



COLLEGE OF MEDICINE
DEPARTMENT OF PATHOLOGY

**Histopathology and clinical characteristics of Lung Cancers at Saint Paul's
Hospital Millennium Medical College, Addis Ababa, Ethiopia**

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**A Research Thesis submitted to the Department of Pathology; Presented in
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Histopathology and clinical characteristics of Lung Cancers at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia; Dec 2018- Oct 2023GC: A cross-sectional study

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Acronyms and Abbreviations

AC – Adenocarcinoma

ACTH - Adrenocorticotrophic hormone

COPD - Chronic Obstructive Pulmonary Disease

HIV - Human Immunodeficiency Virus

NSCLC – Non-small cell lung cancer

SCC - Squamous cell carcinoma

SCLC - Small cell lung cancer

SIADH - Syndrome of inappropriate antidiuretic hormone secretion

TB - Tuberculosis

WHO – World Health Organization

Abstract

Background: Lung cancers account for 2.2 million new cases and 1.8 million deaths worldwide. Histopathology plays a crucial role in the diagnosis and management of lung cancers. With the fact that the incidence of lung cancer is rising in Ethiopia along with other tobacco-related cancers, identifying the commonest patterns and relation with clinical presentation is essential.

Objectives: To assess the histopathology patterns and clinicopathologic correlations of lung cancers at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, Dec 2018-Oct 2023GC.

Methods: The study is a cross-sectional study was carried out at SPHMMC. It included all patients who had lung biopsies and pathologically confirmed diagnoses at the hospital. The data was collected by the primary investigator from the pathology unit's database and the patient's chart through a structured questionnaire. Following this, the data was entered into SPSS version 25. Socio-demographic, histopathologic characteristics, and clinical findings were determined using descriptive statistics. Logistic regression was used to determine associated risk factors. The level of significance was determined at $P < 0.05$.

1. Introduction

1.1. Background

Lung cancer is a type of cancer that starts when abnormal cells grow in an uncontrolled way in the respiratory epithelium (bronchioles, bronchioles, and alveoli[1]. Lung cancer was rare before 1900 with fewer than 400 cases described in the medical literature. Hence, it is considered a disease of modern man, killing over three times as many men as prostate cancer and nearly twice as many women as breast cancer[2].

There are two main types of lung cancer: small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC). NSCLC is more common which includes adenocarcinoma, squamous cell carcinoma, and large cell carcinoma[3]. Histopathology plays a crucial role in the diagnosis and management of lung diseases. It examines lung tissue specimens under a microscope to identify various pathological conditions accurately. Although the main purpose of lung biopsies is detecting and staging lung cancers, various infectious causes can also be diagnosed via histopathologic sections.

There are no specific signs and symptoms for Lung cancer but commonly patients with lung cancer have hemoptysis, loss of weight, loss of appetite, dyspnea, chest pain, fatigue, cough, and finger clubbing. Approximately one-third of patients present with symptoms as a result of distant metastases. These lesions are common and widespread with risk factors including pollution, smoking, human immunodeficiency virus (HIV), other infections, occupational status, and malnutrition[4][5][6].

Common laboratory findings include thrombocytosis, hyperkalemia, hypokalemia, and hyponatremia which may be caused by paraneoplastic syndrome, syndrome of inappropriate Secretion of antidiuretic hormone (SIADH), Ectopic secretion of ACTH by SCLC and pulmonary carcinoids[2].

Diagnostic methods for lung cancer include physical examination, imaging (such as chest X-rays, computed tomography scans, and magnetic resonance imaging), sputum cytology, examination of the inside of the lung using a bronchoscopy, taking a sample of tissue (biopsy) for histopathology examination to identify histologic subtype (NSCLC versus SCLC). Patient can have a milder case (stage 1 and 2) and advanced cases(stage 3 and 4)[2][3][7].

Lung cancer is often diagnosed at advanced stages when treatment options are limited. Screening of high-risk patients allows early identification of the disease. The treatment depends on different factors like the patient's overall health, stages of the disease, and the available treatment options. The patient can be treated with chemotherapy, radiotherapy, surgery, or just palliative care to support life[8]. The main mechanism to prevent lung cancer is to avoid smoking tobacco and reduce air pollution and workplace hazards like chemicals and asbestos[1][2][7]. At St. Paul Hospital, the pathology unit has been receiving lung specimens for more than three years according to the department's database.

1.2. Statement of the Problem

Lung cancers are one of the most common causes of cancer-associated morbidity and mortality, accounting for 2.2 million new cases and 1.8 million deaths worldwide. Among these, 7419 new cases and 6758 deaths from Eastern Africa were registered in 2020[10]. Similarly, these lesions are one of the most common causes of mortality and morbidity in Ethiopia[9]. Along with other tobacco-related cancers, the incidence of lung cancer is rising. In 2019, more than 2000 incidence cases and causes of mortality were registered. In addition, studies have estimated that the true incidence of lung cancers in Ethiopia reaches 1691 annually[10].

The commonly seen lung cancers include non-small cell carcinomas like adenocarcinoma and squamous cell carcinomas, small cell carcinomas, and other types including large cell carcinoma, carcinoid, and mesenchymal tumors[3][11].

Although the occurrence of lung cancers is higher in developed nations, deaths are seen in Africa, and Central and South America. These lesions are associated with smoking, radon in indoor environments and mines, and other occupational exposures as well[2][3].

Identifying the most susceptible patients, risk factors, etiologies, clinical presentations, and histology diagnosis is mandatory to achieve proper treatment ways; as well as to control the disease prognosis[2].

This study plans to contribute to understanding the commonest histologic features, clinical findings, and risks associated with lung cancers at St.Paul's Hospital.

1.3. Rationale of the study

Treating lung tumors and improving patient outcomes is a multidimensional puzzle that comes together through the collaboration of pathologists, radiologists, oncologists, and other healthcare professionals[3]. Hence, understanding the local features of histopathology findings and clinical presentations is essential to achieve correct diagnosis, tailor effective treatment strategies, and improve patient outcomes[11][13].

Therefore, detailed studies of the microscopic and clinical features are of utmost importance; as they provide insights that guide treatment decisions, identify associations with multiple risk factors, and contribute to ongoing research to advance what is known.

2. Literature Review

2.1 Magnitude of lung cancer

Globally, there were an estimated 2.2 million new cases of lung cancer in 2020: approximately 75% occur in males. The most common lung cancer in males and females was adenocarcinoma (39% and 57% of lung cancers respectively); other common lung cancers were squamous cell

carcinoma, small-cell carcinoma, and large-cell carcinoma. Lung cancer is the leading cause of cancer-related deaths worldwide, with an estimated 1.8 million deaths in 2020[1].

In 2018 about 470,039 new cases were seen in Europe leading to 3% of all causes of death and around 20% of cancer deaths, one-third of them occurring in women. This was one death every 83 seconds. In studies done at Ataturk University, Turkey, which includes 566 patients with lung cancer cases, the commonest histopathological subtypes identified were squamous cell carcinoma and small cell lung carcinoma seen in 46.1% and 15.7% respectively and in 2018, a total of 47,838 people had lung cancer diagnoses in United kingdom, with 35,137 deaths recorded; accounting for 21% of all cancer deaths and 1-year survival was 3% for all patients with stage 1 and 17% for stage 4 disease[14][15]. Almost 1 in 5 patients diagnosed with lung cancer in France died within 3 months post-diagnosis[16].

American Cancer Society states in 2023 the most common lung cancer in the US is non-small cell lung cancer accounting for 80-85% of all lung cancer and small cell lung cancer about 10-15%. 238,340 new cases of lung cancer (117,550 in men and 120,790 in women) and about 127,070 deaths from lung cancer 67,160 in men and 59,910 in women[17].

A total of one million new cases were seen in Asia countries in 2012 of which, 71% were males and 29% were females with a Sex ratio was 2.46 and 936,051 deaths. A retrospective record-based analysis done at a tertiary cancer care center in Bangalore, South India which included a cohort of 1248 patients diagnosed with lung cancer detected adenocarcinoma among 70% of patients while Squamous cell carcinoma and Small cell lung cancer were seen among 15%. The median age of the patients was 61 years, with male to female ratio of 3:1[18][19].

In 2020, lung cancer was the most fatal type of cancer in Argentina, accounting for around 10.73 thousand cancer deaths that year[19].

The incidence of lung cancer in the various regions of Africa according to Global Cancer Observatory 2020; in South Africa was 27.5 and 9.3, in North Africa was 19.3 and 3.5, in East Africa 4.2 and 3.0, in Middle Africa 3.4 and 1.8, and West Africa was 2.8 and 1.8 all per 100,000 for males and females, respectively[20]. In South Africa, lung cancer is the most common cause

of cancer deaths with an age-standardized incidence rate of 3.95/100,000 in females and 10.12/100,000 in males[21].

Retrospective study performed at Benbadis University Hospital of Constantine, Algeria, 173 histologically proven cases of lung cancer were included following which clinical and pathological variables were investigated. Male to female ratio was 6:5. 86% of the patients aged greater than 50 years. Adenocarcinoma was found in 56.6% of the cases, followed by squamous cell carcinoma with 22.5% while non-small cell lung cancer subtypes accounted for 12.8%[22].

A cross-sectional study was carried out at Tikur Anbessa Hospital in 2018 to assess clinical, radiologic, and pathologic characteristics; the study included 146 patients with a mean age of 54 plus or minus 13 years. Among these, 61.6% were male, and 25.3% had a history of tobacco use. The most common clinical manifestations were cough, chest pain, and dyspnea with the median duration of any symptoms which was 6 months. The most common radiologic features were lung mass (84.9 %) and pleural effusion (52.7%). Adenocarcinoma accounted for 35.7% of lung cancers and squamous cell carcinoma 19.2%[12].

2.2 Risk factors associated with Lung cancer

Tobacco smoking (including cigarettes, cigars, and pipes) is the primary risk factor for lung cancer but it can also affect non-smokers. Other risk factors include exposure to secondhand smoke, occupational hazards (such as asbestos, radon, and Silca,), air pollution, hereditary cancer syndromes, family history of lung cancer, family history of other tumors, personal history of chronic disease, ventilation in kitchen, lung diseases male sex and older age. Research has shown that tobacco smoking is estimated at 79.1% in men. [1][23][24][25][26][27] [22][28]. Lung cancer presents at an early age and advanced stage in Algerian patients age

3. Objectives

3.1. General Objective

To assess the histopathologic and clinical characteristics of lung cancer among patients biopsied at St. Paul Hospital, Addis Ababa, Ethiopia, Dec 2018- Oct 2023GC.

3.2. Specific objectives

To assess the histopathological features of lung specimens among patients biopsied at SPHMMC, Addis Ababa, Ethiopia, Dec 2018- Oct 2023GC

To assess the clinical characteristics of lung cancer patients among patients biopsied at SPHMMC, Addis Ababa, Ethiopia, Dec 2018- Oct 2023GC

4. Methods

4.1. Study Setting and Period

St. Paul's Hospital Millennium Medical College is one of the largest hospitals in Ethiopia, located in the capital city; Addis Ababa, Gulele sub-city near 1271 Swaziland Street. The hospital was built in 1961 by Emperor Haile Selassie to serve the economically underprivileged population, providing free-of-charge service for 75% of its patients. The hospital serves an estimated 110,000 people annually who are referred from all over the country, following which a medical college was formed in 2007[29].

The hospital serves as a catchment area for more than 5 million people, providing more than one hundred clinical services and diagnostic modalities, including pathology service[30].

The pathology service provides biopsy services for more than 5,000 patients annually since its establishment as a medical specialty within the college in 2014 G.C(Pathology record file).

4.2. Study Design

A facility-based cross-sectional study design was carried out at St. Paul's Hospital Millennium Medical College, Dec 2018- Oct 2023GC.

4.3. Study population

4.3.1 Source population

All patients who had their lung biopsies at SPHMMC were the source population of the study.

4.3.2 Study population

All selected patients who had their lung biopsies at SPHMMC from Dec 2018- Oct 2023GC were the study population.

4.4. Eligibility criteria

4.4.1. Inclusion criteria

All medical records of patients who had a lung surgical biopsy evaluated at SPHMMC; from Dec 2018- Oct 2023GC, who had complete clinical and histopathologic data were included in the study.

4.4.2. Exclusion criteria

Medical records with inconclusive, suboptimal, and secondary carcinoma diagnoses were excluded from the study. Medical records from other medical centers and charts that could not be retrieved were excluded from the study.

4.5. Sample Size determination and sampling technique

4.5.1. Sample size determination

All of the 186 patients who had lung biopsies at SPHMMC with complete clinical and histologic data were included in the study.

4.5.2. Sampling technique and procedures

Clinicopathologic profiles of all patients who had lung biopsies at SPHMMC during the study time were included in the study.

4.6. Study variables

Dependent variable

- Presence of cancer

An independent variable

- Socio-demography of patients (age, sex, and occupation)
- Smoking history
- Family history of lung cancer
- Clinical presentations
- Imaging findings and anatomic site of the lesion

4.7 Operational Definitions

Lung biopsy – is a procedure in which samples of lung tissue are removed with a special biopsy needle or during surgery to determine if lung disease or cancer is present. It includes core needle biopsies and resection specimens[31].

A pathology report - is a medical report that describes the characteristics of a tissue specimen that is taken from a patient[32].

Negative for malignancy – stands for lung lesions that do not show cancer.

Malignant – refers to those lesions that show histomorphologic features of malignancy.

4.8. Data Collection and Procedures

The study started by selecting cases that fulfill the inclusion criteria from the pathology unit database. A structured questionnaire that was prepared by modifying literature, including socio-demographic features, clinical characteristics, and histologic findings was prepared. Data collectors were selected and a briefing on the aim of the study in addition to required data were provided. Following this, the data questionnaire was filled by the primary investigator and the data collectors; with the data source being the database of the pathology unit for histologic findings and the SPHMMC medical record room for clinical data.

4.9. Data quality control

The data collection checklist was pre-tested and the pretested results were used to rearrange the data required. The checklist was pretested on 5% of the total sample and the findings were incorporated to modify and clarify the collection tool before the actual data collection. The data collectors were chosen and received briefing and training on the data collection by the primary

investigator. The main investigator took the lead in supervising the data collection and checking each data for completeness and accuracy.

4.10. Data Analysis Plan and Procedures

Before analysis, data cleaning, coding, and checking for completeness and inconsistencies were checked. Data was entered into Epi-data version 3.1 and transported into SPSS version 25.

Descriptive statistics was used to compute and determine socio-demographic characteristics, and histologic and clinical findings of the patients. Following this, bivariate and multivariate analysis with a 95% confidence interval was carried out between the dependent and independent variables to determine factors associated with lung cancer using binary logistic regression. The level of significance was determined at $P < 0.05$.

4.11. Ethical Consideration

The institutional review board SPHMMC reviewed the protocol to ensure the full protection and the rights of the patients discharged patients, deceased patients, and their families during the data collection and retrospective review of their records. Ethical clearance was obtained and confidentiality was assured by avoiding writing names on the checklist and data extraction format. Following the approval of the board, an official letter was sent to the IT unit of the pathology department and the chart room, following which data collection started collecting the data and coding while maintaining anonymity.

4.12. Dissemination of Results

The outcome of the study was presented to the department of pathology of SPHMMC in the form of a written format. It will be presented and communicated to concerned stakeholders, public health programs, and hospitals. The study will be published in national and international peer-reviewed journals.

5. Results

5.1 Socio-demographic data

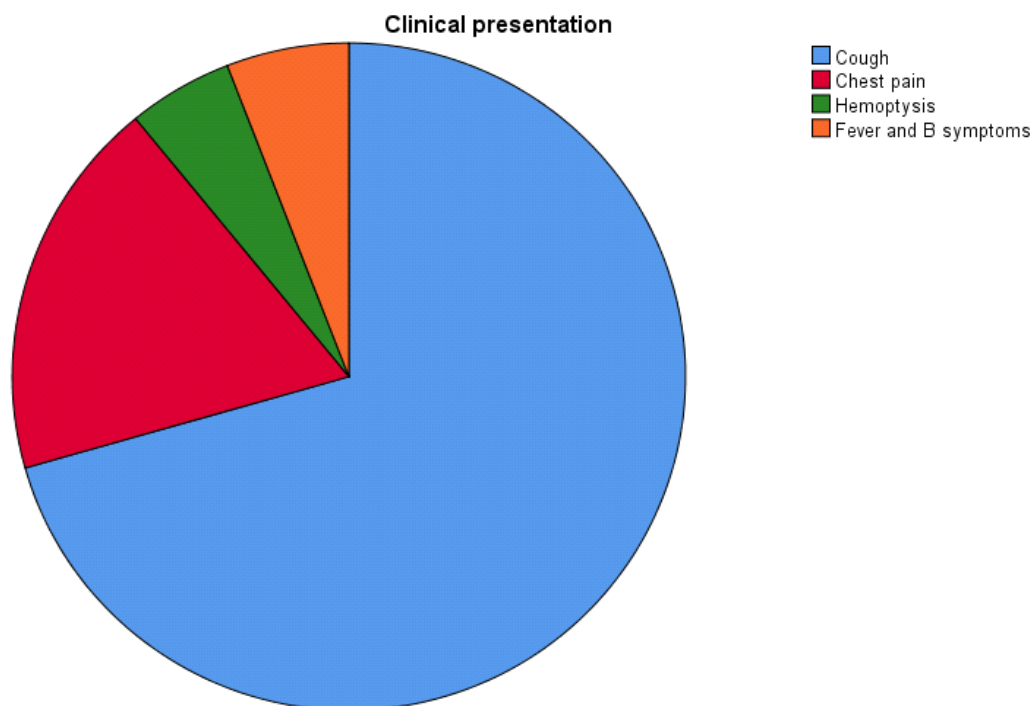
A total of 183 patient medical records were identified during the study time. Among these, 17 patients' data were excluded from the study because the histologic diagnosis was suboptimal or inadequate for diagnosis.

Among those with complete histologic and clinical profiles, and sixty-nine patients (58%) were aged above 40 years while fifty patients (42%) were below 40 years at presentation; with the median age of 45 years. 55% of the patients were male, while 45 % were female.

5.2 Presenting signs and Symptoms, durations of illness and comorbid risk factors

The predominant initial symptom observed in the majority of cases was a cough, reported by eighty-four patients (71%). Chest pain was the second most prevalent presenting symptom, noted in twenty-two patients (19%), while hemoptysis was identified in six cases (5%). (Table 1 below shows clinical presentation). Most of these patients experienced an illness duration over a month reported by seventy-two patients (60.5%), in contrast, forty-seven patients (39.5%) the duration of illness was less than one month.

Table -1 Clinical presentation of patients who had lung biopsies at SPHMMC from Dec 2018- Oct 2023 GC		
	Frequency	Percent
Cough	84	70.6
Chest pain	22	18.5
Hemoptysis	6	5.0
Fever and B symptoms	7	5.9
Total	119	100.0



Pie chart-1 Clinical presentation of patients who had lung biopsies at SPHMMC from Dec 2018-Oct 2023 GC

The majority of patients, comprising eighty-six patients (72%), did not have any identified risk factors. only in thirty-three patients (28%) were found to have identifiable risk factors, Among these risk factors smoking was the most commonly identified in nineteen patients (16%). Other identified risk factors included previous pulmonary Tuberculosis in eleven patients, chronic respiratory illnesses in six patients (5%), and occupational exposure in two patients (1.7%). (Table 2 below shows identified risk factors)

Table -2 Risk factors identified of patients who had lung biopsies at SPHMMC from Dec 2018- Oct 2023 GC		
	Frequency	Percent
None	86	72.3
Smoking	19	16
Previous pulmonary TB	8	6.7
Chronic respiratory illness	4	3.3
Occupational exposure	2	1.7
Total	119	100.0

5.3 Chest CT scans finding, site, and size of the lesion

Among patients who underwent lung biopsies during the study period, the imaging findings revealed malignancy in sixty-seven patients (56%) and fifty-two patients (44%) showed benign or infectious causes. Out of the total 119 cases, 106 of the imaging findings of the cases were concordant with the histologic diagnosis, while 13 cases were discordant, indicating that the positive predictive value of chest CT was 92.5%, while the negative predictive value was 84.6%.

Table 3 - Imaging findings * Outcome Crosstabulation				
		Outcome		Total
		Malignant	Benign	
Imaging findings	Malignant	62	5	67
	Infectious/Benign	8	44	52
Total		70	49	119

The site of lesion in the lung was peripheral in ninety-six patients (81%). In contrast, central lesions were seen in twenty-three patients (19%). The mean longest diameter was 5.97cm with a minimum of 1cm and a maximum of 30cm.

Table -4 Imaging findings of patients who had lung biopsies at SPHMMC from Dec 2018- Oct 2023 GC		
	Frequency	Percent
Malignant	62	56.3
Infectious/Benign	47	43.7
Total	119	100.0

5.4 Type of biopsy taken, category of biopsy report, and histological diagnosis

Among patients who underwent lung biopsies during the study period, core needle biopsy was done in seventy-one patients (60%) and lobectomy/resection was done in forty-eight patients (40%). The biopsy results showed malignancy in 62 patients (52%) and benign in forty-seven patients (42%). (Pie-chart 2 below shows a category of biopsy report). From malignant lesions majority were adenocarcinoma in forty-three patients (69%) and neuroendocrine

tumor/Carcinoma 6% squamous cell carcinoma in 5% other fin. (Table 5 below shows histologic findings).

Table -5 Histologic diagnosis of patients who had lung biopsies at SPHMMC from Dec 2018- Oct 2023 GC		
Diagnosis	Frequency	Percent (%)
Infectious/Inflammatory	47	39.5
Adenocarcinoma	43	36.1
Undifferentiated	10	8.4
Neuroendocrine tumor/Carcinoma	7	5.9
Squamous cell carcinoma	6	5.0
Mesenchymal tumor	4	3.4
Large cell cancer	1	0.8
Small cell cancer	1	0.8
Total	119	100

5.5. Bi-Variable and Multi-variable analysis

Binary logistic regression was applied to identify the associated variables with a significance value of less than 0.05. The variables were initially inserted into bivariate analysis; which identified variables were significantly associated with lung cancer, with a significant level P-value > 0.25. The variables identified were the age of the patients, history of smoking for >30 years, presence of any risk factor, and site of the lesion.

After controlling the effects of other variables, the values were inserted into the multivariable logistic regression, and significance was determined at the p-value less than 0.05. The output of the multivariate analysis showed significant values of the variables age and presence of smoking history. Patients >40 years were 2.880 times more likely to develop lung carcinoma than Patients <40 years old, with a significance value and confidence interval of 0.010, 95%CI 1.281-6.472. Similarly, Patients with a history of smoking were 6.789 times more likely to develop lung malignancy compared to patients without a history of smoking, P-0.044, 95%CI 1.055-43.684.

Table 6 - Multivariable logistic regression of the variables

Variables	Malignancy		COR(95% CI)	AOR(95% CI)	P-value
	Yes	No			
Age					
>40	48	21	2.909(1.363-6.209)	0.559(0.163-1.914)	0.354
<40 years	22	28	1	1	
Imaging findings					
Benign	8	44	0.015(0.004-0.048)	0.015(0.004-0.53)	0.000
Malignant	62	5	1	1	
Risk factors					
Not - identified	54	33	1.636(0.723-3.705)	2.9(0.694-12.203)	0.144
Identified	16	16	1	1	
Site of the lesion					
Central	16	7	1.77(0.670-4.715)	2.1(0.464-9.506)	0.336
Peripheral	54	42	1	1	

6. Discussion

This study assesses the histopathologic and clinical characteristics of lung cancer among patients biopsied at St. Paul Hospital. Among 119 study subjects, the largest groups accounting for 58% were above the age of 40 years, while 55% of the total number of patients were males. Although male sex was associated with a higher incidence of lung cancer in other studies, no significance was identified in this study[23][24][26]. Literature has also identified the male sex to be associated with lung cancer because males were more likely to smoke[33]. But currently, the prevalence of smoking is decreasing in males, which may define our findings.

The most common clinical manifestations were cough, chest pain, and prolonged duration of illness. Similarity among clinical presentations can be explained with the fact that cough and chest pain are the main reasons to visit health facilities in patients with respiratory conditions. The cough occurs when the tumor irritates or obstructs the airway and chest pain might be due to invasion or compression of nerves, and blood vessels to the chest wall[2].

Among these patients CT- Scans of the chest showed malignant lesions in 56% and benign lesions or infectious cases in 44%. From 119 lung biopsies most common histologic finding was malignancy in sixty-two patients (52%); from which adenocarcinoma accounted for forty-three patients (82.6%). This finding is similar to studies done in Black Lion, India and WHO reports[1][12][34][28][27]. The reason for this similarity could be shared lifestyles and epidemiological exposures, in contrast to a study done in Turkey; which showed squamous cell carcinoma as the most common histologic type. This was associated with a higher proportion of smoking in Turkey, given the fact that smoking is the most important risk factor to develop squamous cell carcinoma [15]

The output of the multivariate analysis showed significant values of the variables age and presence of smoking history. This study identified that patients who were older than 40 years were 2.880 times more likely to develop lung carcinoma than those patients younger than 40 years old, with a significance value and confidence interval of 0.010, (95%CI 1.281-6.472). This is similar to other studies done in, Black Lion Hospital, Algeria, India, and the main reason may be that the longer individuals are exposed to these substances throughout their lives, the higher the likelihood of developing genetic mutations and damage to lung cells, leading to the development of cancer[12][35][22].

Similarly, as individuals age increase, their DNA repair mechanisms may become less efficient. Over time, cells may accumulate genetic mutations due to exposure to carcinogens, and the reduced ability to repair damaged DNA increases the risk of cancer development.

Additionally, the immune system tends to weaken with age, making it less effective at recognizing and eliminating cancer cells. This decreased immune surveillance allows cancerous cells to proliferate more easily, contributing to the development and progression of lung cancer.

Furthermore, the process of aging itself involves changes at the cellular level, including alterations in cell division, apoptosis (programmed cell death), and telomere length. These changes can contribute to an environment where cancer cells can evade normal regulatory mechanisms and proliferate uncontrollably.

Finally, individuals may be exposed to multiple risk factors throughout their lifetime, and the cumulative effect of these factors increases the overall risk of developing lung cancer. For

example, a person who has smoked for many years may also have been exposed to occupational carcinogens, further elevating surveillance.

Similarly, patients with a history of smoking were 6.789 times more likely to develop lung malignancy compared to patients without a history of smoking, $P=0.044$, 95%CI 1.055-43.684. The wide confidence interval of the variable smoking can be explained with the number of data. Smoking was the most commonly identified risk factor which was similarly shown in another studies[1][23][24][26].

Tobacco smoke contains many chemicals called carcinogens, leading to the initiation of cancer. In addition; certain chemicals in tobacco smoke can directly damage the DNA in lung cells. This damage can result in genetic mutations and alterations that promote the uncontrolled growth of cells, a hallmark of cancer development.

Similarly, smoking induces chronic inflammation in the lungs. Prolonged inflammation contributes to the cellular changes that can lead to cancer. Inflammatory processes may also compromise the normal regulation of cell growth and death, further fostering an environment conducive to the development of cancer.

Finally, smoking is often associated with other unhealthy behaviors, such as poor diet and lack of exercise, which can further contribute to an increased risk of cancer.

But in this study, the proportion of smoking history was lower; this could be epidemiological and unidentified risk factors in our setting like most of our population uses household smokes and traditional ways of making food.

7. Strengths and Limitations of the Study

7.1 Strength

The data was a retrospective data which was collected from medical records of patients hence preventing patients from additional exhaustion while maintaining professionally recorded objective data.

7.1 Limitations

This study uses retrospective data which depends on existing data, recall bias and potential for inaccurate information.

MRN was not properly documented on pathology report paper, which led to less sample size compared to the presumed sample size.

8. Conclusion and Recommendations

8.1 Conclusion

This study identified patients who were older than 40 years and patients with smoking history were strongly associated with lung cancer. Adenocarcinoma was the most common histologic finding.

In this study most the patient did not have identified risk factor, which implies need of larger study to identify common risk factors.

8.2 Recommendations

Health care professionals – Since lung cancer is the most common cancer, it is important to focus on prevention and early detection and management is necessary

Mass media – It is essential to disseminate knowledge regarding lung cancer to create mass awareness which will help to prevent and to identify cases early.

Researcher and scientific community – Given the limited resources available, more research on lung cancer should be done to identify common risk factors.

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10. Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the

Research thesis. I provided timely progress reports to my advisor and sought the necessary advice and approval from my primary advisors in the course of the research. I communicated timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: _____Hiwot Mehari_____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

11. Annexes

Information sheet (English version)

Title of the Research Thesis: Histopathology and Clinical Characteristics of Lung Cancers at Saint Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia; from Dec 2018- Oct 2023 GC: A cross-sectional study

Name of Principal Investigator: Hiwot Mehari

Name of the Organization: St. Paul's Hospital Millennium Medical College

Introduction

This information sheet was prepared for data collectors to identify and collect data from patient medical records at St. Paul's Hospital Millennium Medical College Addis Ababa, Ethiopia. The form aims to make the data collectors clear about the purpose of the research, and data collection procedures, and get consent to conduct the research.

Purpose of the Research Project

This study aims to assess the histopathologic and clinical characteristics of lung cancer among patients biopsied at St. Paul Hospital St. Paul's Hospital Millennium Medical College, Ethiopia from Dec 2018- Oct 2023 GC.

Procedure

You are randomly selected to be one of the data collectors. If you are willing to participate in this study, you will be requested to understand the aim of this study clearly. You will then be trained on the data collection means and fill out the questionnaire with the required pieces of information.

Risk and discomfort

There is no risk or discomfort imposed on you by participating in this research.

Benefits of being in the study

There may not be direct benefits to you following your participation in this study but your participation is likely to help us in assessing the histopathologic and clinical characteristics of lung cancer among patients biopsied at St. Paul's Hospital Millennium Medical College. Ultimately this will help us to provide information for policy makers, programmers, and planners to design and implement tailored interventions.

Confidentiality and privacy protections:

You do not need to tell/write the name of the patients or any personal identifier during the data collection. All of the data and the results obtained will be kept confidential by using a coding system whereby no one will have access to the responses.

Incentives/payments for participating

You will be provided an incentive to participate in this project.

Right to refuse or withdraw

You have the full right to refuse to participate in this research if you are not comfortable. You have also the full right to withdraw from this study at any time if you wish.

Contacts and questions:

If you have any questions about the study please ask now. If you have questions later, want additional information, or wish to withdraw call the researcher conducting the study.

Annex II: English Version Consent form

I have been informed that the purpose of this study is to assess the histopathologic and clinical characteristics of lung cancer among patients biopsied at St. Paul's Hospital Millennium Medical College. I understand that participation in this study is entirely voluntary. I have been communicated that the data collected will be confidential. I have also been informed that my participation or non-participation or my refusal to answer questions will not affect me. I understood that participation in this study does not involve risks.

Your signature below indicates that you have read the information provided above and have decided to participate in the study. If you later decide that you wish to withdraw from the study, simply tell me, you may discontinue your participation at any time.

Signature of the data collector's name: _____ Date _____

Supervisor's name: _____ Signature: _____ Date: _____

English questionnaire

Section 1: Sociodemographic characteristics and medical history	
MRN	_____
Patient sex	• Male • Female
Patient age	_____years
Clinical presentation	• Cough • Chest pain • Hemoptysis • Fever and B-symptom complex • Others_____
Presence of risk factors	• Identified • Not-identified
Which risk factors were identified?	• Smoking • Co-morbidity • Occupation exposure • Radiation exposure • Family history • Prior cancer

Section 2:Imaging findings	
Imaging done	• Chest x-ray • Chest CT • MRI • Chest ultrasound
Imaging findings	• Malignant • Infections/ Benign • Non-specific
Site of the lesion	• Peripheral • Central
Section 3: Histopathologic finding	
Biopsy type	• Core needle biopsy/Trans-bronchial • Resection/Lobectomy
Gross specimen adequacy	• Adequate • Not-adequate
The diagnosis category on the pathology report	• Malignant • Benign/ Negative for malignancy • Non-specific/ Inadequate
If malignant and core needle biopsies	• Small cell carcinoma

	• Non-small cell carcinoma
Histologic Classification	• Adenocarcinoma • Squamous cell carcinoma • Neuroendocrine tumor • Mesenchymal tumors • Undifferentiated • Infectious/ Inflammatory