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Lung and pleural cancers: Histopathology and immunohistochemistry profile in Kinshasa

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ABSTRACT

Introduction

Bronchopulmonary and pleural cancers represent a major public health problem worldwide. In the Democratic Republic of the Congo (DRC), few studies have focused on these pathologies, and no recent data were found in our review. The frequency and predominant histological types of bronchopulmonary cancers remain unknown.

Purpose

This study aimed to determine the histopathological profile of bronchopulmonary cancers in Kinshasa, with the goal of establishing their frequency, histological types, and levels of tissue infiltration.

Methods

This descriptive case series was conducted in Kinshasa across three histopathological laboratories: the University Clinic of Kinshasa, Nganda Hospital Centre, and the Leboma Laboratory. The study covered a 12-year period from 2012 to 2024.

Results

Bronchopulmonary cancers accounted for 1.4% of all tumoural and non-tumoural pathologies recorded during the study period. Among 182 patients, bronchopulmonary adenocarcinoma was the most common histological type (77%). Both adenocarcinomas and squamous cell carcinomas were primary lung cancers. Mesothelioma was the only primary malignancy of pleural tissue, affecting 12 patients (12%). The most affected age group comprised individuals over 60 years, followed by those aged 51–60 years.

Conclusion

Non-small cell lung carcinoma (NSCLC) was the most frequently reported cancer type in this study. Immunohistochemical markers are critical for establishing accurate differential and definitive diagnoses, particularly to distinguish NSCLC from malignant mesothelioma, which can share overlapping clinical and histological features. Our findings underscore a significant public health concern: lung and pleural cancers in Kinshasa often affect relatively young patients and are typically diagnosed at advanced, invasive stages. Treatment options remain limited, and prognosis is generally poor. There is an urgent need to strengthen early detection programmes, improve access to quality histopathological diagnosis, and raise awareness among both healthcare professionals and the general population regarding the warning signs of these cancers. Enhanced early management could substantially improve patient outcomes.

INTRODUCTION

Bronchopulmonary and pleural cancers are major public health problems worldwide. The global incidence of these cancers is 12.4%, with a mortality rate of 18.7% across both sexes (Bray et al., 2024). In Africa, the prevalence of these cancers remains relatively low. In 2020, the estimated

incidence of lung cancer in Africa represented approximately 1.5% to 2% of all cancers observed (Mremi et al., 2025).

In the city of Kinshasa, few studies have focused on this problem. The Democratic Republic of the Congo (DRC) is among the African countries facing challenges in obtaining accurate data to demonstrate the increasing incidence of lung cancer. This limitation is primarily due to the absence of centralised cancer registries and the scarcity of reliable oncological data. According to global estimates, lung cancer accounts for about 1.5% to 2% of cancers in Africa, yet in the DRC, exact figures remain unclear (Mremi et al., 2025).

Bronchopulmonary and pleural cancers have several established risk factors, including smoking, mining activities, and previous bronchopulmonary tuberculosis, among others (Mremi et al., 2025; Bade & Dela Cruz, 2020). These cancers can be classified into various types and subtypes based on morphology, immunohistochemical staining, and genetic alterations (Nicholson et al., 2022).

The 2021 World Health Organization (WHO) classification of thoracic tumours adopts an integrated approach that combines histopathological, immunohistochemical, and, in some cases, molecular data. This classification primarily distinguishes non-small cell carcinomas (NSCCs)—including adenocarcinomas, squamous cell carcinomas, and large cell carcinomas—from small cell carcinomas (SCCs) (Nicholson et al., 2022; Rindi et al., 2018). It also considers the nature of the specimen—whether derived from small biopsies, cytological samples, or resection specimens—as this influences both terminology and diagnostic criteria.

In this context, immunohistochemistry is an essential diagnostic tool, particularly for small samples, as it refines tumour classification and origin determination (Nicholson et al., 2022; Jason et al., 2025). Markers such as TTF-1, P40, CK7, Ber-EP4, WT1, calretinin, and BAP1 enable the differentiation of tumour types, confirmation of pulmonary or pleural origin, and assessment of invasive potential.

A rigorous diagnostic framework, as proposed by the WHO and enhanced by immunohistochemistry, fully justifies this study. The objective was to determine the histopathological profile of bronchopulmonary cancers in the city of Kinshasa (DRC) by identifying their frequency, histological types, and levels of tissue infiltration. This approach will provide reliable and up-to-date data needed to improve diagnosis and management of these cancers in a local context that remains poorly documented.

METHODS

Study Design

This descriptive retrospective study was conducted in the provincial city of Kinshasa, where the diagnosis of bronchopulmonary and pleural cancers is carried out only in hospitals and specialised laboratories. Data were collected from three major histopathology laboratories over a 12-year period, from 2012 to 2024.

Study Framework

The study involved three of the largest pathology laboratories in Kinshasa: the University Clinics of Kinshasa (CUK), the Nganda Hospital Centre, and the Leboma Pathological Anatomy and Cytology Laboratory. These institutions authorised the study and provided access to medical records, slides, and paraffin blocks. Together, they handle approximately 70% of all bronchopulmonary and pleural samples analysed in the city.

Sampling

A total of 215 cases of bronchopulmonary and pleural cancers were initially identified. Of these, 182 cases met the inclusion criteria and were retained for analysis.

Inclusion and Exclusion Criteria

Inclusion criteria comprised all confirmed cases of bronchopulmonary and pleural cancers with available slides and/or blocks, as well as those whose diagnoses were validated by a third pathologist in cases of initial disagreement. Exclusion criteria included missing cases, samples with insufficient material for reliable histopathological assessment, and persistent diagnostic discordance even after a third review.

Variables

The variables analysed included differentiation, invasion, and histopathological type. Adenocarcinomas were defined by the presence of glandular formations, while squamous cell carcinomas were characterised by sheets of cells with intercellular bridges, with or without keratinisation. A

cancer was considered invasive when tumour cells infiltrated the chorionic tissue.

A TTF-1 or NKX2-positive adenocarcinoma was confirmed when nuclear staining of tumour cells from bronchopulmonary tissue was observed. A TTF-1-negative adenocarcinoma indicated a secondary or metastatic bronchopulmonary adenocarcinoma. P40 positivity in squamous cell carcinoma was defined by nuclear staining in over 50% of the cells. CK7 was considered positive when membranous or cytoplasmic staining was observed in bronchopulmonary adenocarcinoma. For malignant mesothelioma, TTF-1 and Ber-EP4 negativity excluded pulmonary origin, while WT1, calretinin, D2-40, and BAP1 positivity confirmed malignant pleural mesothelioma.

Histopathological and Immunohistochemical Diagnosis

Slides were examined using Leica ICC50W and Leica DHLB optical microscopes equipped with cameras and monitors. Laboratory selection was non-probabilistic, and all patients with histologically confirmed bronchopulmonary or pleural cancers were exhaustively included from laboratory registers. All samples underwent second readings by pathologists, with third readings performed when diagnostic confirmation was required.

Immunostaining was conducted using the BenchMark Ultra device at the Beaujon/AP-HP Paris Nord Cytology and Anatomy Laboratory. The antibodies used included TTF-1 (clone 8G7G3/1), CK7 (clone SOu-TL 12/30), and P40 (Bio).

Statistical Analysis

Data were first entered into Microsoft Excel and subsequently exported to R software (version 4.2.0) for statistical analysis. Univariate analysis was used to determine the mean, median, quartiles, and extreme ages of the patients, as well as the frequency, histological type, and degree of invasion. The level of statistical significance was set at $\alpha < 0.05$. Student's *t*-test and Pearson's chi-squared test were used for proportions. Graphical representations were produced using Microsoft Excel 2016.

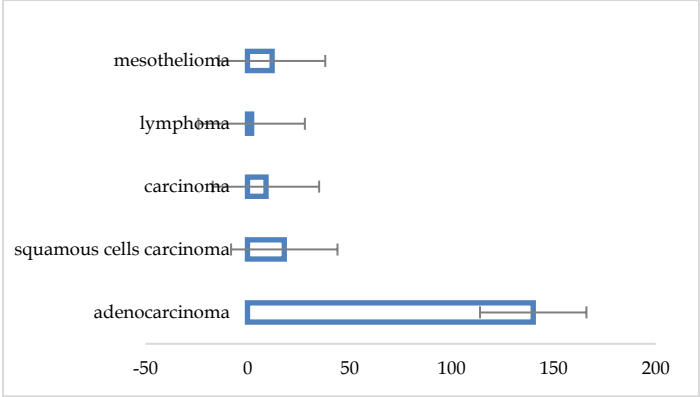
Ethical Considerations

As this study was based on archived data rather than direct patient participation, informed consent was not required. Nevertheless, all ethical standards concerning anonymity, confidentiality, and data protection were strictly observed.

RESULTS

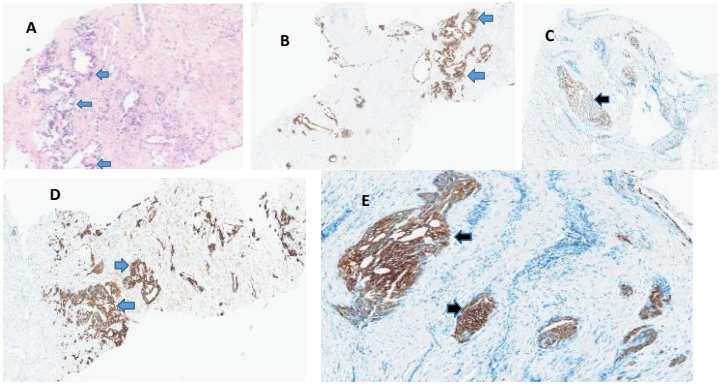
The present study recorded 182 patients diagnosed with bronchopulmonary cancers out of a total of 13,316 biopsies (tumoural and non-tumoural cases) collected during the study period, representing a relative frequency of 1.4%.

Figure 1:
Distribution of Bronchopulmonary and Pleural Cancers by Histopathological Type



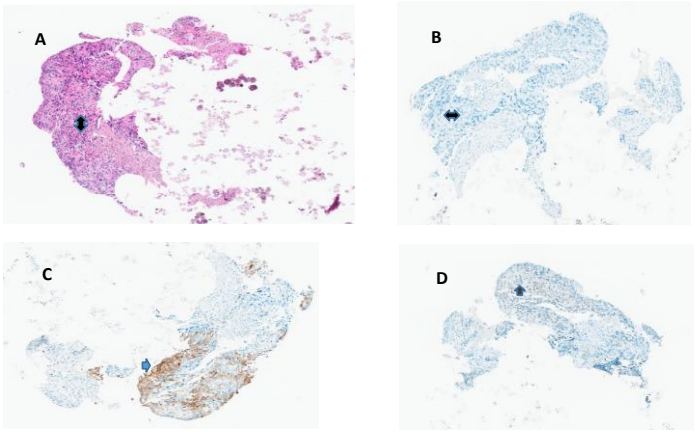
Primary bronchopulmonary adenocarcinoma was the most common histological type, followed by squamous cell carcinoma and pleural mesothelioma. *Note: Rare histological types (e.g., lymphoma, metastatic hepatocellular carcinoma) were grouped under "Others."*

Figure 2:
Microscopic Images of Lung Adenocarcinoma (Primary and Metastatic)



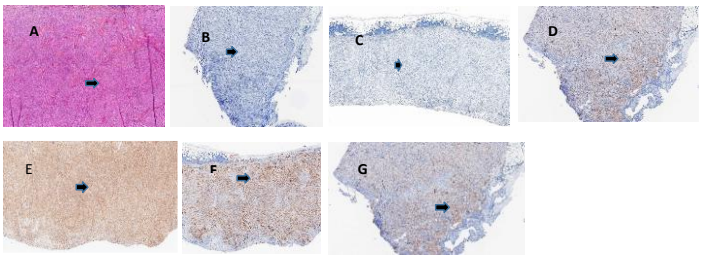
(A, D) Non-small cell carcinoma (NSCLC) with glandular differentiation (blue arrows, HE, ×100); (B) NSCLC, TTF-1 positive (nuclear staining, blue arrows); (C) TTF-1 negative (metastatic adenocarcinoma); (E) NSCLC, CK7 positive (membrane staining, black arrows).

Figure 3:
Lung Squamous Cell Carcinoma



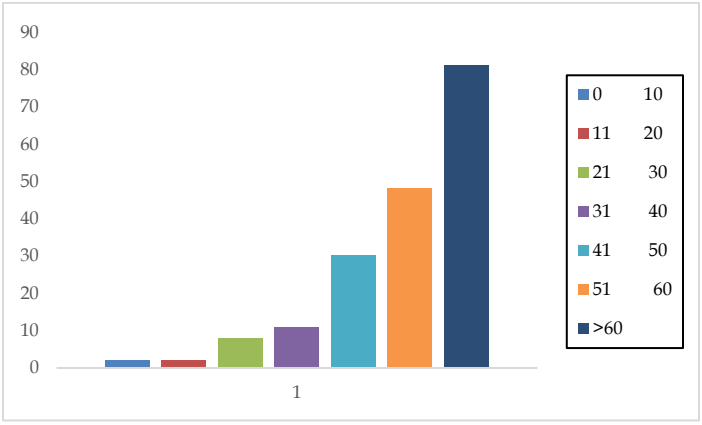
(A) Malignant epithelial cells with squamous differentiation (HE, ×40); (B) TTF-1 negative; (C) P40 strongly positive (blue arrows); (D) CK7 positive (black arrows).

Figure 4:
Malignant Pleural Mesothelioma



(A) Neoplastic cells infiltrating pleural tissue (HE, ×40); (B–C) TTF-1 and BerEP4 negative; (D–G) WT1, BAP1, D2-40, and calretinin positive (nuclear and membranous staining, depending on the marker).

Figure 5:
Distribution of Bronchopulmonary Cancers by Age Range



The highest frequency of bronchopulmonary cancers was observed among patients aged over 60 years, followed by those aged 51–60 years.

Table 1:
Distribution of Bronchopulmonary and Pleural Cancers by Histological Type and Tissue Origin

Histological Type	Total (n)	%	Tissue Origin
Adenocarcinoma	140	77	Primary
Squamous cell carcinoma	18	10	Primary
Mesothelioma	12	6.5	Primary
Lymphoma	2	1	Secondary
Hepatocellular carcinoma	1	0.5	Secondary

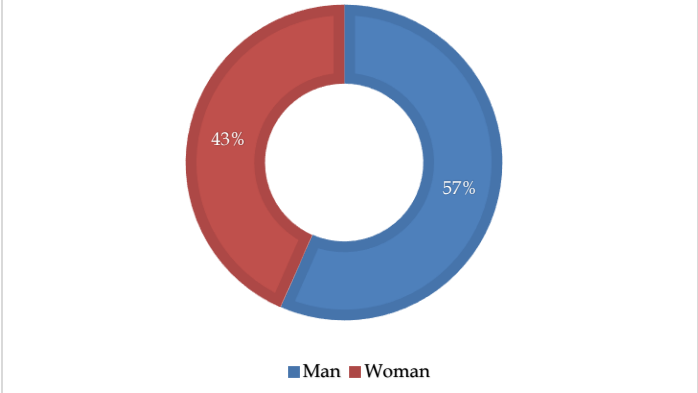
Primary bronchopulmonary adenocarcinoma was the most common histological type (77%), followed by squamous cell carcinoma (10%). Mesothelioma was the only primary malignancy of pleural tissue, affecting 12 patients (6.5%). Lymphoma and hepatocellular carcinoma represented metastatic tumours in pulmonary parenchyma. *Note: "n" = number of cases; % = proportion of total. Primary and metastatic lesions were clearly distinguished.*

Table 2:
Distribution of Bronchopulmonary and Pleural Cancers According to Histopathological Grade and Invasion

Histopathological Grade	Total (n)	%	Invasion Type	Total (n)	%
Grade 1	90	83	Infiltrative	157	98
Grade 2	8	7.4	Non-infiltrative	3	2
Grade 3	10	9.2	–	–	–

Most cancers were grade 1 (83%) and invasive (98%).

Figure 6:
Distribution of Bronchopulmonary and Pleural Cancers by Gender



Of the 182 patients, 103 were male (57%) and 79 female (43%), giving a sex ratio of 1.3.

Table 3:
Demographic Characteristics of Patients with Bronchopulmonary and Pleural Cancers

Variable	Value
Total number of patients	182
Minimum age	3 years
Maximum age	84 years
Mean age	56.3 years
Median age	57.5 years
Age range (Q1–Q3)	3–66 years
Male sex	103 (57%)
Female sex	79 (43%)
Male-to-female ratio	1.3

The patients' ages ranged from 3 to 84 years, with a mean age of 56.3 years and a median of 57.5 years. Seventy-five percent of patients were between 3 and 66 years old, illustrating a wide age dispersion at diagnosis.

The mean age among male patients was 56.3 years, and among female patients, 57.5 years. The difference in mean age between the sexes was not statistically significant (p = 0.6, α = 0.05). Age did not significantly influence the degree of invasion (p = 0.5). However, gender was a significant factor associated with tumour invasiveness (p = 0.003), indicating that men and women did not exhibit the same degree of tumour infiltration.

DISCUSSION

Our study conducted in Kinshasa revealed a marked predominance of lung adenocarcinoma (77%), followed by squamous cell carcinoma (10%) and malignant pleural mesothelioma (6.5%). These findings align with global trends reported in several studies. Mehta et al. (2025), in a study conducted in South India, also observed a predominance of adenocarcinoma (52%) among lung cancer patients over a 15-year period. The higher rate observed in our study may be explained by differences in diagnostic methods, limited access to immunohistochemical testing in Kinshasa, and variations in tobacco consumption profiles between the two regions.

Similarly, Erefai et al. (2022) in Morocco found that adenocarcinoma accounted for 46.4% of cases, followed by squamous cell carcinoma (41.5%). This differs from our findings, where squamous cell carcinoma represented only 10%. This discrepancy may reflect differences in smoking prevalence, as smoking is more common among Moroccan men, whereas in Kinshasa, environmental factors such as air pollution, poor infrastructure, and domestic biomass exposure likely play more significant roles (Zhang et al., 2023).

In our cohort, the mean age was 56.3 years, with a male predominance of 57%. These findings are consistent with studies from Asia, such as that by Sabbula et al. (2025), which also reported an advanced mean age at diagnosis. In men, this may be associated with occupational exposures, including mining, cement production, and construction work, as well as tobacco use.

The relatively low proportion of squamous cell carcinoma in our study contrasts with earlier reports where it was considered the predominant subtype. Perez-Moreno et al. (2012) noted a global decline in squamous cell carcinoma incidence, attributed to reduced smoking rates and improved peripheral biopsy techniques. Pyana Kitenge et al. (2019) also observed that early-stage squamous cell carcinoma carries a less favourable prognosis than adenocarcinoma, underscoring the importance of accurate histopathological classification.

In our study, 98% of tumours were invasive, consistent with findings by Talcott et al. (2021), who reported that non-small cell lung cancers are typically invasive at diagnosis, even when preceded by in situ lesions. This underscores the need for early detection and improved access to chest imaging—both major challenges in the DRC.

Immunohistochemical markers such as TTF-1, CK7, P40, WT1, and calretinin facilitated more precise histological classification, in accordance with the 2021 WHO classification (Travis et al., 2015; Nicholson et al., 2022; Liang et al., 2024). Limited access to reagents in Kinshasa likely contributes to underclassification and diagnostic errors. The 12 cases of malignant pleural mesothelioma (6.5%) identified in our study are concerning, especially given the lack of asbestos regulation in the region. Pyana Kitenge et al. (2019) reported similar findings in the DRC, while Walker-Bone et al. (2023) demonstrated a strong association between occupational asbestos exposure and mesothelioma incidence in Australia.

Interestingly, the presence of a 3-year-old child in our series raises diagnostic questions, as such cases may correspond

to rare pre-invasive or atypical lesions described by Ruffini et al. (2004) and in IARC classifications (Travis et al., 2015).

CONCLUSION

This study reveals a clear predominance of adenocarcinoma among non-small cell lung carcinomas in Kinshasa, often diagnosed at an advanced and invasive stage. Men and individuals over 60 years are the most affected. Although pleural mesothelioma is relatively rare, it remains a public health concern due to the absence of asbestos regulation.

The main limitations of this study include its retrospective nature, limited number of laboratories, restricted access to immunohistochemical reagents, and absence of molecular diagnostic data. Our findings highlight the urgent need to strengthen diagnostic capacities, establish a national cancer registry, integrate molecular pathology, and implement early screening and preventive measures—particularly concerning tobacco control and household air pollution.

Conflicts of Interest: None declared.

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