively. Surgery with adjuvant chemotherapy significantly improved prognosis of the small cell lung cancer patients. In conclusion, this analysis provides the most recent epidemiological information on lung cancer in Fujian, China.

Keywords: Lung cancer, survival, prognosis, China, southeast

Introduction

Lung cancer is the most frequently diagnosed human malignancy worldwide, and is a leading cause of cancer-related death in both men and women [1]. In China, approximately 452,000 deaths are related to lung cancer each year [2], and it is feared that these numbers will continue to increase; in fact, it has been estimated that without intervention the number of lung cancer deaths will double in the next 30 years [3]. Improving rates of early detection, accurate diagnosis, and proper treatment is key to reducing lung cancer mortality. One of the most significant risk factors of lung cancer in China is cigarette smoking [4-6], but environmental pollution is another important contributing factor [1]. Unfortunately, the rate of tobacco consumption has increased and the air quality in major cities has deteriorated, priming China, for higher lung cancer morbidity and mortality rates.

Studies of the epidemiological characteristics of lung cancer in China have shown remarkable distinctions by region [7]. For example, residents in eastern China tend to face a higher risk of lung cancer than those in western China, and the risk is higher for women particularly in western China [1]; moreover, residents of urban areas also face a higher risk than those of rural areas [8]. Intriguingly, the incidence of lung cancer has showed a faster rise among women than men (men, 1.3%; women, 2.34%) [1]. Lung cancer mortality also varies widely between

regions, being higher in eastern China than in western China and in urban areas than in rural areas [8]; moreover, the distribution of mortality is not consistent among regions for men and women [9]. Finally, there are differences in age of lung cancer patients by region, with urban residents being 5-10 years younger than rural residents [10].

While there are distinct regional differences among lung cancer patients across the Chinese population, there are no systematic reviews of the characteristics of patients in Fujian Province in southeast China. This retrospective study aimed to determine the clinical characteristics and prognostic risk factors of lung cancer patients in the province.

Patients and methods

Patients

This retrospective study was approved by Ethics Committee of Fujian Provincial Hospital (K2012-006-01). A total of 925 patients who had been diagnosed pathologically or cytologically with primary lung cancer between January 2009 and August 2012 in our Hospital, Fujian, China were screened to determine eligibility for study participation. Exclusion criteria were: 1) non-resident of Fujian Province; 2) suspected primary lung cancer without histological or cytological evidence; 3) metastatic cancers from other primary organs or sites other than lung; 4) primary lung cancer relapse or recurrence. Of the total cases, 94 were excluded and 831 were analyzed.

Pathological classification was defined according to the 2004 World Health Organization histological classification of lung cancer guidelines [11]. Non-small cell lung cancer (NSCLC) stage was defined according to the 2009 International Association for the Study of Lung Cancer guidelines [12]. Early stage refers to stage I, II, IIIa; advanced stage refers to stage IIIb and IV. Small cell lung cancer (SCLC) stage was defined according to the Veterans Administration Lung Study Group staging system [13], and was divided into limited stage (LS) and extensive stage (ES). LS SCLC involves a primary tumor contained within one hemithorax and/or mediastinal nodes with ipsilateral supraclavicular disease; ES SCLC refers to disease located beyond the LS areas that cannot be confined to a single radiotherapy portal, and includes widely metastatic disease.

Non-smoker refers to < 100 smoked cigarettes during the patient's lifetime. Ex-smoker refers to > 100 previously smoked cigarettes and smoking cessation > 6 months. Smoker refers to > 100 currently smoked cigarettes. Nutritional status was mainly evaluated via serum hemoglobin (Hb) and albumin (ALB) levels. Hypoalbuminemia was defined as serum ALB < 35 g/L (normal: > 35 g/L); normal Hb levels were ≥ 110 g/L (women) and ≥ 120 g/L (men). Anemia was defined as Hb < 120 g/L (men) or < 110 g/L (women).

Therapy

Therapies included surgery, surgery plus chemotherapy, chemotherapy, targeted therapy, targeted therapy plus chemotherapy, or no treatment at our hospital. Surgical resection was performed in patients with tumors classified as T1-3 N2 M0 stage IIIa [12]. A subset of patients also received postoperative chemotherapy. Chemotherapy for SCLC included etoposide or irinotecan plus cisplatin or carboplatin. First-line NSCLC chemotherapy included platinum-based agents plus gemcitabine, paclitaxel, or vinorelbine; pemetrexed was included when treating adenocarcinoma (ADC). Second-line chemotherapy included pemetrexed or docetaxel plus cisplatin, carboplatin, or targeted therapy. Targeted therapy refers to the use of epidermal growth factor receptor (EGFR) tyrosine kinase inhibitors (TKI) alone as first-line therapy or in combination with chemotherapy as second- or third-line therapy. No treatment refers to patients who did not receive treatment at our hospital.

Follow-up

Follow-up was conducted for all patients by telephone or patient clinical visits. Patients were followed every three months during the first two years, every six months for the next three years, and then once every year thereafter. The follow-up period was calculated from the first day of diagnosis to the last follow-up date or day of death.

Statistical analysis

One-way ANOVA was used to compare differences among groups. The X^2 test was used to compare differences among three or more

Table 1. Characteristics of patients based on smoking status

Characteristic	Total (n = 831) n (%)	Non-smoker (n = 400) n (%)	Current smoker (n = 374) n (%)	Ex-smoker (n = 57) n (%)	P*
Sex					
Male	572 (68.8)	149 (26.0)	366 (64.0)	57 (10.0)	
Female	259 (31.2)	251 (96.9)	8 (3.1)	0 (0)	
Male vs. Female	2.21	0.59	45.75	Infinity	0.000
Age (years)	60.22 ± 10.38	59.06 ± 11.26	61.03 ± 9.19[a]	63.00 ± 10.38[a]	0.003
Male (mean ± SD)	60.92 ± 9.91	59.72 ± 11.57	61.11 ± 9.03	62.91 ± 10.38	0.101
Female (mean ± SD)	58.79 ± 11.19	58.83 ± 11.07	57.00 ± 15.58	None	0.924
Histology	831	400	374	57	0.000
SCLC	76 (9.1)	18 (4.5)	51 (13.6)	7 (12.3)	
SCC	220 (26.5)	54 (13.5)	140 (37.4)[a]	26 (45.6)[a]	
ADC	436 (52.5)	289 (72.3)	128 (34.2)[a]	19 (33.3)[a]	
ASC	25 (3.0)	13 (3.3)	11 (2.9)	1 (1.8)	
LCC	24 (2.9)	12 (3.0)	10 (2.7)	2 (3.5)	
UDC	24 (2.9)	8 (2.0)	16 (4.3)	0 (0)	
Other	26 (3.1)	6 (1.5)	18 (4.8)	2 (3.5)	
Stage					0.000
NSCLC	754 (90.9)				0.000
I	111 (14.7)	63 (16.5)	44 (13.6)	4 (8.0)	
II	68 (9.0)	30 (7.8)	31 (9.6)	7 (14.0)	
IIIa	165 (21.8)	63 (16.5)	89 (27.6)	13 (26.0)	
IIIb	35 (4.6)	11 (2.9)	21 (6.5)	3 (6.0)	
IV	347 (45.9)	201 (52.6)	123 (38.1)	23 (46.0)	
Unknown	29 (4.0)	14 (3.7)	15 (4.6)	0 (0.0)	
SCLC	77 (9.2)				0.505
Limited	35 (44.7)	7 (38.9)	25 (49.0)	2 (28.6)	
Extensive	42 (55.3)	11 (61.1)	26 (51.0)	5 (71.4)	
Comorbidity	235 (28.2)	118 (50.2)	92 (39.2)	25 (10.6)	
Tumor	22 (9.2)	9 (7.6)	10 (11.9)	3 (12.0)	0.217
COPD	8 (3.4)	0 (0)	5 (5.4)[a]	3 (12.0)[a]	0.000
Asthma	5 (2.1)	4 (3.4)	1 (1.1)	0 (0)	0.349
Pulmonary TB	19 (8.1)	7 (5.9)	9 (9.8)	3 (12.0)	0.248
Hypertension	171 (72.8)	95 (80.5)	58 (63.0)[a]	18 (72.0)	0.002
Diabetes	47 (20.0)	27 (22.9)	16 (17.4)	4 (16.0)	0.294
Heart disease	25 (10.6)	10 (8.5)	11 (11.9)	4 (16.0)	0.175
Nutritional status (g/L)					
ALB (mean ± SD)	38.59 ± 5.72	39.30 ± 6.05	37.91 ± 5.34[a]	38.14 ± 5.31	0.003
Hb (mean ± SD)	130.15 ± 16.46	128.07 ± 15.88	131.52 ± 16.91[a]	135.61 ± 15.53[a]	0.006
Family history of cancer	33 (4.0)	14 (42.4)	18 (54.5)	1 (3.0)	0.438

Note: All data are expressed as number of patients (%) unless otherwise indicated. NSCLC, non-small cell lung cancer. SCLC, small cell lung cancer. COPD, chronic obstructive pulmonary disease. ALB, albumin. Hb, hemoglobin. TB, tuberculosis. SCC, squamous cell carcinoma. ADC, adenocarcinoma. ASC, adenosquamous carcinoma. LCC, large cell carcinoma. UDC, undifferentiated carcinoma. [a]Indicates comparison with non-smokers, $P < 0.05$. *Indicates comparisons among non-smokers, current smokers, and ex-smokers.

groups. Univariate and multivariate risk factor analysis were performed using Cox proportional hazards models (SAS version 9.1.3; SAS Institute, Inc., Cary, NC). The survival was calculated using the Kaplan-Meier method. A *p*-value < 0.05 was considered statistically significant.

Table 2. Lung cancer treatment based on staging

	Surgery	Chemotherapy	Surgery + chemotherapy/targeted	Targeted	Chemotherapy + targeted	Untreated/other	Total
Total	112 (13.5)	214 (25.8)	187 (22.5)	34 (4.1)	40 (4.8)	244 (29.4)	831 (100)
NSCLC							
I	53 (47.7)	4 (3.6)	47 (42.3)	0 (0.0)	1 (0.9)	6 (5.4)	111
II	20 (29.4)	6 (8.8)	38 (55.9)	0 (0.0)	0 (0.0)	4 (5.9)	68
IIIa	21 (12.7)	39 (23.6)	68 (41.2)	4 (2.4)	2 (1.2)	31 (18.8)	165
IIIb	1 (2.9)	15 (42.9)	3 (8.6)	4 (11.4)	0 (0.0)	12 (34.3)	35
IV	14 (4.0)	112 (32.3)	18 (5.2)	23 (6.6)	37 (10.7)	143 (41.2)	347
Unknown	2 (6.9)	5 (17.2)	2 (6.9)	3 (10.3)	0 (0.0)	17 (58.7)	29
SCLC							
Limited	0 (0.0)	13 (38.2)	10 (29.4)	0 (0.0)	0 (0.0)	11 (32.4)	35
Extensive	1 (2.4)	20 (47.6)	1 (2.4)	0 (0.0)	0 (0.0)	20 (47.6)	42

Note: All data are expressed as number of patients (%) unless otherwise indicated. NSCLC, non-small cell lung cancer. SCLC, small cell lung cancer.

Results

Patient characteristics

The patient demographic and clinical characteristics are summarized in **Table 1**. There were 572 (68.8%) men and 259 (31.2%) women. Among these, 66 (7.9%) were young, 361 (43.4%) middle-aged, and 404 (48.6%) old. Women were younger than men ($P < 0.05$). Non-smokers comprised 26% of men and 96.9% of women; the majority of smokers were male.

NSCLC and SCLC accounted for 90.9% and 9.1% of patients, respectively. ADC and SCC incidence were significantly different between men and women: SCC incidence was higher in men while women were likelier to have ADC (all $P < 0.001$).

NSCLC and SCLC accounted for 95.5% and 4.5%, respectively, of non-smokers. ADC incidence (72.3%) in non-smokers was significantly higher than that in current (34.2%) or ex-smokers (33.3%) (all $P < 0.001$). SCC incidence in smokers (ex-smokers, 45.6%; current smokers, 37.4%) was significantly higher than that in non-smokers (13.5%) (both $P < 0.001$). At diagnosis, 50.0% of the NSCLC patients were at advanced stage. Among the SCLC patients, 44.7% and 55.3% were LS and ES, respectively.

Comorbidity

Of the 831 patients, 235 (28.2%) had concurrent disease: 171 had hypertension (72.8%), 47 had diabetes mellitus (20%), 25 had heart disease (10.6%), 22 had malignant tumors in other organs (9.2%), 19 had pulmonary tuberculosis (8.1%), 8 had chronic obstructive pulmonary disease (COPD, 3.4%), and 5 had asthma (2.1%). The incidence of hypertension was higher in non-smokers than that in smokers ($P = 0.005$).

The mean serum ALB levels and blood Hb levels were significantly different between smokers and non-smokers ($P < 0.001$).

Diagnostic characteristics

Specimens were obtained as follows: 425 (51.1%) fiber bronchoscopy biopsies, 276 (33.2%) surgical biopsies, 144 (17.3%) percutaneous lung biopsies, 59 (7.1%) pleural biopsies, and 40 (4.8%) lymph node biopsies. Among these, fiberoptic bronchoscopy was performed most frequently.

Treatment

Table 2 summarizes the treatments received. Of all patients, 112 (13.5%) underwent surgery, 214 (25.8%) received chemotherapy, 187 (22.5%) received targeted therapy after surgical resection. The majority of patients with early-stage NSCLC received surgical treatment. A minority was treated with chemotherapy; no patient was treated with targeted therapy. Non-surgical treatments were the major strategies for the majority of patients with advanced NSCLC. Thirteen patients (38.2%) with LS SCLC received chemotherapy, 10 (29.4%) underwent surgery with adjuvant chemotherapy, and 11 (32.4%) were not treated.

Table 3. Univariate analysis of risk factors affecting survival

	MST (months, mean ± SD)	Survival (%)				P* 1-yr	P* 2-yr	P* 3-yr	P* 4-yr
		1-yr	2-yr	3-yr	4-yr				
Total	24.60 ± 1.99	70.3	51.0	40.1	32.2				
Sex									
Male	22.43 ± 2.08	66.5	47.6	37.6	30.6	0.008[a]			
Female	30.23 ± 3.66	78.0	57.6	44.6	37.5	0.001	0.004	0.025	0.024
Age (years)									
21-45	38.20 ± 7.48[c]	73.5	63.5	51.7	43.1	0.016[a]			
46-60	27.43 ± 2.55[c]	75.7	51.6	41.9	35.3				
> 60	20.00 ± 2.51	64.5	47.3	35.7	27.5	0.011	0.069	0.065	0.057
Smoking status									
Non-smoker	28.57 ± 3.08	73.6	55.4	43.4	36.8	0.038[a]			
Current smoker	22.23 ± 3.44[b]	67.0	47.3	37.6	28.7				
Ex-smoker	18.30 ± 3.81	65.3	35.8	26.8	26.8	0.086	0.029	0.154	0.183
Histology									
SCLC	14.23 ± 1.33	59.6	29.0	17.4	17.4	0.000[a]			
SCC	23.70 ± 2.48	69.5	47.7	35.5	25.2				
ADC	30.83 ± 4.22	73.9	57.5	47.4	40.6				
Other	15.57 ± 4.50	61.1	44.0	31.5	28.0	0.001	0.000	0.000	0.000
NSCLC									
I-IIIa	45.46 ± 3.32	82.5	69.8	60.6	45.3	0.000[a]			
IIIb-IV	16.40 ± 1.08	61.5	38.2	26.3	23.2				
Unknown	18.83 ± 7.63	57.4	38.9	38.9	38.9	0.000	0.000	0.000	0.000
SCLC									
Limited	14.23 ± 3.01	68.8	38.7	25.4	25.4	0.048[a]			
Extensive	12.50 ± 2.52	51.8	17.0	17.0	17.0	0.227	0.237	0.506	0.279
ALB (g/L)	24.87 ± 1.97								
≥ 35	26.30 ± 2.05	72.2	53.4	41.5	32.3	0.031[a]			
< 35	17.50 ± 1.92	63.5	41.1	36.2	29.8	0.042	0.004	0.03	0.029
Hb (g/L)	24.37 ± 2.05								
< 120	15.57 ± 1.47	62.5	34.6	28.7	18.0	0.000			
≥ 120	29.00 ± 2.16	71.9	54.5	43.3	34.9	0.073	0.000	0.002	0.001
Treatment									
Surgery	39.06 ± 1.52[b]	86.5	78.8	72.0	65.6	0.000[a]			
Surgery + chemotherapy	46.23 ± 1.39	86.7	74.8	59.1	45.5				
Chemotherapy	16.20 ± 0.87	60.6	37.2	25.7	21.9				
Targeted	15.37 ± 2.54	62.1	29.0	10.9	0.0				
Targeted + chemotherapy	27.43 ± 2.53	85.0	58.1	23.5	23.5				
No treatment	13.76 ± 1.28	54.9	30.7	24.1	20.9	0.000	0.000	0.000	0.000

Note: MST, median survival time. NSCLC, non-small cell lung cancer. SCLC, small cell lung cancer. COPD, chronic obstructive pulmonary disease. ALB, albumin. Hb, hemoglobin. TB, tuberculosis. SCC, squamous cell carcinoma. ADC, adenocarcinoma. yr, year. [a]Indicates comparisons among clinical characteristic subgroups, $P < 0.05$. [b]Indicates MST. [c]Indicates comparison with old-aged group. *Indicates comparison between smokers and non-smokers.

Survival

Table 3 summarizes patient survival. The overall median survival time (MST) was 24.60 ± 1.99 months; 1-, 2-, 3-, and 4-year overall survival rates were 70.3%, 51%, 40.1%, and 32.2%, respectively (**Figure 1A**). The MST for men and women was significantly different (**Figure 1B**, $P < 0.05$). The 1-, 2-, 3-, and 4-year survival rates for women were significantly higher than that for men (all $P < 0.05$). MST of the young and middle-age groups were signifi-

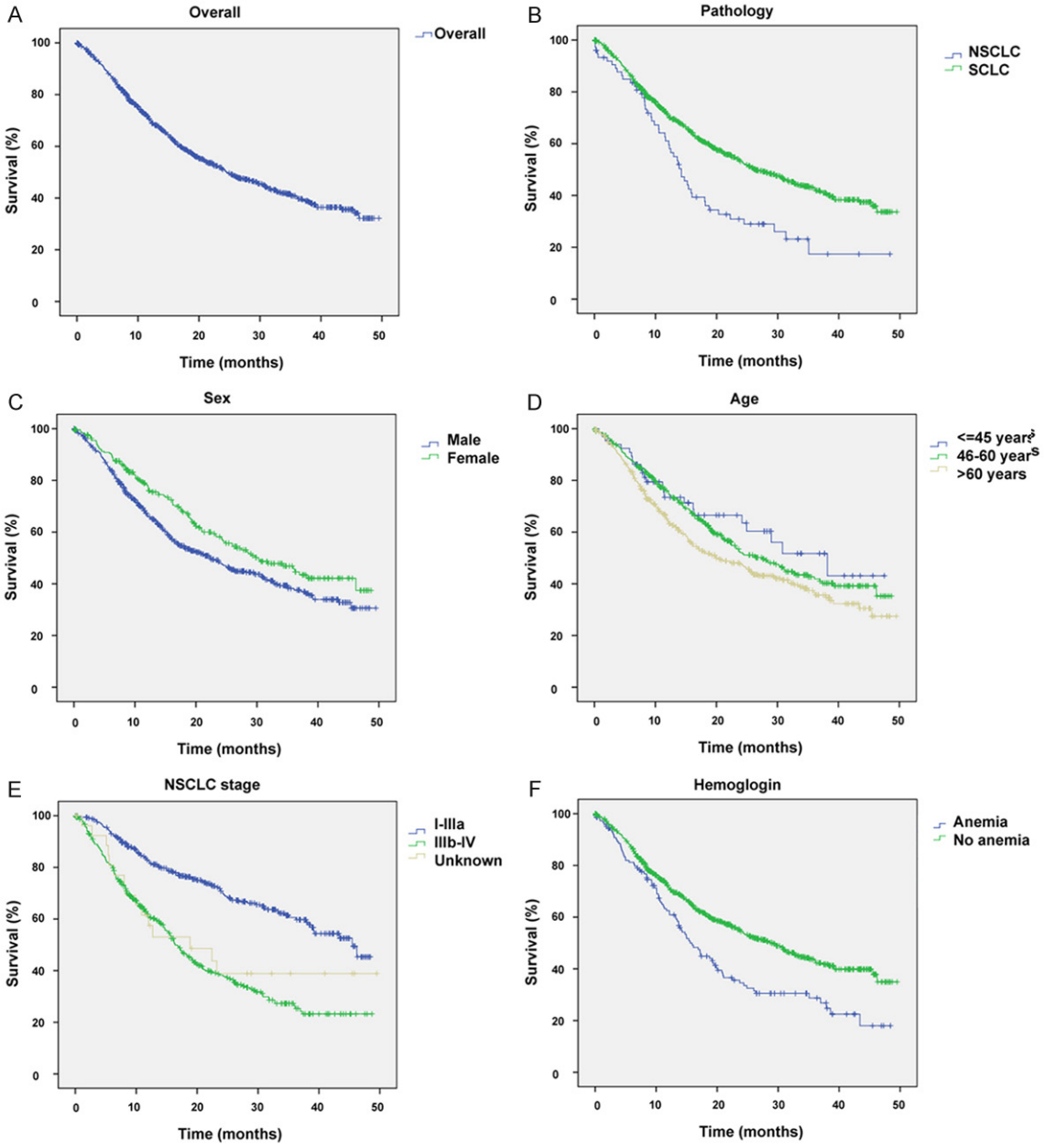

Figure 1. Kaplan-Meier plots for overall survival (OS) in patients with lung cancer. A. Overall survival in all patients with lung cancer. B. OS in patients with non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC) according to pathological classification. NSCLC was correlated with inferior OS ($P < 0.001$). C. OS in male and female patients with lung cancer. Male was correlated with inferior OS ($P = 0.008$). D. OS in patients with lung cancer according to different age. Patients were divided into three groups on the basis of age: 21-45 years, 46-60 years, > 60 years. Older age was correlated with inferior OS (all $P < 0.05$). E. OS in patients with NSCLC according to clinical stages. An advanced stage was correlated with inferior OS ($P < 0.001$). F. OS in patients with lung cancer according to hemoglobin (Hb) levels. A reduced Hb level was correlated with inferior OS ($P = 0.000$).

cantly longer than that in the old-age group (young vs. old: $P = 0.045$; middle-aged vs. old: $P = 0.015$) (**Figure 1C**). MST was significantly longer in non-smokers than in current or ex-smokers (all $P = 0.030$). However, there was no significant difference in MST between current and ex-smokers.

MST of NSCLC and SCLC patients was 26.30 ± 2.05 months and 14.23 ± 1.32 months, respectively (**Figure 1D**). There were significant differences in MST among groups with different histological classifications ($P < 0.001$). Additionally, the differences in the yearly survival rates among the different histological

Table 4. Multivariate analysis of risk factors affecting prognosis [overall survival (OS)]

		β	Hazard ratio	95% confidence interval		p
				Lower	Upper	
NSCLC	Sex	0.317	1.373	1.08	1.747	0.01
	Stage					0.011
	Advanced	0.416	1.517	1.137	2.023	0.005[a]
	Treatment					0.000
	Surgery + chemotherapy	0.229	1.257	0.775	2.039	0.354[b]
	Chemotherapy	1.240	3.454	2.161	5.521	0.000[b]
	Targeted therapy	1.289	3.628	1.936	6.799	0.000[b]
	Chemotherapy + targeted therapy	0.741	2.098	1.109	3.967	0.023[b]
	No treatment	1.298	3.66	2.298	5.83	0.000[b]
	Hemoglobin	0.440	1.553	1.202	2.007	0.001
SCLC	Treatment					0.049
	Surgery	1.477	4.378	0.553	34.685	0.162[c]
	Surgery + chemotherapy	-1.242	0.289	0.099	0.846	0.023[c]
	Chemotherapy	-0.299	0.741	0.403	1.365	0.337[c]

Note: NSCLC, non-small cell lung cancer. SCLC, small cell lung cancer. [a]Indicates comparison with early-stage group. [b]Indicates comparison with surgery group. [c]Indicates comparison with untreated group.

classification groups were statistically significant. Clinical tumor stage exerted a significant influence on MST and yearly survival rates in NSCLC patients. MST was significantly longer in early-stage patients (stage I-IIIa) than in advanced-stage patients (stage IIIb-IV) ($P < 0.001$) (**Figure 1E**), and was significantly longer in LS SCLC patients than in ES SCLC patients ($P = 0.048$). The MST of patients with normal ALB and Hb was significantly longer than that of patients with low ALB and Hb (ALB: $P = 0.031$; Hb: $P = 0.000$ (**Figure 1F**)). The ALB and Hb levels also affected survival rates. Surgical resection of tumors at stage I and II significantly prolonged MST (all $P < 0.05$).

Univariate and multivariate risk factor analysis

Univariate analysis showed that sex ($P = 0.017$), age ($P = 0.007$), smoking status ($P = 0.023$), clinical stage ($P < 0.001$), treatment ($P < 0.001$), ALB level ($P = 0.003$), and Hb level ($P < 0.001$) were independent risk factors influencing prognosis (**Table 4**).

In NSCLC patients, multivariate analysis identified the following as independent risk factors influencing prognosis: sex, advanced stage, chemotherapy, targeted therapy, chemotherapy plus targeted therapy, no treatment, and Hb level. In SCLC patients, univariate analysis identified treatment ($P = 0.049$) as an independent risk factor affecting prognosis. Multivariate analysis showed that surgery with adjuvant chemotherapy significantly improved prognosis.

Discussion

Global studies have indicated that China alone accounts for 30% of lung cancer patients worldwide, and estimated that over 300000 males and nearly 160000 females in China are affected [14]. Fujian is located on the coast of southeast China and is a large city with a rapidly developing economy and industrial sector that is accompanied by heavy pollution. Our current study sought to investigate the clinical characteristics and prognostic factors of lung cancer patients living in Fujian, a typical metropolitan area of China, but one that has not been formally investigated or reported on previously.

Our study shows that in recent years the majority of patients with lung cancer in the Fujian area are male (68.8%). Among these male patients, 74% had smoking habits. Although, the proportion of female patients with lung cancer is less than that of the males, we note an increasing trend in non-smoking females being diagnosed with the lung cancer. The average age of the female patients was 58.79 ± 11.19 years old and 60.92 ± 9.91 years old for males; however, the age of onset was significantly lower than reported for the United States [15].

The present study reveals that the majority of patients with primary lung cancer in Fujian are men with a history of smoking. Histologically, approximately 85% of patients had NSCLC; 9.1% had SCLC. ADC was the commonest tumor type, occurring in half of the studied population, followed by SCC and SCLC. ADC mostly occurred in non-smokers or women, while SCC mostly occurred in either current or ex-smokers. Half of the NSCLC patients were diagnosed at the advanced stage; half of the SCLC patients were diagnosed at ES. ADC and SCC comprised the largest proportion of stage I-IIIa NSCLC patients (36% and 49%, respectively) [16], who differed in terms of sex and histology. Among female patients, 55% had ADC and 25% had SCC. In contrast, 30% of male patients had ADC and 57% had SCC [16]. Our findings are in line with these previously published data. It has also been suggested that people living in eastern China, particularly women, face a higher risk of lung cancer than those living in western China [1]. However, our study suggests that the incidence of male lung cancer patients remains much higher than that of female patients. One possible reason is that men comprise the majority of smokers. Our data support the premise that cigarette smoking remains the major risk factor for lung cancer. Our study also demonstrates that the number of lung cancer cases among ex- and non-smokers is increasing. This suggests that additional risk factors contribute to lung cancer carcinogenesis.

Concomitant lung diseases, such as COPD, tuberculosis and pneumonia, are important risk factors that are independent of tobacco consumption [17]. In 50% of patients, lung cancer is accompanied by COPD [18]. According to our data, comorbidities were present in approximately one-third of the patients. In particular, hypertension was present in two-thirds of the patients, suggesting that hypertension is another important concomitant disease associated with lung cancer in Fujian residents. The existence of hypertension in lung cancer patients is not associated with smoking status. Hypertension control may represent an important strategy for preventing lung cancer in this region. However, COPD was present in only 3.4% of patients in our study, which was much lower than that previously reported [18]. Cigarette smoking remains closely associated with COPD. Smoking cessation is critical for preventing both COPD and lung cancer.

Radical surgery is the best means of improving prognosis and prolonging survival. In stage I-IIIa NSCLC patients, radical surgery plus cisplatin-based chemotherapy remains the standard treatment for those with completely resected tumors. In patients with advanced (stage IIIb/IV) or inoperable NSCLC, cisplatin-based chemotherapy plus a third-generation cytotoxic agent or a cytostatic drug are recommended [19-22]. The present study shows that 36% of patients received surgical treatment when diagnosed. The majority of surgically treated NSCLC patients were in the early stage. Some patients with advanced NSCLC underwent palliative surgery. Chemotherapy or adjuvant chemotherapy with other treatments remains the main treatment for advanced NSCLC. For SCLC patients, platinum-based chemotherapy and radical thoracic radiotherapy remain the best treatment options for suitable cases.

One of the advances is that the first-line treatment of lung cancer has moved from nonspecific cytotoxic chemotherapy to molecular targeted therapies. The most promising targeted therapy is the application of EGFR-TKI. The major limitation of this type of targeted therapies is that only small numbers of patients are positive for gene mutations. In the present study, a small number of NSCLC patients was treated with EGFR-TKI. They were mainly female non-smokers with stage III-IV ADC.

The 5-year survival rate of NSCLC patients is usually < 15% [23, 24]. Hu et al. [24] reported that the MST of Chinese is 24.7 months in men and 27.8 months in women. The 5-year survival rate of SCLC patients is usually 2-10% [25, 26]. The MST of patients with ES SCLC is 10-20 months depending on disease conditions [13, 25, 26]. In the present study, the overall MST was 24 months: 26 months in NSCLC patients and 14 months in SCLC patients. The survival data from the Fujian population in our study are consistent with that of previous reports [23-26].

Univariate and multivariate factor analysis showed that sex, clinical stage, treatment option, and anemia were independent risk factors affecting prognosis in NSCLC. Surgery with adjuvant chemotherapy was the only risk factor affecting prognosis in SCLC. Previous studies have suggested that sex is a risk factor that influences prognosis in NSCLC [13, 27-29], Asamura et al. [30] studied 13,010 cases of

resected lung cancer and demonstrated that 5-year survival in women was significantly longer than that in men. The prolonged survival in women may be because the majority of female lung cancer patients have ADC, which is typically more sensitive to chemotherapy and has a better prognosis. Moreover, EGFR mutations are more common in women than in men. Additionally, drug resistance is lower in women. These factors likely contribute to the better prognosis in female patients. Tumor, node, metastasis (TNM) stage directly guides treatment, thus it is another important prognostic risk factor in NSCLC [31, 32].

Once diagnosed with lung cancer, appropriate treatment is the key to improving the rate of survival. The present study showed that the MST of patients who underwent surgery or surgery plus chemotherapy was significantly longer than in patients who received chemotherapy alone, targeted therapy alone, or chemotherapy plus targeted therapy. Surgical intervention is a favorable prognostic factor in NSCLC. It has been demonstrated that the 5-year survival rate of patients who receive postoperative chemotherapy was better [33-35]. In this study, we also confirmed that patients who had received surgery plus chemotherapy had longer MST than those who only underwent surgery or only received chemotherapy, although the difference was not significant.

Typically, SCLC is sensitive to chemotherapy. Whether surgery should be recommended to a patient with SCLC remains controversial. De Stefani et al. [36] reported that the MST of SCLC patients who underwent surgery werewas better than in those who did not. The present study showed that the MST of patients treated with both surgery and chemotherapy was longer than those who only received chemotherapy. This suggests that postoperative adjuvant chemotherapy is a favorable prognostic factor for SCLC. It has been demonstrated that anemia was associated with poor prognosis in lung cancer; in particular, preoperative anemia significantly influences the prognosis [37, 38]. Our study showed that anemia was an adverse prognostic factor influencing survival in NSCLC.

In conclusion, we conducted a systematic analysis of the clinical features and prognostic factors of lung cancer in Fujian, China. This study provides the most recent epidemiological information on lung cancer in this region. It will aid our understanding of the epidemiology of lung cancer, thereby improving early diagnosis and timely treatment of lung cancer in southeast China and beyond.

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Disclosure of conflict of interest

None.

Authors' contribution

All authors have read and approved the content, and agree to submit it for consideration for publication in your journal.

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