

Radiological and Histopathological Features of Lung Carcinomas in a Tertiary Level Hospital: A Cross-sectional Study

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ABSTRACT

Introduction: Lung cancer is a leading cause of mortality globally and in Nepal. Computed tomography (CT) is the preferred screening modality for detection of primary lesions; histopathological examination remains gold standard for definitive morphological diagnosis and subclassification.

Methods: This one-year hospital-based descriptive cross-sectional study analyzed patients with clinically and radiologically suspected lung carcinoma who underwent contrast-enhanced CT of the chest followed by CT-guided percutaneous transthoracic core needle biopsy and in whom histopathological examination showed unequivocal features of malignancy. CT chest and CT-guided biopsy were performed by the same interventional radiologist. The final histopathological diagnosis was reviewed by three pathologists. Demographic findings, smoking history, CT and histopathological findings were analyzed using frequencies and percentages, and age using mean and range.

Results: Sixty patients were included in the study. There were 23 (38.33%) males and 37 (61.67%) females. Squamous cell carcinoma (SCC) was seen in 28 (46.67%) cases and adenocarcinoma in 20 (33.33%) cases. Squamous cell carcinoma was central in 17 (60.71%) cases and adenocarcinoma was peripheral in 15 (75%) cases. Radiological findings included mediastinal lymphadenopathy 49 (81.67%) and adjacent tissue invasion 29 (48.33%). Thirty nine (65%) cases had a positive smoking history.

Conclusions: Squamous cell carcinoma was the most frequent and commonly central, whereas adenocarcinoma was commonly peripheral. Mediastinal lymphadenopathy was the predominant CT finding, followed by adjacent tissue invasion and hilar enlargement. These findings may aid lesion assessment and biopsy planning, but histopathology remains essential for definitive classification.



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INTRODUCTION

Lung cancer is the leading cause of cancer mortality worldwide and represents the most frequent malignancy in Nepal.^{1,2} Driven largely by smoking, its high mortality rate is significantly exacerbated by delayed diagnosis.³⁻⁵

Diagnosis of lung carcinoma requires combination of advanced radiological imaging and tissue assessment. While histopathological examination remains the absolute gold standard for confirmation of malignancy and its classification, obtaining a biopsy specimen is an invasive, time-consuming, and expertise-intensive procedure.^{5,6} In contrast, computed tomography (CT) offers a safer, non-invasive alternative for screening and lesion

characterization, providing precise information on lesion size, contour, and extent, and accessibility for sampling.⁷ CT imaging may even serve as a roadmap for more accurate surgical staging.⁸ This study aims to describe the demographic characteristics, diverse CT findings, smoking history, and histopathological subtypes among patients with histologically confirmed cases of lung carcinoma who underwent CT-guided biopsies in a tertiary-level hospital.

METHODS

This descriptive cross-sectional study was conducted at the Department of Pathology, Chitwan Medical College and

Teaching Hospital (CMCTH), Bharatpur, Nepal, over a period of one year, from 1st June 2022 to 30th May 2023. Ethical approval for the study was obtained from the Institutional Review Committee of Chitwan Medical College (CMC-IRC/078/079-221) prior to commencement of the study. All relevant clinical and histopathological information was collected and analysed in accordance with the approved study protocol. Patients undergoing CT-guided biopsy for a clinically and radiologically suspected lung malignancy during the study period were considered for inclusion. Consecutive sampling was employed to enroll eligible cases presenting during the study period.

The decision to proceed with CT-guided biopsy was made jointly by the referring pulmonologist and the interventional radiologist after reviewing the clinical presentation and radiological findings. Biopsy was considered when there were clinical and radiological features suggestive of lung malignancy, particularly the presence of a pulmonary mass or nodule identified on contrast-enhanced computed tomography (CT) of the chest that was considered accessible through a percutaneous transthoracic approach. CT imaging and the subsequent CT-guided biopsy procedure were performed by the same interventional radiologist for all patients, thereby maintaining consistency in the radiological assessment and biopsy procedure.

All cases undergoing CT-guided biopsy for a clinically and radiologically suspected primary lung carcinoma were assessed for eligibility. Patients were included when the histopathological examination demonstrated unequivocal features of malignancy. The diagnosis was based on the morphological characteristics identified in the biopsy specimens on routine histopathological examination. Cases with inadequate tissue samples, non-diagnostic specimens, biopsies that did not demonstrate unequivocal evidence of malignancy, and specimens showing metastatic deposits from a previously known extrapulmonary primary malignancy were excluded. This approach was adopted to ensure that the study population represented cases with definitive histopathological evidence of primary pulmonary malignancy.

Following the biopsy procedure, all tissue specimens were appropriately labelled and immediately fixed in 10% neutral buffered formalin. The specimens were subsequently processed using standard routine histopathological techniques. Paraffin-embedded tissue sections were prepared and stained with hematoxylin and eosin (H&E). The stained sections were examined microscopically for assessment of tumour morphology and determination of the histopathological diagnosis. The final histopathological diagnosis of each case was reviewed independently by three pathologists to improve diagnostic consistency and minimise the possibility of interpretative variation. Tumours were classified according to the World Health Organization (WHO) classification of lung tumours applicable during the study period.

Immunohistochemical examination and other ancillary

molecular investigations were not performed as part of the study. Therefore, tumour classification was based primarily on the morphological features identified on routine H&E-stained sections. Demographic characteristics, including age and other relevant patient information, were documented along with clinical history, smoking status, radiological findings and histopathological characteristics. The data were collected systematically using a predesigned and preapproved data collection proforma. Particular attention was given to documenting the location and characteristics of pulmonary lesions on CT, relevant clinical features, smoking history and the final histopathological diagnosis.

The collected data were entered, coded, organised and analysed using Statistical Package for the Social Sciences (SPSS), version 24.0. Since the study included only patients with histologically confirmed malignancy and did not include a comparison group consisting of patients without malignancy, inferential statistical analysis was not considered appropriate. Consequently, no statistical test of association was performed, and no measure of diagnostic accuracy, such as sensitivity, specificity, positive predictive value or negative predictive value, was calculated. The analysis was therefore restricted to descriptive statistics.

RESULTS

A total of sixty patients were enrolled in this study. Out of 60 cases, 23 (38.33%) were males, and 37 (61.67%) were females. Among the 60 participants, 46 (76.67%) were aged ≥ 60 years, while 14 (23.33%) were aged 38–59 years. There were 39 (65%) smokers and 21 (35%) non-smokers among the 60 participants.

Mediastinal lymphadenopathy was observed in 49 (81.67%) participants, adjacent tissue invasion in 29 (48.33%), hilar enlargement in 23 (38.33%), calcification in 21 (35%), segmental collapse in 14 (23.33%), cavitation in 12 (20%), and SVC compression in 4 (6.67%) (Table 1). Squamous cell carcinoma was reported in 28 (46.67%) participants, adenocarcinoma in 20 (33.33%), poorly differentiated carcinoma in 7 (11.67%), small cell carcinoma in 4 (6.67%), and carcinoid tumour in 1 (1.67%) (Table 2). Squamous cell carcinoma was located centrally in 17 (60.71%) cases and peripherally in 11 (39.29%) cases, whereas adenocarcinoma was located centrally in 5 (25%) and peripherally in 15 (75.00%) cases. Poorly differentiated carcinoma was centrally located in 3 (42.86%) and peripherally in 4 (57.14%) cases. All 4 (100%) cases of small cell carcinoma were centrally located, while the single case of carcinoid tumour was peripherally located. Overall, 29 (48.33%) carcinomas were centrally located and 31 (51.67%) were peripherally located (Table 3).

Among the cases of squamous cell carcinoma, hilar enlargement was observed in 10 (35.71%) cases, segmental collapse in 6 (21.43%), calcification in 11 (39.29%), and cavitation in 7 (25.00%). Adjacent tissue involvement was observed in 11 (39.29%) cases, while mediastinal lymphadenopathy was present in 24 (85.71%) cases.

In the cases of adenocarcinoma, Hilar enlargement was observed in 8 (40%) cases, segmental collapse in 5 (25%), calcification in 4 (20%), and cavitation in 2 (10%). Adjacent tissue involvement was observed in 13 (65%) cases, while mediastinal lymphadenopathy was present in 14 (70%) cases. All four cases of small cell carcinoma showed mediastinal lymphadenopathy. Hilar enlargement and calcification were each recorded in one small cell carcinoma. Among the 7 cases of poorly differentiated carcinoma, hilar enlargement was observed in 4 (57.14%) cases, segmental collapse in 3 (42.86%), calcification in 4 (57.14%), and cavitation in 3 (42.86%). Adjacent tissue involvement was observed in 4 (57.14%) cases, while mediastinal lymphadenopathy was present in 6 (85.71%) cases.

A single case of carcinoid tumor showed mediastinal lymphadenopathy, adjacent tissue invasion, and calcification. Smoking was reported in 24 (85.71%) of the 28 cases of squamous cell carcinoma, 7 (35.00%) of the 20 cases of adenocarcinoma, 4 (57.14%) of the 7 cases of poorly differentiated carcinoma, and all 4 (100.00%) cases of small cell carcinoma. None of the patients with carcinoid tumour were smokers (Table 4).

Table 1. CT findings in lung carcinoma (n=60).

CT Findings	n(%)
Calcification	21(35)
Cavitation	12(20)
Segmental collapse	14(23.33)
Hilar enlargement	23(38.33)
Mediastinal lymphadenopathy	49(81.67)
Adjacent tissue invasion	29(48.33)
SVC compression	4(6.67)

Table 2. Histological types of lung carcinoma (n=60).

Type of carcinoma	n(%)
Squamous cell carcinoma	28(46.67)
Adenocarcinoma	20(33.33)
Poorly differentiated carcinoma	7(11.67)
Small cell carcinoma	4(6.67)
Carcinoid tumour	1(1.67)
Total	60(100)

DISCUSSION

The present study identified several patterns among 60 patients with histologically confirmed lung carcinoma who underwent CT-guided percutaneous transthoracic core needle biopsy. The most common histological subtype was squamous cell carcinoma. Mediastinal lymphadenopathy was the predominant CT finding. Squamous cell carcinoma was commonly central, whereas adenocarcinoma was commonly peripheral. Squamous cell carcinoma was most common among smokers. In our study, the peak age of diagnosis of lung carcinoma was in the sixth and seventh decades of life which is similar to the study by Bhat N et al where maximum number of cases of lung

Table 3. Distribution of lung carcinoma according to location (n=60).

Types	C	P	T
Squamous Cell Carcinoma	17 (60.71)	11 (39.29)	28(100)
Adenocarcinoma	5(25)	15(75)	20(100)
Poorly differentiated carcinoma	3 (42.86)	4(57.14)	7(100)
Small cell carcinoma	4(100)	0(0)	4(100)
Carcinoid tumor	0(0)	1(100)	1(100)
Total	29 (48.33)	31 (51.67)	60 (100)

C: Central; P: Peripheral; T: Total.

Table 4. Different types of lung carcinoma among smokers (n=60).

Types	Yes	No	Total
Squamous Cell Carcinoma	24(85.71)	4(14.29)	28(100)
Adenocarcinoma	7(35)	13(65)	20(100)
Poorly differentiated carcinoma	4(57.14)	3(42.86)	7(100)
Small cell carcinoma	4(100)	0(0)	4(100)
Carcinoid tumor	0(0)	1(100)	1(100)
Total	39(65)	21(35)	60(100)

carcinoma are diagnosed in between 61-70 years.⁵ Kumar V et al also found most of the lung carcinomas diagnosed in the sixth and seventh decade of life.⁹ The male-to-female ratio was 1.2:1 and 2.2:1 in study by Govert et al and Lam et al which is in contrast to our study, where the male-to-female ratio was 0.62:1.^{10,11} Meta analytic data showed that excess lung cancer risk associated with solid fuel smoke is greater in women than in men, which is consistent with use of firewood for household in this population resulting greater exposure among women than among men. However, our findings were similar to study by Miao Y et al where male to female ratio for lung carcinoma was 0.79:1.^{12,13}

In the present study, the most frequently diagnosed histological subtype was squamous cell carcinoma, accounting for 46.66% of cases, followed by adenocarcinoma present in 33.33%. This is in contrast to a study by Dhungana A et al, where they showed adenocarcinoma was the commonest subtype present in 37.7% of cases.¹⁴ In our study, 29 of the cases were centrally located, with the most common being squamous cell carcinoma, and 31 of the cases were peripherally located, with the most common being adenocarcinoma. This distribution is similar to the findings described by Saijo T et al which showed two thirds of squamous cell carcinomas are centrally located. Godara CS et al also found that most of the squamous cell carcinomas were centrally located, and adenocarcinomas were peripherally located.^{15,16}

Commonest radiological findings were mediastinal lymphadenopathy, adjacent tissue invasion, hilar enlargement, calcification, segmental collapse, cavitation, and SVC

compression. Mediastinal lymphadenopathy was present in (81.66%) of cases in our study, which is similar to Godara CS et al, where 82.9% of the cases had mediastinal lymphadenopathy.¹⁶ Separate histopathological examination of mediastinal lymph nodes was not carried out; enlarged mediastinal lymph nodes in such patients may show reactive changes or granulomatous inflammation rather than metastatic involvement.^{17,18} Therefore, nodal enlargement on CT alone should not be equated with nodal metastasis. Cavitation was most commonly present in squamous cell carcinoma, which is similar to the studies done by Reddy R et al and Gupta R et al in which cavitation was frequently noted in squamous cell carcinoma.^{7,19} Segmental collapse was observed in both squamous cell carcinoma and adenocarcinoma in a study by Chakraborty R et al which is consistent with our findings.²⁰ SVC compression is seen in 6% and calcification in 35 % of cases of lung carcinoma in our study, similar to observations by Shah D et al.²¹

In the present study, a high degree of association was found between smoking and the incidence of lung cancer. Tobacco smoking and environmental exposure to certain agents such as asbestos and radon are the main etiological factors in the development of lung cancer.^{3,4} In the present study, a positive smoking history was present in 65% of cases; smoking was reported in 85.71% of patients with squamous cell carcinoma, all four cases with small cell carcinoma, and 35% of those with adenocarcinoma. This might be the reason for squamous cell carcinoma being the commonest histological type of lung cancer in our study. In a study by Shah D et al.²¹ most of patients with lung carcinoma were chronic smokers, accounting 82.66% of patients.

Location patterns are more descriptive than diagnostic. Though most of the cases of squamous cell carcinomas were centrally located, and adenocarcinomas were peripherally located. But there were a few cases of squamous cell carcinomas with peripheral location and a few cases of adenocarcinomas with central location. Similar overlapping features can be seen with other CT findings as well. Mediastinal lymphadenopathy was common among all subtypes, and cavitation, although commonest in squamous cell carcinoma, was also seen in adenocarcinoma and poorly differentiated carcinoma. CT findings describe non-specific imaging phenotypes; biopsy remains absolute gold standard for diagnosis of lung carcinoma. However, CT findings provide a clue to clinicians to plan tissue sampling.

There are several sampling routes available for clinicoradiologically suspected cases of lung carcinoma. Flexible bronchoscopy with endobronchial or transbronchial biopsy, bronchial brushing, and bronchial washing are best for central endobronchially visible lesions.¹¹ Percutaneous transthoracic CT-guided core biopsy gives higher yield for peripheral lesions. In this study, only percutaneous transthoracic CT-guided core biopsy was used.

This study has a few limitations. Apart from the study design-related limitations, inter-observer variability among pathologists in making the diagnosis is a major limitation. However, this was mitigated by independent review of every case by three pathologists with a consensus final diagnosis. Other special tests like immunohistochemistry and molecular analysis were not done as they were not available in our center. Mediastinal lymph nodes were not sampled separately. Only CT-guided transthoracic biopsy was used; lesions accessible to this route are over-represented relative to central endobronchial lesions. Taking an appropriate biopsy specimen may depend on the skill of the radiologist. As this study was conducted in a single tertiary care center with a small, selected sample restricted to histologically malignant percutaneous transthoracic CT guided biopsy cases, the findings may not be generalizable.

CONCLUSION

Squamous cell carcinoma was the most frequent subtype and was commonly centrally located, whereas adenocarcinoma was the second most frequent subtype and was commonly peripheral. Mediastinal lymphadenopathy was the predominant CT finding, followed by adjacent tissue invasion and hilar enlargement. These findings may help clinicians anticipate lesion pattern and plan tissue sampling. However, histopathological examination remains necessary for definite classification of lung carcinoma.

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Conflicts of Interest: None.

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