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INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/22526
DOI URL: http://dx.doi.org/10.21474/IJAR01/22526

RESEARCH ARTICLE

CLINICO-RADIO-PATHOLOGICAL PROFILE OF LUNG CANCER: AN OBSERVATIONAL STUDY IN A TERTIARY CARE HOSPITAL IN TRIPURA

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Manuscript Info

Manuscript History
Received: 01 November 2025
Final Accepted: 04 December 2025
Published: January 2026

Key words:-
Lung cancer, histopathology, radiological findings, adenocarcinoma, observational study, India

Abstract

Background: Lung cancer remains the leading cause of cancer mortality globally. The clinic radio pathological profile varies across geographic regions and populations. Data from North-Eastern India, particularly Tripura, are limited.

Objective: To characterize the clinical,radiological,and histopathological profile of primary lung cancer patients in a tertiary care hospital in Tripura.

Methods: A cross-sectional observational study was carried out over a period of 24 months (2023-2025) at the Department of Respiratory Medicine, Agartala Government Medical College and GBP Hospital. A total of two hundred forty (240) patients with newly diagnosed primary lung cancer were included in the study. Clinical presentations, imaging results (including chest radiography and computed tomography), and histopathological diagnoses were meticulously recorded.

Results: Among 240 patients, the mean age was 63.4 years with male predominance (65%, Male: Female ratio 1.89:1). The most common presenting symptom was cough (55.4%), followed by chest pain (54.6%) and weight loss (54.4%). Chronic obstructive pulmonary disease (45.8%) was the most frequent co morbidity. Chronic smoking (>20 pack-years) was reported in 59.2% of patients. Adenocarcinoma was the most common histological type (44.6%), followed by squamous cell carcinoma (40.4%), adenosquamous carcinoma (10.4%), small cell carcinoma (3.3%), and large cell carcinoma (1.3%). On imaging, peripheral lung field tumors (63.8%) predominated with spiculated margins (44.2%). Computed tomography-guided

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fine-needle aspiration cytology demonstrated superior diagnostic yield (61.7%) compared to bronchoscopic sampling (38.3%).
Conclusion: Adenocarcinoma has emerged as the most prevalent lung cancer subtype in this population, aligning with global trends.Chronic smoking and COPD remain significant risk factors. Early suspicion in patients presenting with persistent cough and constitutional symptoms warrants comprehensive evaluation. Regional cancer control strategies should emphasize tobacco cessation, occupational health protection, and early diagnostic protocols.

Introduction:-

Lung cancer represents the leading cause of global cancer incidence and mortality, with approximately 2 million new diagnoses and 1.8 million deaths annually [1]. The disease ranks as the second most common cancer in both males and females globally, second only to prostate and breast cancer, respectively [1]. With expanding tobacco consumption and rapid industrialization in developing nations, the incidence of lung cancer is rising steeply [1].
Hungary reports the highest age-standardized incidence rates (47.6 per 100,000)[2]. Compared to Western populations, epidemiological studies demonstrate substantially higher prevalence of lung cancer in Indian populations [2]. In India, the estimated incidence is 7.7 per 100,000, representing 5.9% of all cancers with predominance in males [3]. Lung cancer accounts for 8.1% of all cancer-related mortality, with a median age at diagnosis of 61 years [3]. The rising burden has been attributed to insufficient public education and persistent tobacco consumption coupled with environmental pollution [4].

The North-Eastern states of India, including Tripura, exhibit unique epidemiological patterns due to higher tobacco consumption and distinctive environmental exposures [5]. The region shows distinct disease patterns warranting location-specific research to inform regional public health interventions.Clinical presentations are frequently non-specific, often delaying diagnosis. Common symptoms include persistent cough, hemoptysis, chest pain, dyspnea, weight loss, and anorexia [6]. Mass lesions represent the most frequent radiological finding in both adenocarcinoma and squamous cell carcinoma, while pleural effusion is more common in small cell and adenocarcinoma subtypes [7,8].Chest radiography and sputum cytology have been evaluated for screening; however, advances in imaging technology have shifted emphasis toward low-dose computed tomography (LDCT) for superior sensitivity in detecting small lesions[9]. Pulmonary nodules exceeding 3 cm diameter are almost invariably malignant [9]. Benign lesions typically exhibit well-circumscribed, round appearances, whereas malignant nodules characteristically display irregular or lobulated borders [9].

Two main histological categories define lung cancer: (i) small cell lung cancer (SCLC), characterized by small cells with ill-defined boundaries, scanty cytoplasm, and distinctive nuclei, and (ii) non-small cell lung cancer (NSCLC), comprising adenocarcinoma, squamous cell carcinoma, and large cell carcinoma [9]. Recent decades have witnessed a paradigm shift from squamous cell carcinoma predominance to adenocarcinoma, attributed to changes in smoking patterns, cigarette composition, and environmental exposures [11]. This shift carries significant implications for screening, diagnosis, and treatment strategies.Tobacco smoking is the principal risk factor, responsible for over 80% of cases in men and at least 50% in women [7]. Additional risk factors include second-hand smoke exposure, occupational hazards (asbestos, silica), indoor air pollution (biomass fuel), outdoor air pollution, genetic susceptibility, and chronic obstructive pulmonary disease history [8]. The relative risk in long-term smokers has been estimated at 10-30 fold compared with lifetime non-smokers [3].

Cancer staging follows the American Joint Commission on Cancer TNM (tumor, node, metastasis) classification system, with pathological staging considered definitive [13]. Early detection and accurate characterization are crucial for improving outcomes. Lung cancer imposes substantial economic burden through high treatment costs, lost productivity, and poor survival rates [5]. Public health strategies focusing on tobacco control, early diagnosis, and multidisciplinary care access are essential, particularly in high-burden regions.Despite significant disease burden in North-East India, comprehensive regional data on clinico-radio-histopathological profiles remain limited. This study aims to systematically analyze the clinical, radiological, and histopathological characteristics of lung cancer patients in a tertiary care center in Tripura, thereby enhancing regional understanding and informing context-specific cancer control strategies.

Methods:-

Study Design and Setting:-

A cross-sectional observational study based in a hospital was carried out over a period of two years (2023-2025) in the Department of Respiratory Medicine at Agartala Government Medical College and GBP Hospital, located in Agartala, Tripura, India. This tertiary care facility caters to both outpatient and inpatient populations throughout the region.

Study Population and Sampling:-

All patients with newly diagnosed primary lung cancer attending the Respiratory Medicine department were eligible for inclusion. Patients of all ages were included without any age restrictions. Exclusion criteria included: (1) inability to provide valid informed consent, (2) secondary lung malignancy, and (3) previously treated lung cancer.Census sampling technique was employed to include all consecutive eligible patients during the study period. 240 no of patients were included as study sample. After obtaining institutional ethical approval and informed consent, patients underwent comprehensive clinical evaluation including: Detailed history and physical examination, Demographic and socioeconomic characteristics, Symptomatology and duration (cough, hemoptysis, dyspnea, chest pain, weight loss, fever, hoarseness, night sweats), Smoking history (pack-years, duration, current/former status),Past medical history (tuberculosis, COPD, diabetes, hypertension, HIV, malignancy), Comorbidities and occupational exposures and Routine laboratory investigations (hemoglobin, total and differential leukocyte counts, renal function, liver function)

Diagnostic Investigations:-

Chest Radiography: Standard posteroanterior and lateral views were obtained for all patients, evaluated for lesion type (mass, nodule, pleural effusion, collapse-consolidation).

Computed Tomography: High-resolution CT thorax was performed to characterize: tumor location (endobronchial, peribronchial, peripheral), size, margins (spiculated, irregular, ill-defined, lobulated), internal features (calcification, cavitation), pleural involvement, and mediastinal involvement.

Bronchoscopy: Flexible fiberoptic bronchoscopy was performed where feasible to assess airway involvement and obtain tissue samples.

Histopathological Diagnosis: Tissue diagnosis was obtained via: Bronchoscopic guided biopsy, transbronchial needle aspiration (TBNA), or bronchoalveolar lavage (BAL), Ultrasound or CT-guided fine-needle aspiration cytology (FNAC), Pleural fluid cytology when effusion present. Specimens were processed and classified according to WHO classification of lung tumors.

Statistical Analysis

Data were tabulated and analyzed using SPSS version 30.0.0. Descriptive statistics including frequency distributions, percentages, and proportions were calculated. Categorical variables were expressed as frequencies with percentages. Continuous variables were presented as mean ± standard deviation or median with interquartile range as appropriate.

Results:-

Demographic Characteristics:-

Among 240 patients with confirmed lung cancer, age distribution showed concentration in older age groups. Twelve patients (5%) were below 50 years (youngest 41 years), 48 (20%) were 50-60 years, 123 (51.3%) were 61-70 years, 42 (17.5%) were 71-80 years, and 15 (6.3%) were above 80 years. Mean age was 63.4 ± 9.2 years.

Males comprised 65% (157 patients) and females 35% (83 patients), resulting in a male-to-female ratio of 1.89:1. Among religious backgrounds, Hindu patients represented 88.3% (212), Muslim 10.4% (25), Christian 0.8% (2), and Buddhist 0.4% (1).

Clinical Presentation:-

Symptomatology documented in the Study sample:

Symptoms	Number of patients	Percentage
Cough	133	55.4
Dyspnoea	126	52.5
Hemoptysis	85	35.4

Chest pain	131	54.6
Weight loss	130	54.4
Hoarseness of voice	5	2.1
Fever	101	44.2
Clubbing	30	12.5
SVC obstruction	8	3.3

Cough: 133 patients (55.4%) with majority (65 patients, 27%) having duration >90 days
Dyspnea: 126 patients (52.5%), predominantly Grade 2 (97 patients, 40%),
Chest pain: 131 patients (54.6%),
Weight loss: 130 patients (54.4%)
Hemoptysis: 85 patients (35.4%),
Fever: 101 patients (44.2%),
Digital clubbing: 30 patients (12.5%),
Superior vena cava obstruction: 8 patients (3.3%),
Hoarseness of voice: 5 patients (2.1%)

Risk Factors and Comorbidities:-
Smoking History: One hundred forty-two patients (59.2%) were chronic smokers with >20 pack-year history. Among smokers, squamous cell carcinoma was the predominant histological type.
Comorbidities: One hundred eighteen patients (49.2%) presented with comorbid conditions: COPD in 110 patients (45.8%), tuberculosis in 6 patients (2.5%), HIV infection in 2 patients (0.8%), and other conditions (diabetes, hypertension, thyroid disorder) in 30 patients (12.5%).
Tuberculosis History: Forty-three patients (18%) reported prior tuberculosis; adenocarcinoma was the predominant subtype in this subgroup.

Imaging Findings:-
Chest Radiography: Mass lesion was observed in 149 patients (62.1%), pleural effusion in 65 patients (27.1%), and collapse-consolidation in 16 patients (6.7%).

Computed Tomography Findings:

Parameter	CT Finding	Number and Percentage (%)
Tumor location	Peripheral lung field	153 (63.8)
	Endobronchial	52 (21.7)
	Peribronchial	35 (14.6)
Tumor size (cm)	1 to ≤2	44 (18.3)
	2 to ≤3	9 (3.8)
	3 to ≤4	19 (7.9)
	4 to ≤5	77 (32.1)
	5 to ≤7	63 (26.3)
	≥7	28 (11.7)
Tumor margins	Spiculated	106 (44.2)
	Irregular	91 (37.9)
	Spiculated and irregular	32 (13.3)
	Ill-defined, infiltrative	8 (3.3)
	Poorly defined, lobulated	3 (1.3)
Internal tumor features	Calcification	102 (42.5)
	Cavitation	100 (41.7%),

Bronchoscopic Findings:-

Bronchoscopic finding	Percentage (%)
Endobronchial growth 59 (24.6)	Normal airway 102 (42.5)

Unhealthy mucosa 4 (1.7)	Airway compression 33 (13.8)
Bronchoscopic finding n (%)	Normal airway 102 (42.5)
Endobronchial growth 59 (24.6)	Airway compression 33 (13.8)

Bronchoscopy was performed in 198 patients (82.5%), demonstrating: Normal airway: 102 patients (42.5%), Endobronchial growth: 59 patients (24.6%), Airway compression: 33 patients (13.8%), Unhealthy mucosa: 4 patients (1.7%)

Histopathological Diagnosis:-
Among 240 patients, adenocarcinoma was identified in 107 patients (44.6%), squamous cell carcinoma in 97 (40.4%), adenosquamous carcinoma in 25 (10.4%), small cell carcinoma in 8 (3.3%), and large cell carcinoma in 3 (1.3%).

Diagnostic Modality Comparison:-
Histopathological diagnosis was achieved via: CT or ultrasound-guided FNAC: 148 patients (61.7%), Bronchoscopic-guided biopsy, TBNA, or BAL: 92 patients (38.3%) CT/USG-guided FNAC demonstrated superior diagnostic yield.
Metastatic Disease : Distant metastases were documented in 26 patients (10.8%): Adrenal gland: 17 patients (7.1%), Liver: 5 patients (2.1%), Other sites: 4 patients (1.7%)

Discussion:-
This observational study of 240 newly diagnosed primary lung cancer patients in a tertiary care setting provides comprehensive characterization of the clinico-radio-pathological profile in North-East India. Our findings demonstrate several noteworthy patterns relevant to regional disease epidemiology and management strategies.
Our cohort showed peak incidence in the 61-70 year age group (51.3%), consistent with studies from the region[18]. The male predominance (M:F 1.89:1) aligns with reports from North-Eastern India[18], though reflects lower male predominance compared to some pan-Indian studies (M:F 2.95:1)[12]. The female representation suggests potential changing exposure patterns or detection biases warranting further investigation.Cough (55.4%) emerged as the most frequent symptom, predominantly of chronic duration (>90 days in 27%), corroborating findings by Chandramouli and colleagues[23]. Secondary symptoms included chest pain (54.6%), weight loss (54.4%), and fever (44.2%). Hemoptysis, while present in 35.4% of patients, is classically associated with squamous cell histology.

Chronic smoking (>20 pack-years) in 59.2% of patients reinforces tobacco as the principal modifiable risk factor. Notably, 40.8% of our cohort were never or light smokers, highlighting the substantial burden of lung cancer in non-smokers, likely attributable to environmental exposures, secondhand smoke, and occupational hazards[5]. Squamous cell carcinoma predominance among heavy smokers versus adenocarcinoma predominance in non-smokers aligns with established smoking-histology correlations[11].The high frequency of COPD (45.8%) corroboration previous reports and likely reflects both shared causative factors (smoking) and COPD as an independent lung cancer risk factor[8]. Adenocarcinoma predominance (44.6%) in our cohort represents a significant histological shift from the squamous cell carcinoma predominance documented historically in Indian studies[25].

Limitation:-
Several study limitations merit acknowledgment: single-center institutional setting may not represent regional disease burden; modest sample size (240 patients) limits subgroup stratification; hospital-based recruitment introduces selection bias toward more advanced or complicated presentations; absence of molecular profiling (EGFR, ALK, PD-L1) limits contemporary oncological perspective; and follow-up data on treatment outcomes and survival were not collected.

Conclusion:-
This observational study from a tertiary care center in Tripura demonstrates that adenocarcinoma has emerged as the predominant lung cancer subtype, aligning with contemporary global epidemiological trends. Chronic smoking and COPD comorbidity remain significant pathogenic factors, though substantial disease burden among non-smokers underscores diverse etiological pathways. Peripheral lung field predominance with spiculated margins characterizes the radiological profile. Early clinical suspicion in patients presenting with persistent cough, constitutional

symptoms, and radiological abnormalities should prompt comprehensive diagnostic evaluation. CT/USG-guided FNAC provides superior diagnostic yield compared to bronchoscopic approaches, particularly for peripheral lesions. Regional cancer control strategies should emphasize: (1) aggressive tobacco cessation programs and secondhand smoke reduction; (2) occupational health protection protocols; (3) standardized early diagnostic pathways; (4) integration of molecular profiling for treatment optimization; and (5) establishment of lung cancer screening programs in high-risk populations. Future research should include molecular characterization, treatment outcome analysis, and long-term survival data to comprehensively understand lung cancer burden and inform evidence-based therapeutic strategies in North-Eastern India.

Acknowledgement:-

NIL

Competing Interests:
The authors declare that they have no competing interests.

Funding:
NIL

Consents:
Ethical approval was taken from institutional ethical committee. All written informed consent for medical procedures and the patient's medical information study was obtained from the patient legal guardian/informants to publish this paper.

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