

Lung Cancer Diagnosis by Bronchoscopy at Tertiary Care Center: A Retrospective Analysis

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Abstract

Introduction: Lung cancer stands second ranked among all cancers with an incidence of 11.4% worldwide. In India, it remains the fourth-most common cancer with an incidence of 5.5% and mortality of 7.8%. The surveillance, epidemiology, and end results (SEER) database is used by the American Cancer Society to access survival rates for various cancer types. Five-year survival of nonsmall-cell lung cancer and small-cell lung cancer by SEER stages is ranging from 8% to 64% and 3% to 29%, respectively, majorly influence by the spread of cancer. **Objectives:** To study the demography of lung cancer and establish the utility of bronchoscopy in lung cancer diagnosis. **Materials and Methods:** A retrospective observational study was carried out on patients having radiologically proven lung mass in the period of November 2017 to October 2020. **Results:** A total of 416 patients, had a mean (standard deviation [SD]) age of 58.1 (10.1) years, including 83.7% males. Most were smokers (79.8%) with a mean (SD) smoking index of 506.45 (252.16). The most common types of lung cancer in descending order were adenocarcinoma (ADC) (43.8%), squamous cell carcinoma (34.9%), small-cell lung cancer (12%), and others (9.3%). Upper lobe involvement (46.8%) was more common. At the time of diagnosis, 72.6% of total patients were presented with a stage III or higher index of severity. The yield of endobronchial biopsy, bronchoalveolar lavage, transbronchial lung biopsy, transbronchial needle aspiration, and brushing were 87.8%, 45.5%, 64.1%, 53.2%, and 45.1%, respectively, with overall diagnostic yields of 69.9%. **Conclusion:** Lung cancer is mainly discovered in the elderly, males, and smokers with advanced pathological stages. The most common morphology of lung cancer is ADC. Bronchoscopy is considered an initial tool for the assessment of lung mass and shows a higher diagnostic yield in centrally located tumors.

Keywords: Biopsy, bronchoscopy, lung cancer, morphology

INTRODUCTION

It estimates that 1 in 5 people will develop cancer during their whole lives (1 in 8 males and 1 in 11 females).^[1] According to Globocon 2020, the second-most common cancer is lung cancer with an incidence of 11.4% affecting 2.2 million. It carries the highest mortality number of 1.8 million (18%). The incidence is 14.3% in males (1.4 million) and 8.4% (770,000) in females.^[2] In India, the incidence of lung cancer is 7.8% in males (51765) and 3.1% in females (20835). It remains the fourth-most common cancer in India with an incidence of 5.5% (72510) and mortality of 7.8% (66279).^[3] As per the National Cancer Registry Programme India, lung cancer incidence is expected in males 71,788 (1 in 68) and in females 26490 (1 in 201) with a cumulation of 98278 (1 in 101).^[4]

The morphology pattern of lung cancer appears to be changing, with adenocarcinoma (ADC) being equal or even higher than squamous cell carcinoma (SqCC) in terms of the probability of occurrence in some Asian and most Western countries.^[5,6] However, the pathological and clinical profile of lung cancer in India appears to show large variations. In addition, longer trends in lung cancer demographics are sparsely studied, and most centers report their results within short periods.^[7]

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MATERIALS AND METHODS

It was a retrospective observational analysis that involved consecutive 416 patients with radiologically diagnosed lung mass in duration from November 2017 to October 2020 in the Respiratory Medicine department at a tertiary care center. The ethical approval was obtained from the institutional ethical committee.

Clinical details were recorded in a decided formulated pattern that includes demographic details such as age, sex, a detailed smoking history (current smoker and nonsmoker in form of cigarette, bidi, and hookah), previous treatment history, and imaging details. Radiological evidence suggested mass lesions in the lung were included in the study. Multiple varieties of diagnostic modalities were utilized: (1) Bronchoscopy guided-end bronchial biopsy, transbronchial lung biopsy (TBLB), transbronchial needle aspiration (TBNA), bronchoalveolar lavage (BAL), and Brushing and (2) without the guidance of bronchoscope-computerized tomography (CT)-guided biopsy, ultrasonography (USG)-guided biopsy and tru-cut biopsy.

Figure 1 shows a flow chart of participants for inclusion in the present study. Patients had a history of isolated pleural effusion, hemodynamic instability, uncooperative, refused consent for the procedure, and radiological imagine inconclusive of mass were excluded from the study.

The morphological analysis was performed according to WHO grading of lung cancer (1) Nonsmall-cell lung cancer-ADC, SqCC, Non Small Cell Lung Carcinoma - Not Otherwise Specified (NSCLC-NOS), (2) small-cell lung carcinoma (SCLC), (3) Others.^[8]

Staging of cancer was carried out by CT scan chest and upper abdomen, CT scan head and neck, Brain CT or whole-body positron emission tomogram CT, magnetic resonance imaging brain or bone scanning. The staging was based on the system of the 8th edition of the International Association for Study of Lung Cancer.^[9] SCLC classification of two stages: limited vs. extensive, was analyzed as per American Joint Commission for Cancer TNM system.^[10]

Statistical analysis

Data were collected in prepared pro forma and arranged in

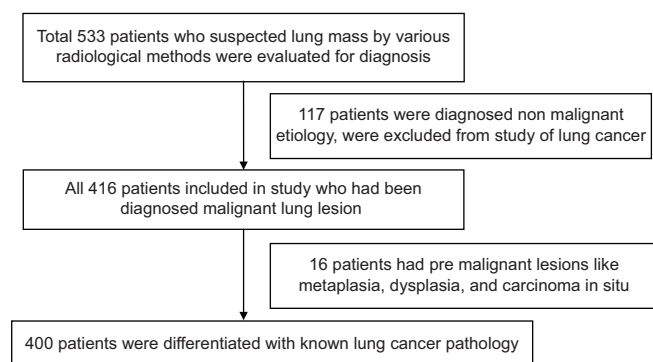


Figure 1: Flow chart of patients screening and inclusion in the study

excel file. The variables quantitative in nature were expressed in mean ± standard deviation (SD). The categorical variables were shown as frequency and percentage. The correlation between the two defined variables was judged by a *t*-test or Chi-square test. The data analysis was performed using IBM SPSS (Statistical Package for the Social Sciences) 20.0 (IBM, Chicago city, Illinois, USA) software. *P* < 0.05 was considered to be statistically significant, marked as bold letter in table.

RESULTS

The demographic baseline characteristics of malignant lung disease are shown in Table 1. The mean (SD) age was 58.15 (10.16). The proportion of male patients was higher (83.7%) compared to females (16.3%). There were 332 (79.8%) smokers and 84 (20.2%) nonsmokers. The mean (SD) smoking index was 506.45 (252.16) with a higher percentage of heavy smokers. The right-sided and upper lobe pathology was more common. ADC (43.8%) was the most common pathology detected in lung cancer patients, followed

Table 1: Demographic and baseline characteristics of patients having lung pathology

Variables (n=416)	Subgroups	n (%)
Age (years)	Mean±SD	58.15±10.16
Sex	Male	348 (83.7)
	Female	68 (16.3)
Smoking status	Smokers	332 (79.8)
	Nonsmokers	84 (20.2)
Smoking index (n=332)	Mean±SD	506.45±252.16
	<100	23 (6.9)
	100-300	69 (20.8)
	301-600	112 (33.7)
	>600	128 (38.6)
Laterality (n=416)	Right	227 (54.6)
	Left	170 (40.9)
	Bilateral	17 (4.1)
	Undefined	2 (0.4)
Predominant lobe involvement (n=416)	Upper	195 (46.8)
	Middle/lingular	45 (10.8)
	Lower	88 (21.2)
	Others	88 (21.2)
Morphology	ADC	182 (43.8)
	SqCC	145 (34.9)
	SCLC	50 (12)
	NSCLC - NOS	23 (5.5)
	Premalignant	16 (3.8)
Stage NSCLC - TNM staging 8 th ed.. ition (n=366)	T _{is} N ₀ M ₀	4 (1.1)
	T _x N ₀ M ₀	12 (3.3)
	I	27 (7.4)
	II	57 (15.6)
	III	157 (42.8)
	IV	109 (29.8)
Small cell carcinoma (n=50)	Limited stage	21 (42)
	Extensive stage	29 (58)

SD: Standard deviation, ADC: Adenocarcinoma, SCLC: Small cell lung cancer, NSCLC: Non-SCLC, NOS: Not otherwise specified, TNM: Tumor, node, metastasis, SqCC: Squamous cell carcinoma

by SqCC (34.9%), small-cell carcinoma (SCLC) (12%), and others (5.5%). The pre-malignant lesion was depicted in 3.8% of cases. According to Stage NSCLC-TNM Staging eighth Ed, there were a higher percentage of stage three and stage four patients, 42.8% and 29.8%, respectively. Advanced SCLC was detected in 58% of individuals.

Table 2 shows lung cancer cases comparison among smokers and nonsmoker groups. This firmly suggests that smokers developed lung cancer at an earlier age than nonsmokers. Smoking rates were higher in men than in women (95.9% vs. 4.1%). Overall, the incidence of ADC was higher in both groups, but SqCC, SCLC, and NSCLC (NOS) were commonly observed in smokers.

A comparison of lung cancer morphology is shown in Table 3. It defines that parameters such as age, sex, smoking status, smoking index, and stage of severity were evenly distributed in all groups of patients. The incidence among males was significantly higher compared to females. It was observed that in ADC, SqCC, and SCLC, upper lobe involvement was almost two times more common than lower lobe involvement. NSCLC-NOS were more likely to exhibit lower lobe pathology. However, more research is required to emphasize lobular dominance in each type of lung cancer.

The various methods utilized to diagnose lung cancer are shown in Table 4. Each morphology of lung cancer diagnosed by bronchoscopy has been demonstrated which has not previously been studied in detail. Out of the total of 660 biopsies, there were 447 biopsies had positive malignancy results (72.3%). Visible endobronchial lesions were observed more among SqCC (56%) and SCLC (61.7%) groups compared to ADC (35.2%) due to the tendency of ADC lesions at peripheral sites. The yield of another bronchoscopic sampling such as TBLB, BAL, TBNA, and brushing detected 64.1%,

45.5%, 53.2%, and 45.1%, respectively. Overall diagnostic yield of lung cancer by bronchoscopic methods was 69.9%. The bronchoscopic procedures yield in SqCC and SCLC were 90.8% and 85%, respectively, due to its tendency to involve central structures of the mediastinum. Other types of lung

Table 2: Comparison between smokers and nonsmokers in study population

Variables (n=400)	Subgroups	Smokers (n=320), n (%)	Nonsmokers (n=80), n (%)	P
Age (years)	Mean±SD	55.0±12.39	58.9±9.35	<0.05
Sex	Male	307 (95.9)	30 (37.5)	<0.05
	Female	13 (4.1)	50 (62.5)	
Laterality (n=416)	Right	175 (54.7)	44 (55)	0.75
	Left	130 (40.6)	32 (40)	
	Bilateral	14 (4.4)	3 (3.8)	
	undefined	1 (0.3)	1 (1.2)	
Predominant lobe involvement (n=416)	Upper	165 (51.6)	23 (28.8)	<0.05
	Middle/lingular	34 (10.6)	10 (12.4)	
	Lower	61 (19.1)	23 (28.8)	
	Others	60 (18.7)	24 (30)	
Morphology	ADC	137 (42.8)	45 (56.3)	0.06
	SqCC	121 (37.8)	24 (30)	
	SCLC	45 (14.1)	5 (6.2)	
	NSCLC - NOS	17 (5.3)	6 (7.5)	
Stage NSCLC - TNM staging 8 th ed.. ition (n=350)	I	24 (7.5)	3 (3.8)	0.23
	II	44 (13.8)	13 (16.2)	
	III	129 (40.3)	28 (35)	
	IV	78 (24.4)	31 (38.8)	
Small cell carcinoma (n=50)	Limited stage	18 (5.6)	3 (3.8)	0.39
	Extensive stage	27 (8.4)	2 (2.4)	

SD: Standard deviation, ADC: Adenocarcinoma, SCLC: Small cell lung cancer, NSCLC: Non-SCLC, NOS: Not otherwise specified, TNM: Tumor, node, metastasis, SqCC: Squamous cell carcinoma

Table 3: A comparison of study groups according to morphology of lung cancer

Variables (n=400)	Subgroups	ADC (n=182), n (%)	SqCC (n=145), n (%)	SCLC (n=50), n (%)	NSCLC - NOS (n=23), n (%)
Age (years)	Mean±SD	58.73±10.1	58.41±9.74	56.46±7.7	55.5±13.3
Sex	Male	139 (76.4)	131 (90.3)	48 (96)	19 (82.6)
	Female	43 (23.6)	14 (9.7)	2 (4)	4 (17.4)
Smoking status	Smokers	137 (75.3)	121 (83.4)	45 (90)	17 (73.9)
	Nonsmokers	45 (24.7)	24 (16.6)	5 (10)	6 (26.1)
Smoking index	Mean±SD	513.2±230.25	517.0±263.88	467.8±267.8	528.0±284.2
Predominant lobe	Upper	96 (52.7)	67 (46.2)	19 (38)	6 (26.2)
	Middle/lingular	17 (9.3)	20 (13.8)	6 (12)	1 (4.3)
	Lower	41 (22.5)	25 (17.2)	7 (14)	11 (47.8)
	Others	28 (15.5)	33 (22.8)	18 (36)	5 (21.7)
Stage NSCLC - TNM Staging 8 th ed.. ition (n=350)	I	14 (7.6)	11 (7.6)	NA	2 (8.6)
	II	31 (17.1)	21 (14.5)		5 (21.7)
	III	68 (37.4)	77 (53.1)		12 (52.3)
	IV	69 (37.9)	36 (24.8)		4 (17.4)
Small cell carcinoma (n=50)	Limited stage	NA	NA	21 (42)	NA
	Extensive stage			29 (58)	

SD: Standard deviation, ADC: Adenocarcinoma, SCLC: Small-cell lung cancer, NSCLC: Non-SCLC, NOS: Not otherwise specified, TNM: Tumor, node, metastasis, SqCC: Squamous cell carcinoma, NA: Not available

tissue sampling like tru-cut biopsy, USG-guided biopsy, and CT-guided biopsy had diagnostic values of 85.7% with a higher proportion of ADC (61.9%).

DISCUSSION

Advancing age is a major risk factor for lung cancer. It is most commonly seen between the ages of 40 and 70, and its prevalence increases with age and reaches the highest value in the sixth to seventh decades.^[10] The occurrence of lung cancer is lower in young adults (around 5 to 10% under 50 years of age). This group of young adults usually has a positive family history and the most common cancer pathology is ADC.^[11] The average age of the present study group was 58.1 years, which is quite similar to other Indian studies.^[7,12-16] In addition, the present study also supports a higher frequency of lung cancer in men in comparison to women.^[7,12-21]

There was a higher incidence of lung cancer among smokers. As shown in Table 5, the percentage of smokers in various studies of lung cancer is higher, ranging 52%–89% which is comparable with our study (79.8%). The percentage of heavy smokers (smoking index >300) was 69.2% in Mohan *et al.*^[7] which is comparable to our study (72.3%).^[15] Similarly, upper lobe predominance pathology was observed in 46.8% of patients in our study who comparable of 51.3% of Mohan *et al.*^[7] Interestingly, smokers had predominantly upper lobe involvement compared to nonsmokers who

showed lower lobe predominance which had not clearly defined in previous studies. The various national studies show that the incidence of ADC was higher than SqCC after 2012 [Table 5] which might be explained by rising numbers of lung cancer in younger age group, nonsmokers and female patients.

At the time of initial diagnosis, most NSCLC patients belonged to the advanced stage of the category. Stage III and higher stage of lung cancer were depicted in 72.6% of patients in the present study. In other studies such as Bhattacharya *et al.*,^[22] Furrkh *et al.*,^[23] Mohan *et al.*,^[7] and Singh *et al.*^[15] had noticed 71.8%, 82.1%, 96%, and 97% of patients who had lung cancer pathology of stage III or higher. Similarly, in SCLC, the extensive stage of cancer was more common than the limited stage (Singh *et al.*^[15] vs. Mohan *et al.*^[7] vs. present study: limited stage-44.8% vs. 24.8% vs. 42% and extensive stage-55.2% vs. 75.2% vs. 58% respectively).

Table 6 shows comparisons of various methods for lung cancer detection. The diagnostic outcome is higher in visible endobronchial lesions. Overall, bronchoscopy yield was 69.9% in the present study group, which is comparable to other reference ranges.

Limitation of the study

This study has not included details of pleural fluid analysis and thoracoscopic analyzed patients. Advanced methods of

Table 4: A various types of diagnostic modalities utilized for diagnosis of lung cancer

	EBB (n=255), n (%)	TBLB (n=145), n (%)	BAL (n=68), n (%)	TBNA (n=32), n (%)	Brushing (n=62), n (%)	Others (n=98), n (%)	All (n=660), n (%)
ADC	75 (29.4)	58 (40)	11 (16.2)	2 (6.3)	15 (24.2)	52 (53.1)	213 (32.3)
SqCC	97 (38)	26 (17.9)	16 (23.5)	9 (28.1)	9 (14.5)	16 (16.3)	173 (26.2)
SCLC	37 (14.5)	6 (4.1)	2 (2.9)	4 (12.5)	2 (3.2)	9 (9.2)	60 (9.1)
NSCLC NOS	15 (5.9)	3 (2.1)	2 (2.9)	2 (6.3)	2 (3.2)	7 (7.1)	31 (4.7)
Malignancy yield	224 (87.8)	93 (64.1)	31 (45.5)	17 (53.2)	28 (45.1)	84 (85.7)	477 (72.3)

ADC: Adenocarcinoma, SCLC: Small-cell lung cancer, NSCLC: Non-SCLC, NOS: Not otherwise specified, SqCC: Squamous cell carcinoma, BAL: Broncho alveolar lavage, EBB: Endobronchial biopsy, TBLB: Trans bronchial lung biopsy, TBNA: Trans bronchial needle aspiration

Table 5: A comparison of lung cancer demographics between various Indian studies^[7]

Author (reference)	Place	Year	Total	Male: female	Mean age (years)	Smokers (%)	ADC (%)	SqCC (%)	ADC : SqCC	SCLC (%)
Prasad <i>et al.</i> ^[12]	Lucknow	2004	400	4.3:1	57	71	18.5	46.5	0.4	18.2
Rawat <i>et al.</i> ^[13]	Uttarakhand	2009	203	8.2:1	56.4	81.77	19.38	44.83	0.43	16.75
Sheikh <i>et al.</i> ^[14]	Kashmir	2010	783	6.98:1	57.8	68.1	2.6	71.3	0.04	20.8
Singh <i>et al.</i> ^[15]	Chandigarh	2012	654	5.0:1	58.2	76.9	27.5	38.1	0.72	20.5
Dey <i>et al.</i> ^[16]	Kolkata	2012	607	4.1:1	57.9	67.2	30.8	35.1	0.88	16.5
Noronha <i>et al.</i> ^[17]	Mumbai	2012	489	3.5:1	56	52	43.8	26.2	1.67	8
Krishnamurthy <i>et al.</i> ^[18]	TamilNadu	2012	258	3.5:1	56	60.5	42.6	15.8	2.7	13.2
Malik <i>et al.</i> ^[19]	New Delhi	2013	434	4.6:1	55	67.9	37.1	32.1	1.16	14.7
Murali <i>et al.</i> ^[20]	Chennai	2017	678	3.17:1	~	53.4	51.2	16.1	3.18	9
Kaur <i>et al.</i> ^[21]	Chandigarh	2017	1301	4.6:1	58.6	76.9	36.4	36.4	1	19.2
Mohan <i>et al.</i> ^[7]	Delhi	2019	1862	4.9:1	58	76.2	34	28.6	1.19	16.1
Present study	Gujarat	2020	416	5.2:1	58.15	79.8	43.8	34.9	1.26	12.02

ADC: Adenocarcinoma, SCLC: Small-cell lung cancer, SqCC: Squamous cell carcinoma

Table 6: A comparison of different modalities in the diagnosis of lung cancer

Study	Place (year)	Bronchoscopic diagnostic yield (%)					Overall	Others
		EBB	TBLB	TBNA	BAL	Brushing		
Schreiber and McCrory ^[24]	USA (2003)	74	46	56	48	59	69-88	33-62
Roth <i>et al.</i> ^[25]	Norway (2008)		60.7	40.8	6.9	23	44.4	-
Rivera <i>et al.</i> ^[26]	Ohio (2013)	74	57-63	65	43	54-61	78	88-92
Patil and Rujuta ^[27]	Latur (2017)	84.55	26.22	62.6	-	-	71.95	-
Present study	Gujarat (2020)	87.8	64.1	53.2	45.5	45.1	69.9	85.7

BAL: Broncho alveolar lavage, EBB: Endobronchial biopsy, TBLB: Trans bronchial lung biopsy, TBNA: Trans bronchial needle aspiration

diagnosis such as fluoroscopy, endobronchial ultrasound, virtual bronchoscopy navigation, and electromagnetic navigational bronchoscopy were not utilized due to unavailability at study centers. The study population represents only the west zone of India.

CONCLUSION

Lung cancer is mainly diagnosed in older patients and in the advanced pathological stage. The incidence of lung cancer is higher among males and smokers. ADC is the most common pathology to be encountered in lung cancer. Bronchoscopy is the initial tool for the diagnosis of lung cancer, shows a high yield for centrally located lung mass.

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Conflicts of interest

There are no conflicts of interest.

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