Section: Pulmonology

Original Research Article

A COMPREHENSIVE ANALYSIS OF THE CLINICAL PRESENTATION AND DIAGNOSTIC APPROACHES IN PATIENTS WITH PULMONARY CARCINOMA AT A TERTIARY CARE HOSPITAL

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Received : 09/09/2024
Received in revised form : 31/10/2024
Accepted : 14/11/2024

Keywords:
Lung cancer, histopathology, radiology, adenocarcinoma, squamous cell carcinoma.

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DOI: 10.47009/jamp.2024.6.6.10

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (6); 45-51

Abstract

Background: Lung cancer is one of the leading causes of cancer-related morbidity and mortality worldwide. In India, the burden of lung cancer is increasing, with a significant proportion of patients presenting at advanced stages. The aim of this study was to analyze the clinical, radiological, and histopathological characteristics of lung cancer patients at a tertiary care hospital in India, focusing on demographic trends, symptomatology, tumor staging, and histological subtypes. **Materials and Methods:** This was a retrospective, observational study conducted at a tertiary care hospital from January 2021 to December 2023. A total of 100 lung cancer patients were included, with demographic data, clinical symptoms, radiological findings, and histopathological diagnoses recorded. Radiological imaging was reviewed to assess tumor size, location, and metastatic spread, while histopathological examination and immunohistochemistry (IHC) were used for tumor classification. Staging was performed using the TNM classification. **Result:** The mean age of patients was 59.3 years, with a male predominance (66%). The majority of patients were smokers (62%), with squamous cell carcinoma (SCC) and small cell lung carcinoma (SCLC) being more common in smokers. Non-smokers predominantly had adenocarcinoma (94.7%). Cough, loss of appetite, and dyspnea were the most common symptoms, with 50% of patients presenting with symptoms for 2 weeks to 1 month. Radiologically, 84% of patients had mass lesions, and 49% showed pleural nodules. The most common sites of metastasis were the opposite lung (46.7%) and pleura (41.1%). Histologically, adenocarcinoma was the most frequent subtype (60%), and 65.6% of patients had stage T4 tumors. **Conclusion:** This study highlights the high prevalence of smoking in lung cancer patients, the increasing incidence of adenocarcinoma in non-smokers, and the advanced stage at diagnosis. The findings emphasize the need for early detection, improved awareness, and targeted therapies to improve patient outcomes in lung cancer. Smoking cessation programs and increased screening for high-risk populations should be prioritized to reduce the burden of the disease.

INTRODUCTION

Pulmonary malignancies, especially lung cancer, rank among the most significant global health concerns. With an estimated 2.1 million new cases annually, lung cancer accounts for about 11.6% of all new cancer diagnoses worldwide and remains the leading cause of cancer-related mortality, responsible for 1.8 million deaths or 18.4% of all cancer deaths.[1] In India, where Non-Communicable Diseases

ISSN (O): 2687-5365; ISSN (P): 2753-6556

(NCDs) contribute to 63% of all deaths, cancer is a major cause, accounting for 9% of these deaths. The prevalence of lung cancer has been increasing in India, and it is the most common cancer among men, driven largely by high rates of tobacco use, exposure to air pollution, and contact with radioactive carcinogens.[2]

India's unique tobacco consumption patterns further exacerbate lung cancer rates. Tobacco is consumed in diverse forms including cigarettes, bidis, hookahs, and various smokeless forms like pan chewing and dried tobacco powder inhalation.[3] This widespread use contributes not only to lung cancer but also to other malignancies such as laryngeal, pharyngeal, and gastrointestinal cancers. Rural regions, like Andhra Pradesh, are experiencing a noticeable rise in lung cancer cases, likely due to the increasing prevalence of tobacco use.[4]

The demographic characteristics of lung cancer in India reveal a younger affected population compared to other countries. Prognosis varies by histological subtype, with non-small cell carcinoma (NSCLC) generally showing a better outcome than small cell carcinoma.[5] Interestingly, adenocarcinoma, once rare among non-smokers, has become a more common subtype due to advances in understanding molecular markers like EGFR mutations, which open new therapeutic avenues for targeted treatments.[6]

Diagnosis of pulmonary malignancies requires a combination of imaging and biopsy techniques. Techniques such as fiber-optic bronchoscopy and image-guided transthoracic biopsies are selected based on the tumor's location and spread.[7] Imaging modalities like chest X-rays, computed tomography (CT), and positron emission tomography (PET) are integral to the diagnostic process.[8] Globally, there has been a shift in the most prevalent lung cancer subtype: while squamous cell carcinoma was historically dominant, adenocarcinoma has now become more common, especially in Western and many Asian countries.[9] Indian studies reflect this trend variably, with some identifying adenocarcinoma as the most common epithelial lung malignancy, while others report squamous cell carcinoma as predominant.[10]

Given the increasing burden of lung cancer and the challenges associated with its diagnosis and management, this study aims to analyze the clinical presentation, diagnostic methods, and existing healthcare gaps in lung cancer management at a tertiary care hospital in India. Through this study, we seek to contribute to a better understanding of lung cancer trends in India, enhancing early detection strategies, optimizing resource allocation, and ultimately improving outcomes in this high-burden context.

MATERIALS AND METHODS

Study Design and Setting: This study was a cross-sectional, observational, and descriptive analysis conducted over a 2-year period, from October 2021 to October 2023, at the Respiratory Medicine Department of NRI Medical College and General Hospital in Chinakakani, Guntur District, India. The hospital is a tertiary care center providing comprehensive diagnostics and treatment for patients with pulmonary conditions. The study included both inpatients and outpatients who presented with symptoms suggestive of pulmonary malignancy. Patients were assessed for various clinical and diagnostic features to evaluate the presence of primary or secondary lung cancer.

Sample Size: A total of 100 patients who met the inclusion criteria were enrolled in the study. These patients were selected based on their clinical presentation, radiological features, and the ability to undergo the necessary diagnostic investigations. The sample size was chosen to ensure adequate power for descriptive analysis of clinical and diagnostic findings in pulmonary malignancy.

Inclusion and Exclusion Criteria

Patients were included in the study if they presented with symptoms and radiologic features suggestive of primary or secondary pulmonary malignancy. These patients were further evaluated with various diagnostic tools to confirm the diagnosis. Exclusion criteria included patients who were unwilling or unable to provide consent for participation or for necessary investigations. Additionally, patients with moribund illness, or those who were uncooperative or unable to comply with the study protocol, were excluded from the study to ensure accurate and reliable data collection.

Data Collection: After confirming eligibility and obtaining informed consent, a detailed proforma was completed for each patient. Data were collected retrospectively from electronic medical records, including demographic data (age, gender, residence), clinical presentation (symptoms like cough, hemoptysis, chest pain, dyspnea, and weight loss), smoking history (including type, duration, and frequency), and known risk factors such as family history of lung cancer and occupational exposures. Clinical Presentation and Examination: Initial clinical symptoms and findings were documented from medical records, and their frequency was analyzed. A history of tobacco use, including the form (cigarettes, bidis, hookahs, etc.) and quantity (pack-years), was recorded. Radiological Assessment: Imaging modalities used in diagnosis, including chest X-ray, computed tomography (CT), and positron emission tomography (PET) scans, were reviewed. For each case, the imaging findings, tumor location (central or peripheral), size, extent of local and distant spread, and staging were recorded. Histopathological and Cytological Analysis: For definitive diagnosis, all patients underwent histopathological or cytological examination. Specimens were obtained via various methods based on tumor location and physician recommendation, including bronchoscopy, endobronchial ultrasound (EBUS)-guided biopsy, or image-guided transthoracic needle aspiration. Histological subtype

ISSN (O): 2687-5365; ISSN (P): 2753-6556

(adenocarcinoma, squamous cell carcinoma, small cell carcinoma, or others) was recorded. Immunohistochemistry was used as needed to confirm diagnoses and identify biomarkers.

Statistical Analysis: Data collected from the study were entered into Excel spreadsheets for analysis. Descriptive statistical methods, including the calculation of frequencies and percentages, were used to summarize the demographic characteristics, clinical presentations, and diagnostic findings of the study population. Since the study was descriptive in nature, no inferential statistics were applied, but simple statistics were employed to analyze trends and patterns within the data.

Ethical Considerations: Ethical approval for this study was obtained from the Institutional Ethics Committee of NRI Medical College. Informed consent was acquired from all patients who participated in the study, ensuring their understanding of the study's objectives and the procedures involved. All patient information was anonymized, and confidentiality was maintained throughout the research process. The study adhered to ethical guidelines outlined in the Declaration of Helsinki, ensuring the protection of participants' rights and safety.

RESULTS

The study included 100 patients with a mean age of 59.3 ± 10.5 years, with a predominance of males (66%). A family history of lung cancer was reported in 6% of patients. The most common comorbidities were hypertension (46%), diabetes (38%), and chronic obstructive pulmonary disease (37%). Among participants, 62% were smokers, primarily exposed to cigarettes (37.1%) or beedis (43.5%), while non-smokers had biomass (39.5%) or passive smoke exposure (15.8%). Pack years were >40 in 61.3% of smokers, and all smokers had a severe smoking index (>300) [Table 1].

Among the 100 patients, the most common symptoms at onset were cough (99%), loss of appetite and weight (88%), and dyspnea (86%). Chest pain and fever were present in 41% and 42% of cases, respectively, while hemoptysis and hoarseness of voice occurred in 35% and 33%. Symptom duration varied, with half of the patients (50%) reporting symptoms between 2 weeks and 1 month. Physical signs included clubbing (59%), pallor (28%), and lymphadenopathy (27%), while 16% presented with superior vena cava obstruction. Lung cancer was primary in 90% of patients, most often affecting the right lung (61%) and involving multiple lobes in 52%. Lesions were predominantly central (66%), reflecting common presentations in advanced pulmonary malignancies [Table 2].

Radiologic findings revealed that the majority of patients (84%) presented with a mass, while nearly half displayed pleural nodules (49%) or lung collapse (49%). Nodules and pleural effusions were each noted in 39% of cases, with less frequent findings including cavitation (14%), bony erosion (13%), and lymphangitis carcinomatosis (18%). In terms of diagnostic procedures, CT-guided biopsy provided the highest yield (64%), followed by bronchoscopy-guided biopsy (25%). Histopathological examination (HPE) of lung malignancies indicated that non-small cell lung cancer (NSCLC) was overwhelmingly predominant (96%) compared to small cell lung cancer (4%). Among primary lung cancers, adenocarcinoma was most common (60%), followed by squamous cell carcinoma (25.6%). Secondary lung cancers were mainly squamous cell carcinoma (70%), with rare instances of clear cell carcinoma, metastatic malignant melanoma, and fibromyxoid sarcoma [Table 3].

In primary lung cancer cases (n=90), most tumors were staged as T4 (65.6%), indicating advanced tumor size or invasion, with fewer cases in T3 (24.4%) and T2 (10%). Nodal staging showed significant lymph node involvement, with over half of the patients (54.4%) classified as N2 and 34.4% as N3. Regarding metastasis, 44.4% had no distant spread (M0), while 25.6% had M1a, 18.9% M1b, and 11.1% M1c metastasis. Among NSCLC cases (n=96), stage 4A (40.6%) was the most common, followed by 3B (20.8%). In small cell lung cancer (SCLC), five out of six cases were classified as extended stage. Metastatic spread in primary lung cancers frequently involved the opposite lung (46.7%) and pleura (41.1%), with notable instances of metastasis to the liver (18.9%), adrenal glands (13.3%), vertebra (12.2%), brain (8.9%), and ribs (8.9%) [Table 4].

Histopathological examination (HPE) with immunohistochemistry (IHC) marker analysis was used to accurately diagnose various lung malignancies. In metastatic malignant melanoma cases, HMB-45 and Melan A were positive, confirming melanocytic origin. For squamous cell carcinoma, pancytokeratin served as a reliable marker, while primary adenocarcinomas were identified using TTF1 and Napsin-A. Small cell carcinoma (SCLC) was confirmed by the presence of neuroendocrine markers, synaptophysin and chromogranin. In rare cases, synovial sarcoma and fibromyxoid sarcoma were diagnosed using specific markers, including CD99, Ki67, and TLE 3 for synovial sarcoma, and S-100 for fibromyxoid sarcoma in the lung. These IHC markers were essential in differentiating tumor types and guiding appropriate treatment strategies [Table 5].

The distribution of primary lung cancer types among smokers and non-smokers revealed significant differences, particularly in the incidence of adenocarcinoma. Among smokers (n=62), adenocarcinoma was found in 29.0% of cases, while in non-smokers (n=38), it was highly prevalent at 94.7% ($p<0.0001$). Squamous cell carcinoma was more common in smokers (35.5%) compared to non-smokers (2.6%). Small cell carcinoma was exclusively observed in smokers (9.7%), while no

ISSN (O): 2687-5365; ISSN (P): 2753-6556

cases were found in non-smokers. Other cancer types such as adenosquamous cell carcinoma (3.2% in smokers vs. 2.6% in non-smokers), undifferentiated carcinoma (4.8% in smokers vs. 0.0% in non-smokers), and synovial sarcoma (1.6% in smokers vs. 0.0% in non-smokers) were also present in smokers but absent in non-smokers. This highlights a significant difference in the types of lung cancer prevalent in smokers versus non-smokers, especially in adenocarcinoma cases [Table 6].

Table 1: Demographic and Clinical Characteristics of Study Participants, Including Smoking and Comorbidities.

Variables	Frequency/Mean+SD	%
Age	59.3+10.5	
Gender		
Male	66	66.0
Female	34	34.0
Family history of lung cancer		
Yes	6	6.0
No	94	94.0
Comorbidities		
Diabetes	38	38.0
Hypertension	46	46.0
Coronary artery disease	16	16.0
Bronchial asthma	4	4.0
Chronic Obstructive Pulmoary Disease	37	37.0
Prior Anti Tuberculosis Treatment	18	18.0
Thyroid Disorder	5	5.0
Smokers		
Yes	62	62.0
No	38	38.0
Type of smoke-exposed		
In smokers (n=62)		
Cigarette	23	37.1
Beedi	27	43.5
Cigarette and beedi	12	19.4
In non-smokers (n=38)		
Biomass	15	39.5
Passive smoking	6	15.8
No exposure	17	44.7
Pack years		
20-29	8	12.9
30-39	16	25.8
>40	38	61.3
Smoking index		
Mild (<100)	0	0.0
Moderate (100-299)	0	0.0
Severe (>300)	62	100.0

Table 2: Clinical Presentation, Symptoms, Signs, and Tumor Characteristics in Lung Cancer Patients.

Variables	Frequency	%
Symptoms at onset		
Cough	99	99.0
Dyspnoea	86	86.0
Chest Pain	41	41.0
Hemoptysis	35	35.0
Hoarseness of voice	33	33.0
Difficulty in swallowing	22	22.0
Fever	42	42.0
Loss of appetite & Loss of weight	88	88.0
Duration of symptoms		
≤ 2 weeks	6	6.0
2 weeks – 1 month	50	50.0
1-5 months	35	35.0
≥6 months	4	4.0
≥12 months	5	5.0
Signs		
Pallor	28	28.0
Clubbing	59	59.0
Lymphadenopathy	27	27.0
SVC obstruction	16	16.0
Lung cancer		
Primary	90	90.0
Secondary	10	10.0
Side of lung		
Left	33	33.0

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Right	61	61.0
Bilateral	6	6.0
Lobe involved		
Upper	17	17.0
Lower	2	2.0
Middle	29	29.0
>1	52	52.0
Site of lesion		
Central	66	66.0
Peripheral	34	34.0

Table 3: Radiologic Findings, Diagnostic Procedures, and Histopathological Findings in Lung Cancer Patients.

Variables	Frequency	%
Radiologic findings		
Mass	84	84.0
Nodule	39	39.0
Collapse	49	49.0
Consolidation	27	27.0
Cavitation	14	14.0
Hilar prominence	23	23.0
Pleural nodules	49	49.0
Pleural effusion	39	39.0
Bony erosion	13	13.0
Lymphangitis carcinomatosis	18	18.0
Diagnostic yield of procedure		
Bronchoscopy guided biopsy	25	25.0
CT guided biopsy	64	64.0
Thoracoscopy guided biopsy	9	9.0
USG guided biopsy	6	6.0
LN FNAC	15	15.0
Sputum cytology	1	1.0
HPE of lung malignancy		
NSCLC	96	96.0
SCLC	4	4.0
HPE of Primary lung cancer (n=90)		
Adenocarcinoma	54	60.0
Squamous cell carcinoma	23	25.6
Small cell carcinoma	3	3.3
Adenosquamous cell carcinoma	6	6.7
Undifferntiated carcinoma	3	3.3
Synovial sarcoma	1	1.1
HPE of Secondary lung cancer (n=10)		
Squamous cell carcinoma	7	70.0
Clear cell carcinoma	1	10.0
Metastatic malignant melanoma	1	10.0
Fibromyxoid sarcoma lung	1	10.0

Table 4: Staging and Metastasis Distribution in Primary Lung Cancer, NSCLC and SCLC.

Variables	Frequency	%
Primary Lung cancer (n=90)		
Tumor staging		
T1	0	0.0
T2	9	10.0
T3	22	24.4
T4	59	65.6
Nodal staging		
N0	4	4.4
N1	6	6.7
N2	49	54.4
N3	31	34.4
Metastasis staging		
M0	40	44.4
M1a	23	25.6
M1b	17	18.9
M1c	10	11.1
NSCLC (n=96)		
Stage		
2B	3	3.1
3A	7	7.3
3B	20	20.8
3C	6	6.3
4A	39	40.6

ISSN (O): 2687-5365; ISSN (P): 2753-6556

4B	9	9.4
SCLC (n=6)		
Stage		
Extended	5	8.3
Limited	1	1.7
Metastases		
Opposite lung	42	46.7
Pleura	37	41.1
Liver	17	18.9
Adrenal	12	13.3
Vertebra	11	12.2
Brain	8	8.9
Rib	8	8.9

Table 5: Immunohistochemical Markers for Histopathological Examination of Lung Cancer and Metastases.

HPE	IHC Markers
Metastatic malignant melanoma	HMB-45, Melan A
Squamous cell ca	Pancytokeratin
Primary adenocarcinoma	TTF1, Napsin-A
Small cell ca	Synaptophysin, Chromogranin
Synovial sarcoma	CD99, Ki67, TLE 3
Fibromyxoid sarcoma lung	S-100

Table 6: Distribution of Primary Lung Cancer Types Among Smokers and Non-Smokers.

Type of Primary lung cancer	Smoker (n=62)		Non-smoker (n=38)		P value
	Frequency	%	Frequency	%	
Adenocarcinoma	18	29.0	36	94.7	<0.0001
Squamous cell carcinoma	22	35.5	1	2.6	
Small cell carcinoma	6	9.7	0	0.0	
Adenosquamous cell carcinoma	2	3.2	1	2.6	
Undifferentiated carcinoma	3	4.8	0	0.0	
Synovial sarcoma	1	1.6	0	0.0	

DISCUSSION

This study comprehensively evaluated the clinical presentation, diagnostic approaches, and histopathological characteristics of pulmonary malignancies in a cohort of 100 patients at a tertiary care hospital. The median age of the cohort was 59.3 years, with a notable male predominance (66%), aligning with global trends where lung cancer predominantly affects males, especially in regions with high tobacco consumption.[11] Cancer symptoms commonly include cough (99%), dyspnoea (86%), and weight loss (88%), consistent with findings from similar studies. For instance, a study by Agarwal et al., found that cough and dyspnoea were the most prevalent symptoms in 75% of lung cancer patients.[12] The weight loss is particularly relevant, as it is often an indicator of advanced disease, underscoring the need for early diagnosis and intervention.[13] Moreover, the majority of patients in our study presented with a tumor size of T4 (65.6%), indicating advanced stages at diagnosis, which is consistent with the late-stage presentation observed in similar studies conducted in India.[14]

In terms of risk factors, smoking was identified as a significant contributor to lung cancer, with 62% of patients being smokers. This aligns with the findings from a large cohort study by Jadhav et al., which reported that 60% of lung cancer cases in India were attributed to smoking.[15] Notably, non-smokers were having a higher incidence of adenocarcinoma, particularly in the non-smoking group (94.7%). This observation echoes the findings of a study by Dhandapani et al., where non-smokers were more likely to develop adenocarcinoma, possibly due to factors such as genetic mutations (e.g., EGFR mutations) and exposure to environmental pollutants.[16]

Radiologically, the most common ere mass (84%), pleural effusion (39%), and collapse (49%), which are typical for patients with lung malignancy. These findings support the diagnostic value of imaging modalities such as chest X-ray and CECT in the initial evaluation of suspected lung cancer. Additionally, the diagnostic yield of CT guided biopsy (64%) was significantly higher than other methods, including bronchoscopy-guided biopsy (25%) and thoracoscopy-guided biopsy (9%), further corroborating the superiority of CT-guided biopsy in the diagnosis of peripheral lung lesions, as also suggested by a study by Bhattacharyya et al., and Dubey et al.[17,18]

Histopathologically, non-small cell lung carcinoma was the predominant type (96%), with adenocarcinoma being the most frequent subtype (60%). These results align with global data, where adenocarcinoma has surpassed squamous cell carcinoma as the most common subtype in both Western and Asian populations.[19,20] The higher incidence of adenocarcinoma in non-smokers (94.7%), suggests that environmental factors and genetic mutations, such as EGFR mutations, may play a critical role in the pathogenesis of lung cancer in this group.[21]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Metastasis staging revealed that 55% of patients had metastasis at the diagnosis, with the most common sites being the opposite lung (46.7%), pleura (41.1%), and liver (18.9%). This emphasizes the aggressive nature of lung cancer and the importance of staging in treatment planning. Similar findings were reported by Tamura et al., where liver, brain, and pleural metastasis were common in advanced lung cancer stages.[22]

The statistical analysis of tumor staging revealed a predominance of T4 tumor and N2 involvement (54.4%), suggesting that late-stage presentation remains a significant challenge. This is consistent with data from the National Cancer Registry Program of India, which reports that a large proportion of lung cancer patients are diagnosed at advanced stages (III and IV).[23] The high proportion of patients with extensive disease (M1a, M1b, M1c) further underscore for earlier detection and the implementation of effective screening programs.[24]

Immunohistochemistry (IHC) played a crucial role in the accurate diagnosis of various lung malignancies, confirm diagnosis of metastatic malignant melanoma, squamous cell carcinoma, and adenocarcinoma.[25] The use of IHC markers such as TTF1, Napsin-A for adenocarcinoma, and pancytokeratin for squamous cell carcinoma is well-documented in the literature as a reliable method for distinguishing between different lung cancer subtypes.[26]

CONCLUSION

In conclusion, the findings of this study highlight several critical aspects of lung cancer, including late-stage presentation, the impact of smoking on disease incidence, the growing incidence of adenocarcinoma, and the importance of advanced imaging and biopsy techniques in diagnosis. Given the high burden of lung cancer in India, it is imperative to strengthen early detection strategies, including the promotion of smoking cessation programs and improved access to screening and diagnostic facilities.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556