Sir Salimullah Medical College Journal

Sir Salimullah Med Coll J 2024; 32: 10-15

Original Article

DOI: https://doi.org/10.3329/ssmcj.v32i1.84525

Location and Histological Pattern of Lung Carcinoma in Relation to the Smoking Habit

Mohammad Towfique Hasan[1], Jalal Mohsin Uddin[2], Mahfuza Tayeba Yasmin[3], Mohua Chatterjee[4], Chandon Roy[4]

Article information
Received: 02.07.2025
Accepted: 18.09.2025

Cite this article:
Hasan MT, Uddin JM, Yasmin MT, Chatterjee M, Roy C. Location and Histological Pattern of Lung Carcinoma in Relation to the Smoking Habit. Sir Salimullah Med Coll J 2024; 32: 10-15.

Key words:
Lung cancer, smoking duration, histological subtypes, adenocarcinoma.

Abstract:

Background: *Lung cancer is the leading cause of cancer-related mortality worldwide, with smoking as the principal risk factor. The histological subtypes of lung cancer, including adenocarcinoma, squamous cell carcinoma, and small cell carcinoma, vary according to smoking history and intensity. This study investigates the effect of smoking duration on the histological subtypes of lung cancer in Bangladesh.* ***Methods:*** *A cross-sectional study was conducted at the National Institute of Diseases of the Chest and Hospital (NIDCH) from July 2021 to June 2022. A total of 81 patients with confirmed primary lung cancer were included who were smokers.* ***Results:*** *Among the 81 patients, 37%% had adenocarcinoma, 33.3% squamous cell carcinoma, 19.8% small cell carcinoma, 6.2% large cell carcinoma, and 3.7% other subtypes. Smokers exhibited a higher incidence of adenocarcinoma. Majority (79.01%) of the patients with lesions in the upper lobe was smokers compared to 20.99%% of patients with lesions in the lower lobe ($p < 0.001$). Ratio of upper and lower lobe tumour among smoker was roughly of 4:1.A significant association was found between smoking duration and the occurrence adenocarcinoma.****Conclusion:*** *In our research releveled that smoking duration has a significant impact on the histological types oflung carcinomas especiallyadenocarcinomas are more prevalent in smokerswhich affect the upper lobe predominantly.*

Introduction:

Lung cancer remains the leading cause of cancer-related mortality worldwide, accounting for a significant percentage of all cancer deaths. It is responsible for approximately 12.8% of new cancer cases annually, with an incidence rate of 37.5 per million among men and 10.8 per million among women.[1] Smoking is the primary risk factor for lung cancer, contributing to nearly 90% of cases in the United States. Other risk factors include occupational exposure, environmental carcinogens, and air pollution, which together account for a smaller percentage of cases.[2] Compared to non-smokers, smokers have a nearly 20-fold increased risk of developing lung cancer.[3]

Histologically, lung cancer is classified into four primary subtypes: squamous cell carcinoma, adenocarcinoma, small cell carcinoma, and large cell carcinoma.[4] These subtypes represent 95% of all primary lung cancer cases, with squamous cell carcinoma and small cell carcinoma showing the strongest associations with smoking history.[5] Studies indicate that smoking duration, more than smoking intensity, is most strongly associated with the development of squamous cell carcinoma and small cell carcinoma.[6] In contrast, adenocarcinoma

1. Associate Professor, Department of Respiratory Medicine, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh.
2. Associate Professor, National Institute of Chest Diseases Hospital, Dhaka, Bangladesh.
3. Senior Medical Officer, BIHS Hospital, Dhaka, Bangladesh.
4. Registrar, Department of Respiratory Medicine, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh.

Correspondence: Dr. Mohammad Towfique Hasan, Associate Professor, Department of Respiratory Medicine, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh,e-mail: hasanmohammadtowfique@gmail.com.

occurs more frequently among individuals with fewer pack-years and among those who have quit smoking, suggesting that different patterns of smoking exposure impact lung cancer histology in distinct ways.[7,8]

Over recent decades, the histological distribution of lung cancer has shifted, with adenocarcinoma becoming more common than squamous cell carcinoma. This change may be linked to modifications in cigarette composition, such as the use of filter tips and altered tobacco blends, which influence inhalation patterns and the type of carcinogens deposited in the lungs.[9] As a result, adenocarcinoma now surpasses squamous cell carcinoma in incidence—a reversal from the 1950s when squamous cell carcinoma was more prevalent. Understanding the connection between smoking patterns and lung cancer subtypes is essential for assessing risk and developing targeted screening measures.[10]

In addition to histology, the location of lung tumors shows an association with smoking. Research suggests that smoking-related lung tumors tend to arise more often in the upper lobes, with studies showing an upper-to-lower lobe ratio of approximately 2.5:1.[4] This phenomenon may be due to variations in lung ventilation and perfusion, with lower ventilation in the upper lobes potentially allowing carcinogens to persist longer. Additionally, differences in lymphatic drainage and blood circulation to the upper lobes may contribute to the predominance of smoking-related tumors in these areas.[11] Such locational patterns could influence cancer management and prognosis, as certain lung cancer subtypes exhibit different survival outcomes based on their location.[12]

In Bangladesh, lung cancer remains a significant health concern, yet there is limited local data on how smoking influences lung cancer type and tumor location.This research seeks to address current knowledge gaps, offering a foundation for improved lung cancer management in Bangladesh that considers local smoking patterns and histological trends.

Methods:

In this cross-sectional study, conducted from July 2021 to June 2022 at the National Institute of Diseases of Chest and Hospital (NIDCH), Dhaka, Bangladesh. 81 patients were diagnosed with primary lung cancer participated. Patients were selected consecutively based on predefined inclusion and exclusion criteria. Onlysmokers with primary lung cancer presenting with a solitary lung lesion were included, while cases with metastatic cancer, bilateral or multi-lobe involvement, and contraindications to fiberoptic bronchoscopy (FOB) were excluded. Informed consent was obtained from all participants, and ethical considerations were adhered to, ensuring minimal invasiveness and immediate management of any complications. Detailed smoking histories, including duration, and other relevant factors were collected through a structured data sheet. Clinical data, such as age of smoking initiation, time since smoking cessation, and type of cigarettes used, were also recorded. Routine investigations included chest X-rays, complete blood counts, sputum analysis, ECG, spirometry, and coagulation tests. For tumor localization and histological analysis, flexible FOB with biopsy, brushing, and bronchoalveolar lavage (BAL) were performed for central lesions, while CT-guided fine-needle aspiration cytology (FNAC) was utilized for peripheral lesions or cases where bronchoscopy was inconclusive. Tumors were categorized as upper or lower lobe based on CT and FOB findings. Histological and cytological diagnoses were confirmed through analysis at NIDCH's Department of Pathology. Data were analyzed using SPSS 27, with statistical tests such as Student's t-test or chi-square applied to assess relationships between smoking variables and lung cancer subtypes. A p-value of less than 0.05 was deemed statistically significant.

Results:

Table I shows the majority of the patients had a history of smoking, with 50.61% being current smokers and 49.38% being former smokers.

Table I: Distribution of Patients by Smoking Habit (n = 81)

Smoking Habit	Frequency	Percentage (%)
Present smokers	41	50.61
Past smokers	40	49.38
Total	81	100

Table II: Comparison of Smoking Habit between Sex (n = 81)

Male (n = 79)	Female (n = 2)
79 (97.53%)	2 (2.46%)

Table II shows a significant difference in smoking habits between males and females. A significantly higher proportion of males were smokers (97.53%)compared to females (2.46%).

Figure 1 shows the distribution of patients based on their use of filters. Majority 44.5% of the patients used filters, 43.2% used non-filter cigarettes, and 12.3% used both filter and non-filter cigarettes.

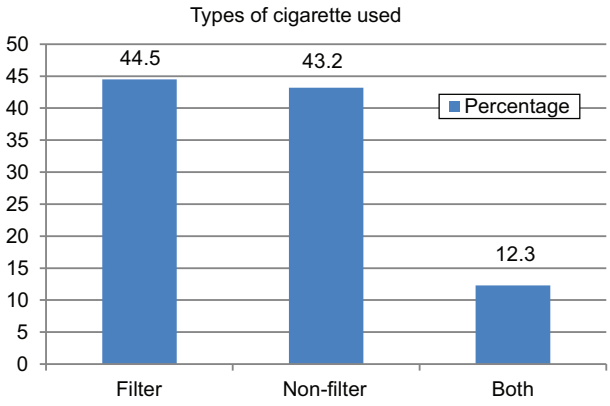

Figure 1: Distribution of patients by types of cigarettes used (n = 81)

Table III shows a significant association between histologic cell type and smoking habit. In the smoker group, 37% had adenocarcinoma, 33.3% squamous cell carcinoma, 6.2% large cell carcinoma, 19.8% small cell carcinoma and 3.7% others.

Table III: Association between Histologic Cell Type and Smoking Habit

Histologic Cell Type	Percentage
Adenocarcinoma	30 (37.0%)
Squamous cell carcinoma	27 (33.3%)
Large cell carcinoma	5 (6.2%)
Small cell carcinoma	16 (19.8%)
Other	3 (3.7%)

Table IV compares smoking-related variables between the major cell types: squamous cell & small cell carcinoma (SCC & SCLC) versus adenocarcinoma & others. The SCC & SCLC group began smoking at a significantly younger age (22.1 ± 3.9 years) compared to the adenocarcinoma group (26 ± 3.7 years, $p < 0.001$) and had a much longer smoking duration (34.5 ± 8.9 years vs. 18.5 ± 8.5 years, $p < 0.001$). Pack-years of smoking were also substantially higher in the SCC & SCLC group (48.1 ± 12.5) than in the adenocarcinoma group (12.8 ± 11, $p < 0.001$). Additionally, there was a significantly longer lag time between quitting smoking and the development of adenocarcinoma compared to SCC & SCLC ($p < 0.001$).

Table IV: Association between Smoking-Related Variables and Cancer Cell Type

Smoking-Related Variables	SCC & SCLC (n = 44)	Adenocarcinoma & Others (n = 54)	p-value
Age at starting smoking (years)	22.1 ± 3.9	26.0 ± 3.7	<0.001
Duration of smoking (years)	34.5 ± 8.9	18.5 ± 8.5	<0.001
Pack-years of smoking	48.1 ± 12.5	12.8 ± 11.0	<0.001
Time since quitting smoking (years)	4.1 ± 5.4	17.2 ± 9.9	<0.001

Table V: Pulmonary Lobe Affected in Smoker Patients

Upper Lobe (n = 64)	Lower Lobe (n = 17)	Upper: Lower Lobe Ratio
64 (79.01)	17 (20.99)	4:1

Table V shows that the majority (79.01%) of the patients with lesions in the upper lobe was smokers compared to 20.99% of patients with lesions in the lower lobe. Ratio of upper and lower lobe tumour among smoker was roughly of 4:1. Smoking tends to be significantly associated with malignancy in the upper lobe of the lungs.

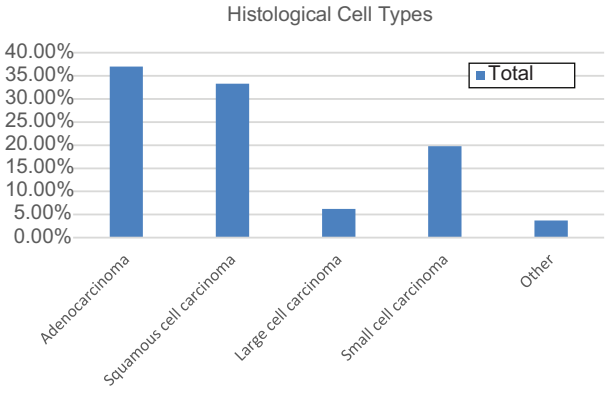

Figure 2: *Distribution of patients by type of cell (n = 81)*

Figure 2 shows the histological and/or cytologic cell type of the lesions. 37% of patients exhibited adenocarcinoma, 33.3% squamous cell carcinoma (SCC), 6.2% large cell carcinoma (LCC), 19.8% small cell carcinoma (SCLC) and 3.7% other cytologic cell type.

Discussion:

Lung cancer remains the leading cause of cancer-related mortality worldwide, with smoking identified as the primary etiological factor.[13] Studies have shown that both smoking duration and cumulative exposure, often expressed in pack-years, are significant predictors of lung cancer risk and histological subtype distribution. This study investigates these associations, with a specific focus on the role of smoking habits in the development of specific histological types of lung cancer.

This cross-sectional study, conducted at the National Institute of Diseases of Chest & Hospital (NIDCH), analyzed 81 patients with confirmed primary lung cancer. After excluding benign cases, inflammatory conditions, and non-localized lung lesions, 81 cases were finalized for analysis, enabling a comparative analysis of lung cancer subtype distribution in relation to smoking history.

The study sample had a significant male predominance, with a39.5:1 male-to-female ratio, consistent with Hussain and Qayyum.[14,15] This trend likely reflects the higher prevalence of smoking among males in Bangladesh and perhaps societal factors limiting healthcare-seeking behavior among females. Smoking was notably more common among males, further highlighting the correlation between smoking habits and lung cancer incidence.

Tumor localization, assessed through chest CT and fiber-optic bronchoscopy, revealed a predominance of upper lobe tumors among smokers, with nearly 79.01% of upper lobe tumors occurring in this group. This finding aligns with prior studies that suggest a higher ventilation-perfusion ratio in the upper lobes, leading to prolonged exposure to inhaled carcinogens in smokers.[16] In contrast, non-smokers more frequently presented with lower lobe tumors. The observed tendency of carcinogens to settle in the upper lobes may contribute to this distribution, with upper lobe tumors being four times more prevalent among smokers compared to non-smokers. This distribution was similar to findings from other studies, such as Jamnik, Uehara, and Silva, who observed a statistically significant predominance of upper lobe tumors among smokers (69.6%).[13]

Among the 81 patients, adenocarcinoma (37.0%) was the most common subtype,followed by squamous cell carcinoma (33.3%), small cell carcinoma (19.8%), and large cell carcinoma (6.2%), others (3.7%). These findings align with those of Strauss, but differ from Hussain, who reported a higher prevalence of squamous cell carcinoma than adenocarcinoma in Bangladesh.[14,17] However, an increasing trend in adenocarcinoma prevalence, particularly among smokers, has been noted in recent years.This shift toward adenocarcinoma in smokers may be attributable to changes in cigarette composition, specifically the adoption of filtered, low-tar cigarettes. These design changes, intended to reduce harm, encourage deeper inhalation and may lead to a greater accumulation of carcinogens in the peripheral lung tissue, the primary site for adenocarcinoma development.[18]

The relationship between smoking duration, cumulative exposure (pack-years), and histological subtype was examined. The data demonstrated that longer smoking duration and higher pack-year history were more strongly associated with

squamous cell carcinoma and small cell carcinoma than with adenocarcinoma. In particular, the mean duration of smoking and the mean pack-year history were significantly higher in patients with squamous and small cell carcinomas, supporting previous research findings by Lee et al., that linked higher smoking intensity with these histological types.[11] Notably, the squamous cell and small cell carcinoma group had a lower average age at smoking initiation and a higher pack-year history, reinforcing the association of smoking intensity with these histological types.

Additionally, patients who had quit smoking exhibited a higher prevalence of adenocarcinoma, which may reflect a delayed response to cessation among this subtype compared to squamous cell and small cell carcinomas. This aligns with Khuder et al., who found that cessation of smoking showed the greatest reduction in risk for squamous and small cell carcinoma, with adenocarcinoma displaying the least reduction.[19]

The study further examined the effect of cigarette type on lung cancer histology, observing a higher prevalence of adenocarcinoma among filter cigarette users compared to non-filter cigarette users. Conversely, squamous cell and small cell carcinomas were more common among those who smoked non-filter cigarettes. This difference was statistically significant, aligning with previous studies that associate filtered cigarettes with a shift toward peripheral adenocarcinoma, possibly due to the inhalation depth promoted by filtered cigarettes.[9]

Limitationsof the study:

This study's single-center design may limit the generalizability of findings to broader populations. Additionally, the relatively small sample size could affect the statistical power and precision of subtype-specific analyses.

Conclusion:

This study findings indicate that upper lobe tumors are more common among smokers, with a significant association between smoking intensity (duration and pack-years) and the histological types most closely linked to tobacco exposure isadenocarcinoma, possibly due to changes in cigarette design and smoking patterns.

Acknowledgment:

The authors sincerely thank the staffs, participants, and colleagues for their invaluable support and contributions to this study.

Financial support and sponsorship:

No funding sources.

Conflicts of interest:

There are no conflicts of interest.

Ethical Approval:

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Institutional Review Board of the National Institute of Diseases of Chest and Hospital. Written informed consent was taken from all the patients before taking part of the study.

References:

1. Jemal A, Murray T, Ward E et al. Cancer statistics, CA cancer J Clin, 2005, vol 55, pp 10-30.
2. Cinciripini PM, Hecht SS, Henningfield JE, Manley MW, Kramer BS. Tobacco addiction: Implications for treatment and cancer prevention. Journal of the national cancer institute; 1997; vol 89,no24 pp 1852-67.
3. Alberg AJ and Samet JM. Epidemiology of lung cancer. Chest: 2003; vol 123, pp 21-49.
4. Paris C. Benichou J, Saunier F et al. Smoking status, occupational asbestos exposure and bronchial location of lung cancer. Lung cancer. 2003; vol 40 1, pp 17-24.
5. Wynder EL, Kabat GC. The effect of low yield cigarette smoking on lung cancer risk. Cancer. 1988; vol 62, pp 1223-30.
6. Sellers TA, Bailey Wilson JE, Elston RC et al. Evidence for mendelian inheritance in the pathogenesis of lung cancer. J Natl Cancer Inst; 1990; vol 82, pp 1272-79.
7. Lubin. IH and Blot WJ. Assessment of lung cancer risk factors by histologic category. J. Natt Cancer Inst, 1984; vol 73, pp 383-92.
8. Lee CH, Ko YC, Goggins W et al. Life time environmental exposure to tobacco smoke and primary lung cancer of non-smoking Taiwanese wonen, International Journal of epidemiology, 2000; vol 29, pp 224-31.
9. Wynder EL and Muscat JE. The changing epidemiology of smoking and lung cancer histology, Environmental health perspect, 1995; vol 103, pp.143-8.
10. Majumder SC, Uddin AKMR, Kashem A, Alam SS. Diagnostic approach of pulmonary radio-opaque shadow through fine needle aspiration cytology. Journal of Dhaka Medical College, 1998; vol. 7. pp. 11-13.
11. Lee BW, Wain JC, Kelsey KT, Wiencke JK, Christiani DC. Association between Diet and lung cancer.

Location. AM J Respir Crit Care Med; 1998; vol 158,pp 1197-1203.

12. Bilello KS, Murin S. Matthay RA. Epidemiology, etiology and prevention of lung cancer. Clin Chest Med. 2002; Vol 23, pp 1-25.
13. Jamnik S, Uehara C, Silva VVD, Location of lung carcinoma in relation to the smoking habit and gender. J Bras Pneumol; 2006; vol 32, pp 510-4.
14. Hussain AKMM. Histopathological pattern of bronchial carcinoma in smokers in Bangladesh, MD thesis, University of Dhaka, 2005.
15. Qayyum MA. Role of bronchial brushing and bronchial biopsy in the diagnosis of lung cancer. MD thesis, University of Dhaka. 2000.
16. Lee BW, Wain JC. Kelsey KT,Wiencke JK, Christiani DC. Association of cigarette smoking and asbestos exposure with location and histology of lung cancer. Am J Respir Crit Care Med; 1998, Vol 157, pp748. 755.
17. Strauss GM, Cummings KM,. Smoking related adenocarcinoma of the lung: Now the most common cause of cancer death in the United States. Proc Am Soc Clin Oncol; 2003; vol 22, p 638.
18. Gazdar AF and Minna JD. Cigarettes, sex and lung adenocarcinoma. Journal of the National Cancer Institute; 1997; vol 89. pp 1563-65
19. Khuder SA, Dayal HH, Mutgi AB, Willey JC, Dayal G. Effect of cigarette smoking on major histological types of lung cancer in men. Lung cancer, 1998; vol 22, pp 15-21.