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Clinical Outcome Analysis of Surgical Intervention in Diagnosed Lung Cancer Patients at a Tertiary Care Thoracic Surgery Department

Muhibullah, Farhan Ahmed Majeed, Bilal Umair, Farhanullah, Adnan Younis Panni, Nabeela Farhan

Department of Thoracic Surgery, Combined Military Hospital, Rawalpindi/National University of Medical Sciences (NUMS) Pakistan

ABSTRACT

Objective: The current study aimed to assess the association of different stages of lung cancer with various demographics and clinical variables.

Study Design: Prospective Longitudinal Study.

Place and Duration of Study: Department of Thoracic, CMH, Rawalpindi, Pakistan, from Jan to Sep 2024.

Methodology: The study participants were patients attending the outpatient department and suspected of lung cancer. The inclusion criteria were age ≥ 18 years, diagnosed with lung cancer, and a resident of Pakistan. The data analysis was carried out using a statistical package for the social sciences (SPSS v25). Descriptive statistics were applied to describe the data. To identify the determinants of late-stage diagnosis, a logistic regression analysis was used.

Results: A total of 45 patients with lung cancer were included in the current study. Most of the patients had a diagnosis of stage IV (73.3%). Tumors were peripheral (57.8%), had primary etiology (91.1%), and were non-small cell lung cancer (NSCLC) (72.7%). Chemotherapy was used as treatment in almost half of the patients (48.8%), and interventions, including Pleurodesis (46.2%), were predominantly. The logistic regression analysis showed that males, age >60 years, and smoking were associated with late-stage diagnosis.

Conclusion: In the current study, most of the patients were referred to stage IV, which was treated on the lines of palliation. Early detection in high-risk identified patients should be offered low-dose CT scans.

Keywords: Advanced diagnosis, Chemotherapy, Lung Cancer, Surgery.

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INTRODUCTION

Lung cancer is a malignant tumor that leads to uncontrolled cell growth in the lung tissue. It is the leading cause of cancer-related deaths in both men and women, accounting for a significant number of cancer deaths worldwide.[1] There are two primary classifications of lung cancer: non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). Non-small cell lung cancer (NSCLC) constitutes around 80-85% of lung cancer cases, while small cell lung cancer (SCLC) represents about 15-20% of instances.[2] The risk factors associated with lung cancer include smoking, previous tuberculosis (TB) infection, chronic obstructive pulmonary disease (COPD), age over 60 years, and lower hemoglobin levels. Additionally, radiation exposure has been shown to increase the mutation rate of cells, leading to genomic instability and an increased risk of lung cancer.[3]

The incidence of lung cancer in emerging nations is escalating owing to variables like increased smoking rates, significant air pollution, insufficient awareness and screening, delayed presentation, and detection at late stages.[3] The burden of cancer in developing countries has markedly increased, with a high incidence of new cases and poor survival rates. Most underdeveloped nations lack reliable statistics on the burden of lung cancer owing to the absence of cancer registries.[4]

Lung cancer has a significant impact on the quality of life (QoL) of patients. It is important to capture the experiences of both patients living with lung cancer and their caregivers to understand their needs and provide appropriate support.[5] Research has shown that lung cancer affects various aspects of patients' lives, including work, relationships, and mental health. Gender differences also play a role in QoL, with women experiencing more hair loss compared to men. Stress appraisal, symptom distress, and psychological distress (anxiety and depression) have been found to impact the QoL of early-stage lung cancer survivors.[6] Implementing organized lung cancer screening programs in developing countries is challenging due to various factors, including

Correspondence: Dr Muhibullah, Department of Thoracic Surgery, Combined Military Hospital, Rawalpindi Pakistan

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infrastructure, trained human resources, cost, and psychological trauma.[7]

Overall, lung cancer is a significant health issue in developing countries, and efforts are needed to address the early detection of these patients. The current study aimed to assess the outcome analysis of surgical support provided by the surgeons at a tertiary care hospital and to assess the determinants of late-stage diagnosis of lung cancer.

METHODOLOGY

The Prospective longitudinal study was carried out at the Department of Thoracic Surgery, CMH, Rawalpindi, Pakistan, from Jan and Sep 2024. The study participants were indoor and outdoor lung cancer patients. Data was collected on self-developed and pre-formulated variables. The ethical committee of the CMH Rawalpindi approved the study (Ref. number: 486, Dated: 16-11-2023). The patients were handled in accordance with the Declaration of Helsinki, and their anonymity was preserved throughout the research.

Inclusion Criteria: Patients of either gender who were included in the study were aged 18 years and above and had a confirmed diagnosis of lung cancer, either through histopathological examination or imaging reports. Both hospitalized and outpatient lung cancer patients were considered eligible. Additionally, participants had to be residents of Pakistan and either have undergone or be under consideration for surgical intervention at the Department of Thoracic Surgery, CMH Rawalpindi.

Exclusion Criteria: Patients were excluded who were less than 18 years, had a history of malignancies other than lung cancer, had insufficient medical records or no diagnostic confirmation, were non-residents of Pakistan, unable to provide informed consent, or terminally ill with ECOG scores of 4 or higher, or unsuitable for surgery.

The patients were recruited through non-probability convenience sampling. Informed consent was obtained from each participant before being included in the study. A biopsy was done for the suspected patients. The data was collected using Google Forms. The data gathered was then transferred into Microsoft Excel for management purposes. The data was screened for missing values, and cases with missing data were excluded.

The data analysis was conducted using the Statistical Package for the Social Sciences (SPSS v25). Descriptive statistics were used to describe the data. The categorical data were shown as frequency and percentage, whilst the continuous data were organized as mean and standard deviation. The Chi-square test and Fisher's exact test (for cell counts ≤ 5) were used to evaluate the relationship between demographic characteristics and late-stage diagnosis, as well as to examine the distribution of treatment/intervention throughout stages (III and IV) of lung cancer. Logistic regression analysis was used to determine the predictors of late-stage diagnosis. The *p*-value was considered significant in ≤ 0.05 for all analyses.

RESULTS

The current study included 45 patients with lung cancer. The mean age of the participants was 59.70±12.48. Most of the participants were male (73.3%), residents of Punjab (80.0%), smokers (57.0%), and had hypertension (84.2%). The details are given in Table-I.

Table-I: Demographic characteristics of the patients (n=45)

Variables	Mean ± SD/n (%)
Age (year)	59.70 ±12.48
Gender	
Male	33 (73.3%)
Female	12 (26.7%)
Resident	
KPK	5 (11.1%)
Punjab	36 (80.0%)
AJK	4 (8.9%)
Smoking	
Yes	26 (57.8%)
No	19 (42.2%)
Co-morbidities	
HTN	16 (84.2%)
COAD	3 (15.8%)

KPK – Khyber Pakhtunkhwa, AJK – Azad Jammu Kashmir, HTN – Hypertension, COAD – Chronic Obstructive Airway Disease

Most of the tumors were peripheral (57.8%), had primary etiology (91.1%,) and were NSCLC (72.7%). U/S (28.9%), VAT (22.2%), and CT (22.2%) guided techniques were most used for biopsy. Most of the patients had a diagnosis of stage IV (73.3%), as shown in Table-II.

As shown in Table-III, most of the patients were treated with chemotherapy (48.8%) and surgical interventions like Pleurodesis (46.2%).

Being male, age greater than 60 years, and having hypertension were associated with late-stage cancer diagnosis, as shown in Table-IV.

The logistic regression analysis showed that males were 4.5 times more likely to be associated with late-stage diagnosis as compared to females (OR: 4.5, 95% CI: 1.07 – 18.92). In addition, patients of older ages (>60 years) and smokers were significantly associated with lung cancer and advanced-stage diagnosis as shown in Table-IV.

Table-II: Characteristics of the Tumor (n= 45)

Variables		n (%)
Location of tumor		
Peripheral		26 (57.8%)
Central		19 (42.2%)
Etiology of tumor		
Primary		41 (91.1%)
Metastatic		4 (8.9%)
Histopathology of tumor		
Small cell		8 (17.7%)
NSCLC		32 (72.7%)
NSCLC	Adeno	18 (56.3%)
	SCC	12 (37.5%)
	Large cell	2 (6.3%)
other		5 (11.4%)
Mode of biopsy		
U/S guided		13 (28.9%)
CT guided		10 (22.2%)
Bronchoscopic lavage/biopsy		7 (15.6%)
VATs guided		10 (22.2%)
fluoroscopic		2 (4.4%)
Open (drainage, Open pleurae)		3 (6.6%)
Stage of malignancy		
Stage III		12 (26.6%)
Stage IV		33 (73.3%)

NSCLC - non-small cell lung cancer, SCC – Squamous Cell Carcinoma, U/S – Ultrasound, CT – Computed Tomography

Table-III: Details of intervention given to the patients (n = 45)

Variables	**n (%)**
Treatment/intervention	
Chemotherapy	21(48.8%)
Surgery	17(39.5%)
Both	7(15.5%)
Surgical Treatment Done	
Chest intubation	8(30.8%)
Lobectomy	5(19.2%)
Pleurodesis	12(46.2%)
Pneumonectomy	1(3.8%)
Surgical Indication Specified	
Palliative	24(80.0%)
Curative	6(20.0%)

Most of the patients in stage IV were treated with chemotherapy (54.8%) and surgery (35.5%). In surgical intervention, Pleurodesis (67.7%) was most performed in stage IV, while in stage II, III, and Lobectomy (62.5%) was done, as shown in Table-V.

Table-IV: Distribution of the demographics across cancer stages (n = 45)

		Cancer Stage		*p*-value	OR	95%CI
		III n = 12	IV n = 33			
		n (%)	n (%)			
Gender	Male	8(66.7)	25 (75.8)	0.04	4.50	1.07 - 6.92
	Female	4(33.3)	8 (24.2)	Ref.		
Age	≤60	5(45.5)	15(45.5)	Ref.		
	>60	6(54.5)	18(54.5)	0.09	3.33	0.82 - 5.48
Smoking	Yes	5(41.7)	21(63.6)	0.01	1.12	0.24 - 4.01
	No	7(58.3)	12(36.4)	Ref.		
Co-Morbidities	HTN	4(80)	12(85.7)	0.11	8.667	0.57 - 12.11
	COAD	1(20)	2(14.3)	Ref.		

HTN – Hypertension, COAD – Chronic Obstructive Airway Disease, OR- Odds ratio, CI- confidence interval

DISCUSSION

The findings of the present study revealed that most patients were diagnosed at Stage IV disease, indicating a trend toward late presentation. This advanced stage at diagnosis was associated with poor survival outcomes and diminished quality of life, underscoring the critical need for prioritizing the development and implementation of effective early detection strategies and diagnostic procedures in future research and clinical practice. In the current study, the male gender was more associated with lung cancer than the female gender. Lung cancer is more prevalent in males worldwide and is the primary cause of cancer-related mortality in men.[7] The higher incidence of lung cancer in men can be attributed to several factors. Historically, lung cancer studies mainly enrolled men, as the incidence among women was low. However, with changing social patterns and increased smoking among women, the epidemiology of lung cancer has shifted, which is reported in an international Release Notice by Cancer Research.[8] Smoking is a major risk factor for lung cancer, and men have traditionally had higher smoking rates than women. Moreover, disparities may exist in risk factors, histology, pathophysiology, treatment results, and prognosis between male and female lung cancer patients as reported by May *et al.*,[9]

Smoking is the main risk factor for lung cancer, with 80-90% of lung cancers attributed to cigarette smoking. The incidence of lung cancer is closely tied to tobacco smoking, particularly cigarette smoking. However, it is important to note that only 10% of tobacco smokers develop lung cancer, indicating that other factors may also be involved.[10] Smoking is the most frequent risk factor for lung cancer, with a high

percentage of diagnosed patients being smokers. In addition to active smoking, exposure to environmental tobacco smoke (ETS) also increases the risk of lung cancer, as reported by Bade *et al*.[11] Similarly, in the current study, smoking was also a significant predictor of lung cancer. Therefore, smoking cessation is crucial in reducing the risk of developing lung cancer, and implementing smoking cessation clinics in oncology practices can be effective in helping patients with lung cancer quit smoking.

In the current study, most of the patients were diagnosed in the advanced stage (Stage IV). Lung cancer is often diagnosed in advanced stages due to several reasons. One reason is that symptoms of lung cancer are not usually present in the early stages, leading to delayed detection, as confirmed by Gce *et al*.,[12] Additionally, the public participation in the screening method is very limited. Furthermore, patients with NSCLC are most often diagnosed at advanced stages, which is associated with poor prognoses. Corrales *et al*., concluded that early diagnosis is crucial for improving the survival rates of lung cancer patients, and there is a need for the development of novel biomarkers and more effective diagnostic strategies.[13]

The current study highlighted that hypertension is associated with lung cancer. Hypertension is associated with lung cancer due to several factors reported by Wang *et al*.[14] Firstly, pulmonary hypertension (PH) is considered an unfavorable patient. factor and even a contraindication for major pulmonary resection in lung cancer patients. Secondly, patients with precapillary PH following a diagnosis of patients. Cancer often has a high comorbidity burden and is oxygen-dependent, which complicates the management and treatment of both conditions. Moreover, pulmonary hypertension linked to parenchymal illness or left heart disease is often seen in lung cancer patients, complicating their perioperative treatment as described by Nooreldeen *et a*l.[15] Furthermore, Alam *et al*., also reported that renin-angiotensin system blockers (RASBs), commonly used to treat hypertension, have been reported to have diagnostic and prognostic effects on lung cancer patients, suggesting a potential link between hypertension and lung cancer.[16] Finally, lung cancer-associated pulmonary hypertension is characterized by increased vascular remodeling and perivascular inflammatory cell accumulation, which may contribute to the development and progression of both conditions.

Early diagnosis of lung cancer is crucial because it allows for better treatment outcomes and increased survivability, as described by Rizzo *et al*.,[17] Lung cancer is often not diagnosed until it reaches an advanced stage, which significantly impacts prognosis and survival rates. The 5-year survival rate for stage IA lung cancer can exceed 90%, while for stage IV lung cancer, it can be less than 10%. Current methods of diagnosing lung cancer, such as imaging screening and bronchoscopy, have limitations in detecting early-stage cancer, which has been proven by Alam et al.[18]

Therefore, there is a need to identify novel biomarkers and explore emerging diagnostic strategies, including liquid biopsies and volatile organic compounds, to improve early detection rates. Early identification and prediction of lung diseases, including lung cancer, can be facilitated by deep learning and machine learning techniques, which can aid in the subsequent clinical management of patients.

RECOMMENDATION

Lung cancer prevention and early diagnosis at advanced stages are important for survival benefits. Recommendations for prevention include reducing exposure to common risk factors such as smoking and environmental pollution. To improve early diagnosis, low-dose CT scans are suggested as a replacement for chest X-rays, as they can detect lung cancer at an earlier stage. Screening programs using low-dose CT scans in high-risk populations have shown a reduction in lung cancer mortality. Additionally, efforts should be made to increase public awareness, provide healthcare professional education, and implement clinical pathways that facilitate earlier diagnosis of symptomatic lung cancer. Policies regarding screening for lung cancer should be designed and implemented. In addition, public participation should be encouraged in the screening programs. By implementing these recommendations, it is possible to prevent lung cancer and diagnose it at advanced stages more effectively.

CONCLUSION

In conclusion, most of the patients were diagnosed with stage IV. Stage diagnosis leads to a poor survival rate and quality of life. Therefore, it is recommended that researchers give top priority to developing techniques and procedures for early detection.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

M & FAM: Data acquisition, data analysis, critical review, approval of the final version to be published.

BU & F: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

AYP & NF: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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