Original Research Article

Epidemiology of lung cancer in Eastern India with focus on histopathological subtypes and smoking history: a single rural tertiary center experience

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ABSTRACT

Background: Lung cancer is the most common cancer and the leading cause of mortality worldwide. Smoking remains the commonest risk factor for development of lung cancer. This study aimed to evaluate the histopathological subtypes and smoking history among patients with lung cancer.

Methods: This was a retrospective observational study that included all the patients attending Radiotherapy OPD of Burdwan Medical College during 2017 and 2018. Demographic data, smoking history, comorbidities, symptoms, smoking history, histology of lung cancer, stage at presentation, site of metastasis, and site of lesions were collected.

Results: There were 484 patients, with a median age of 59 years, of which 82.4% were men and 17.6% were women. The men-to-women ratio was 4.7:1. Regular smoking was common in patients with lung cancer (72.7%). Total 12.4% of patients had small-cell carcinoma; of the 87.6% patients with non-small-cell carcinoma, the most common histology was adenocarcinoma (44.6%), followed by squamous cell (38.4%), large cell (17.0%). The most common metastatic sites were lung (42.1%) followed by bone (34.1%), lymph node (15.9%), liver (2.7%), vertebra (2.5%), pleura (2.1%), and anterior chest wall (0.6%). A larger proportion of men (92.6%) were smokers as compared to women. There was a statistically higher occurrence of adenocarcinoma in smokers than in non-smokers (62.2% vs. 2.4%; p<0.001). The majority of patients with a smoking history (73.0%) were found to have advanced cancer (Stage IV).

Conclusions: The present study confirmed that apart from smoking history, demographic characteristics appear to have an impact on lung cancer development.

Keywords: Adenocarcinoma, Loss of weight, Non-small-cell carcinoma, Metastatic

INTRODUCTION

A recently published report from 28 population-based cancer registries (PBCRs) for the composite period 2012-2016 across India has made it evident that the cancer incidence, patterns, time trends, and mortality varies greatly across different geographic regions. The age-adjusted incidence rate ranged from 62.8 to 269.4 per 100000 population and age-adjusted mortality rate ranged from 20.5 to 152.7 per 100000 population across the Northeast region only.1

Worldwide, lung cancer has variable epidemiologic pattern according to the geographic region. The heterogenous epidemiology of lung cancer across the various geographic regions in India is also noteworthy.2 It is estimated that lung cancer is the one of the top five prevalent types of cancer and one in 68 men across India will develop lung cancer during their lifetime. However,
the highest cancer incidence rate observed in the Northeast region compared to other areas in the country and lung cancer as one of the leading sites of cancer is a concerning fact.\(^1\)

Global trend of rise in the incidence of adenocarcinoma among the patients with lung cancer indicates a vast change in histological pattern. Epidemiological studies from India have shown inconsistent patterns, few studies showing squamous histology as the prevalent one while others indicating adenocarcinoma and squamous cell carcinoma (SCC) as equally prevalent.\(^1,4\) A recent evidence from North India has reported a similar global trend of highest prevalence of adenocarcinoma over other histology patterns.\(^5\)

Indian epidemiological data on lung cancer is limited, more so from the eastern parts of the country and rural scenario. The present study aimed to assess the epidemiological patterns of lung cancer in a high-volume rural centre of Eastern India, and determine whether global trends observed with respect to changing patterns of epidemiological profile of lung cancer is also applicable for Indian population, especially in the rural scenario.

**METHODS**

This was a retrospective observational study that included all the patients attending Radiotherapy OPD of Burdwan Medical College and Hospital having histopathological diagnosis of lung cancer between June 2017 and November 2018. The study was conducted in accordance with the principles of Declaration of Helsinki and after ethics committee approval. The patients aged >18 years of either sex, diagnosed with lung cancer on histopathological examination were included in the study. Patients with thoracic metastatic disease from a non-pulmonary primary cancer were excluded.

Demographic data (age and sex), comorbidities, symptoms, smoking history, histology of lung cancer, stage at presentation, site of metastasis, and site of lesions were collected from hospital records. Diagnosis of lung cancer was confirmed by histopathological and/or cytological examination of representative tissue specimens at our center.

Descriptive data analysis was performed using Statistical package for social sciences (SPSS) version 23.0. Quantitative variables were presented as mean (standard deviation [SD]) and qualitative variables were presented as frequency and percentage.

**RESULTS**

A total of 484 patients with lung cancer were included in the study, 399 (82.4%) were men and 85 (17.6%) were women with a men-to-women ratio of 4.7:1. The median (range) age of study population was 59 (33-79) years. Majority of patients belonged to the age group of >40 to ≤60 years (52.3%) followed by the age group >60 years (42.8%) and the age group ≤40 years (4.9%).

| Parameters         | Number of patients (N=484) |
|--------------------|-----------------------------|
| **Sex**            |                             |
| Men                | 399 (82.4)                  |
| Women              | 85 (17.6)                   |
| **Age [years], median (range)** | 59.0 (33.0-79.0) |
| **Age groups [years]** |                        |
| ≤40                | 24 (4.9)                    |
| >40≤60             | 253 (52.3)                  |
| >60                | 207 (42.8)                  |
| **Comorbidities**  |                             |
| Diabetes mellitus  | 76 (15.7)                   |
| Hypertension       | 63 (13.0)                   |
| Chronic kidney disease | 19 (3.9)            |
| Hypothyroid        | 13 (2.7)                    |
| Ischemic heart disease | 12 (2.5)            |
| Other              | 4 (0.8)                     |
| **Symptoms**       |                             |
| Loss of weight     | 390 (80.6)                  |
| Cough              | 293 (60.5)                  |
| Chest pain         | 281 (58.1)                  |
| Loss of appetite   | 251 (51.9)                  |
| Dyspnea            | 131 (27.1)                  |
| Fever              | 107 (22.1)                  |

Continued.
Parameters | Number of patients (N=484)
--- | ---
Hemoptysis | 86 (17.8)
Facial swelling | 41 (8.5)
Hoarseness of voice | 20 (4.1)
**Smoking status** | 
Smoker | 352 (72.7)
Non-smoker | 132 (27.3)
**Histological type of lung cancer** | 
Non-small cell lung cancer | 424 (87.6)
Small cell lung cancer | 60 (12.4)
**Histological subtype of non-small cell lung cancer [n=424]** | 
Adenocarcinoma | 189 (44.6)
Squamous cell carcinoma | 163 (38.4)
Large-cell lung cancer | 72 (17.0)
**Stage** | 
II | 18 (3.7)
III | 209 (43.2)
IV | 257 (53.1)
**Sites of metastases** | 
Bone | 204 (42.1)
Liver | 165 (34.1)
Lung | 77 (15.9)
Lymph node | 13 (2.7)
Pleura | 12 (2.5)
Vertebra | 10 (2.1)
Ant chest wall | 3 (0.6)
**Site of lesion** | 
Right | 298 (61.6)
Left | 123 (25.4)
Bilateral | 63 (13.0)

Data shown as n (%), unless otherwise specified.
Other comorbid conditions: asthma (n=2); dementia (n=1); epilepsy (n=1).

Table 2: Comparison of characteristics between smokers and non-smokers with lung cancer.

| Parameters | Smoker (n=352) | Non-smoker (n=132) | P value |
| --- | --- | --- | --- |
| **Sex** | 
Men | 326 (92.6) | 73 (55.3) | <0.001 |
Women | 26 (7.4) | 59 (44.7) | 
| **Age [years], median (range)** | 53.0 (33.0-68.0) | 64.0 (60.0-79.0) | <0.001 |
| **Age groups [years]** | 
≤40 | 24 (6.8) | - | <0.001 |
>40≤60 | 230 (65.3) | 23 (17.4) | 
>60 | 98 (27.8) | 109 (82.6) | 
| **Comorbidities** | 
Diabetes mellitus | 74 (21.0) | 2 (1.5) | 
Hypertension | 56 (15.9) | 7 (5.3) | <0.001 |
Chronic kidney disease | 16 (4.5) | 3 (2.3) | 
Hypothyroid | 12 (3.4) | - | 
Ischemic heart disease | 11 (3.1) | 2 (1.5) | 
Other | 4 (1.1) | - | 
| **Symptoms** | 
Loss of weight | 326 (92.6) | 64 (48.5) | <0.001 |
Cough | 274 (77.8) | 19 (14.4) | <0.001 |
Continued.
### Parameters

| Parameters                   | Smoker (n=352) | Non-smoker (n=132) | P value |
|------------------------------|----------------|--------------------|---------|
| Chest pain                   | 216 (61.4)     | 65 (49.2)          | 0.018   |
| Loss of appetite             | 208 (59.1)     | 43 (32.6)          | <0.001  |
| Dyspnea                      | 90 (25.6)      | 41 (31.1)          | 0.251   |
| Fever                        | 84 (23.9)      | 23 (17.4)          | 0.141   |
| Hemoptysis                   | 77 (21.9)      | 9 (6.8)            | <0.001  |
| Facial swelling              | 31 (8.8)       | 10 (7.6)           | 0.855   |
| Hoarseness of voice          | 13 (3.7)       | 7 (5.3)            | 0.445   |

### Histological type of lung cancer

| Non-small cell lung cancer   | 299 (84.9) | 125 (94.7) | 0.003 |
| Small cell lung cancer       | 53 (15.1)  | 7 (5.3)    |       |

### Histological subtype of non-small cell lung cancer [n=424]

| Adenocarcinoma               | 186 (62.2) | 3 (2.4)   | <0.001 |
| Squamous cell carcinoma      | 51 (17.1)  | 112 (89.6)| <0.001 |
| Large-cell lung cancer       | 62 (20.7)  | 10 (8.0)  |         |

### Stage

| Stage | Smoker (n=352) | Non-smoker (n=132) | P value |
|-------|----------------|--------------------|---------|
| 2     | -              | 18 (13.6)          | <0.001  |
| 3     | 95 (27.0)      | 114 (86.4)         |         |
| 4     | 257 (73.0)     | -                  |         |

### Sites of metastases

| Site             | Smoker (n=352) | Non-smoker (n=132) | P value |
|------------------|----------------|--------------------|---------|
| Bone             | 122 (34.7)     | 43 (32.6)          |         |
| Liver            | -              | 13 (9.8)           |         |
| Lung             | 204 (58.0)     | -                  |         |
| Lymph node       | 26 (7.4)       | 51 (38.6)          | <0.001  |
| Pleura           | -              | 10 (7.6)           |         |
| Vertebra         | -              | 12 (9.1)           |         |
| Ant chest wall   | -              | 3 (2.3)            |         |

### Site of lesion

| Site             | Smoker (n=352) | Non-smoker (n=132) | P value |
|------------------|----------------|--------------------|---------|
| Right            | 298 (84.7)     | -                  | <0.001  |
| Left             | 50 (14.2)      | 73 (55.3)          |         |
| Bilateral        | 4 (1.1)        | 59 (44.7)          |         |

Data shown as n (%), unless otherwise specified.

Other comorbid conditions: asthma (n=2); dementia (n=1); epilepsy (n=1).

The most common symptoms were loss of weight (80.6%), cough (60.5%), chest pain (58.1%), and loss of appetite (51.9%). While dyspnea, fever, hemoptysis, facial swelling, hoarseness of voice occurred in 27.1%, 22.1%, 17.8%, 8.5%, and 4.1% of patients, respectively. Regular smoking was common in patients with lung cancer (72.7%). Small cell lung cancer was diagnosed in 12.4% of patients, while 87.6% of the patients had non-small cell lung cancer (NSCLC). Within NSCLC, the most common histology was adenocarcinoma (44.6%) followed by SCC (38.4%) and large-cell lung cancer (17.0%). A small proportion (4.5%) of patients were diagnosed by cytology as NSCLC, without further histopathological sub-typing. Eighteen patients belonged to stage II, 209 patients in stage II, and 257 patients in stage IV. The most common metastatic sites were lung (42.1%) followed by bone (34.1%), lymph node (15.9%), liver (2.7%), vertebra (2.5%), pleura (2.1%), and anterior chest wall (0.6%). Out of 484 patients, 61.6% patients had the lesion on right side, 25.4% on left side while 13.0% of patients had bilateral lesions (Table 1).

A larger proportion of men (92.6%) were smokers as compared to only 7.4% of women who were smokers. The median age of non-smokers was significantly higher than that of smokers (64 versus 53 years, p<0.001). A larger proportion of non-smokers with lung cancer (82.6%) were noted in the older age group (>60 years). The NSCLC was the most common histological type both among smokers and non-smokers. There was a statistically higher occurrence of adenocarcinoma in smokers than in non-smokers (62.2% versus 2.4%; p<0.001). The SCC histology was more commonly found among non-smokers than smokers (89.6% versus 17.1%; p<0.001). The majority of patients with a smoking history (73.0%) were found to have advanced cancer (Stage IV). The most common metastatic sites among smokers were lung
(58.0%) and bone (34.7%). The most common metastatic sites among non-smokers were lymph node (38.6%) and bone (32.6%). Left and bilateral-sided lesions were significantly higher in non-smokers than smokers (55.3% versus 14.2% and 44.7% and 1.1%, respectively) (Table 2).

**DISCUSSION**

The present study comprises a total of 484 patients. Majority of them were men with a men-to-women ratio of 4.7:1. The majority of the present study population was from the age group >40 to ≤60 years. The average age of presentation in the study was 59 years. Regular smoking was common in patients with lung cancer. The NSCLC was diagnosed in 87.6% of the patients. Within NSCLC, the most common histology was adenocarcinoma followed by SCC and large-cell lung cancer. Most of the patients were in the late stage. Lung, bone, lymph node, liver, vertebra, pleura, and anterior chest wall were the common sites of metastases. There was a statistically higher occurrence of adenocarcinoma in smokers than in non-smokers. The majority of patients with smoking history were in advanced cancer stage (Stage IV).

Men predominance in patients with lung cancer was observed in this study. This finding is in general agreement with previous worldwide and Indian reports showing that the incidence of lung cancer is more often in men than women, and in younger adults aged >40 years.6 Lu et al used the Surveillance, Epidemiology, and End results (SEER) database and noted that lung cancer incidence was majorly driven by men (n=646,662).7 Another noteworthy study from Indian literature that included patients with lung cancer noted the prevalence of men over women (82.9 versus 17.1%).5 Hence, men patients are more prone to develop lung cancer.

In the present study, younger patients reported a higher incidence of lung cancer than older patients. A study by Noronha et al that the incidence of lung cancer was directly proportional with increasing age and the majority of patients diagnosed with lung cancer were in the age group of >40-60 years.8 The previous study conducted at a regional cancer centre from western India reported the prevalence of lung cancer and it was found to be highest in the younger age group (15-60 years).9 Another evidence-based ambispective observational study reported the analysis of 1862 patients with lung cancer and remarkable prevalence in younger individuals aged between 46-70 years (75.7%).5 Regarding age distribution, the burden of lung cancer has increased with an increasing incidence of diagnosed lung cancer in the adult age 40 years and older.2

Tobacco smoking is the major cause of all major histopathological types of lung cancer. Smoking history was the most common lifestyle-related risk factor seen among this study population. These findings are in concordance with Agarwal et al, study wherein smoking and tobacco were the risk factors shown to be strongly associated with lung cancer.10 The risk of developing lung cancer was 20-50-fold higher among continuous smokers than non-smokers.11 The epidemiological studies have drawn a causal association between exposure to cigarette smoke and lung cancer risk.12,13 Gupta et al, demonstrated that environmental tobacco smoke exposure during childhood was associated with the risk of developing lung cancer (odds ratio, OR: 3.9, 95% confidence interval [95% CI] 1.9-8.2).14 Overall evidence reveals that passive smoking led to poor lung function and increased risk for the development of lung cancer.

The NSCLC was present among 87.6% of patients with lung cancer. Adenocarcinoma was found to be commonest histological type followed by SCC, and large-cell lung cancer. These observation concord with a previous study in the literature wherein adenocarcinoma was the most common histological type observed in 29.3% of patients with lung cancer.10 Krishna et al, reported a higher incidence of NSCLC (80-85%) among lung carcinomas. Furthermore, within NSCLC adenocarcinoma was found to be the predominant histologic type in India.15 Similarly, another study from India demonstrated that adenocarcinoma was the most common histological type which accounts for 44.0% of the patients.8 Therefore, all these evidences along with the present study conclude that the predominance of adenocarcinoma among patients with lung cancer.

Adenocarcinomas appear to be more common in non-smokers, light smokers, or former smokers, whereas SCC or other histologic types are more common in heavy smokers and current smokers. A study by Noronha et al reported that around 52% of lung cancer patients were found to be never smokers, with adenocarcinoma being the most common histology followed by SCC.8 Similar findings were observed in study done by Das et al. in Chennai which reported adenocarcinoma being the most common histology non-smokers.10 However, SCC was the most common histology among the smokers. In contrast to these results present study noted a higher occurrence of adenocarcinoma in smokers than in non-smokers.

**Limitations**

The major limitations of this study are its retrospective design and small sample size. This study did not record the fatality status of the patients therefore the study could not calculate the association between smoking history and the risk of death. Further large study population-based studies are required to better explain the above trends.

**CONCLUSION**

The present study confirmed that apart from smoking history, demographic characteristics, including age, and sex appear to have an impact on lung cancer development. In addition, present reflected the global trend of rise in the incidence of adenocarcinoma.
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Conflict of interest: None declared  
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Mathur P, Sathishkumar K, Chaturvedi M, Das P, Sudarshan KL, Santhappan S, et al. Cancer Statistics, 2020: Report From National Cancer Registry Programme, India. JCO Glob Oncol. 2020;6:1063-75.
2. Noronha V, Pinninti R, Patil VM, Joshi A, Prabhash K. Lung cancer in the Indian subcontinent. South Asian J Cancer. 2016;5(3):95-103.
3. Behera D. SC17.03 Lung Cancer in India: Challenges and Perspectives. Journal of Thoracic Oncology. 2017;12.1S:S114-5.
4. Kaur H, Sehgal IS, Bal A, Gupta N, Behera D, Das A, et al. Evolving epidemiology of lung cancer in India: Reducing non-small cell lung cancer—not otherwise specified and quantifying tobacco smoke exposure are the key. Indian J Cancer. 2017;54:285-90.
5. Mohan A, Garg A, Gupta A, Sahu S, Choudhari C, Vashistha V, et al. Clinical profile of lung cancer in North India: A 10-year analysis of 1862 patients from a tertiary care center. Lung India. 2020;37:190-7.
6. Milovanovic IS, Stjepanovic M, Mitrovic D. Distribution patterns of the metastases of the lung carcinoma in relation to histological type of the primary tumor: An autopsy study. Ann Thorac Med. 2017;12(3):191-8.
7. Lu T, Yang X, Huang Y, Zhao M, Li M, Ma K, et al. Trends in the incidence, treatment, and survival of patients with lung cancer in the last four decades. Cancer Manag Res. 2019;11:943-53.
8. Noronha V, Dikshit R, Raut N, Joshi A, Pramesh CS, George K, et al. Epidemiology of lung cancer in India: focus on the differences between non-smokers and smokers: a single-centre experience. Indian J Cancer. 2012;49(1):74-81.
9. Kulkarni RS, Anand AS, Parikh SK. Clinical and epidemiological profile of neuroendocrine tumors: An experience from a regional cancer center from Western India. South Asian J Cancer. 2019;8(3):198-202.
10. Agrawal A, Tandon R, Singh L, Kumar P, Pant H, Prakash S. Clinical profile of lung cancer in a tertiary care teaching hospital in north India with special reference to acceptance and outcome of treatment. J Pulmonol. 2018;2(1):4-8.
11. Doll R, Peto R, Boreham J. Mortality in relation to smoking: 50 years’ observations on male British doctors. BMJ. 2004; 328: 1519.
12. Hymowitz N. Cigarette Smoking and Lung Cancer: Pediatric Roots. Lung Cancer Int. 2012;2012:790841.
13. Remen T, Pintos J, Abrahamowicz M, Siemiatycki J. Risk of lung cancer in relation to various metrics of smoking history: a case-control study in Montreal. BMC Cancer. 2018;18(1):1275.
14. Gupta D, Aggarwal A, Jindal S. Pulmonary effects of passive smoking: the Indian experience. Tob Induc Dis. 2002;1(2):129-36.
15. Krishna GG, Vahini G, Mrudula K, Asha T. An interesting study of lung cancers at a tertiary care centre. MedPulse Int J Med. 2019;10(2):56-8.
16. Das A, Krishnamurthy A, Ramshankar V, Sagar TG, Swaminathan R. The increasing challenge of never smokers with adenocarcinoma lung: Need to look beyond tobacco exposure. Indian J Cancer. 2017;54(1):172-7.

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