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CT CHARACTERIZATION OF LUNG LESIONS WITH HISTOPATHOLOGICAL CORRELATION IN A TERTIARY CARE HOSPITAL – A CROSS SECTIONAL STUDY

Radio-Diagnosis

Dr. Ramesh Parate Professor, Department of Radiodiagnosis, GMCH Nagpur.

Dr. Lisha Choudhari* Junior Resident, Department of Radiodiagnosis, GMCH Nagpur. *Corresponding Author

Dr. Tilottama R. Parate Professor, Department of Medicine, IGGMC Nagpur.

ABSTRACT

Lung carcinoma remains a leading cause of cancer-related mortality worldwide. Early and accurate imaging-based diagnosis is essential for improving outcomes. Computed tomography (CT) provides detailed morphologic evaluation of pulmonary lesions and, when correlated with histopathology, enhances diagnostic accuracy. **Aim:** To characterize lung lesions using CT and correlate imaging findings with histopathological diagnosis for distinguishing benign from malignant etiologies. **Methods:** A cross-sectional study was conducted in the Department of Radiodiagnosis, Government Medical College, Nagpur, including 72 patients with lung lesions between 2022 and 2024. All patients underwent contrast-enhanced CT (CECT) chest followed by histopathological confirmation by biopsy. CT findings-site, size, margins, internal characteristics, enhancement, cavitation, calcification, and associated features-were analyzed and correlated with histopathology. **Results:** Among 72 cases, malignant lesions predominated-**Adenocarcinoma** was the most common subtype, followed by **squamous cell carcinoma.** Adenocarcinomas were mainly peripheral, with spiculated margins and heterogeneous enhancement, whereas squamous cell carcinomas were typically central, often cavitating and associated with bronchial obstruction. Benign lesions were smaller with smooth margins and homogeneous enhancement. CT findings showed excellent correlation with histopathological results. **Conclusion:** CT is indispensable for evaluating lung lesions. Characteristic imaging features suggest the probable histologic subtype, improving diagnostic confidence and guiding biopsy and treatment planning.

KEYWORDS

Lung carcinoma, CT characterization, adenocarcinoma, squamous cell carcinoma, histopathological correlation.

INTRODUCTION

Lung carcinoma is one of the most frequent and deadly malignancies worldwide. It represents a heterogeneous group of tumors originating from the tracheobronchial tree and pulmonary parenchyma, arising from epithelial, mesenchymal, or neuroendocrine cells. The increasing prevalence in both smokers and non-smokers underscores the significance of early detection. Nearly 85% of cases are related to tobacco smoking. CT has become the cornerstone imaging modality for evaluating lung lesions because of its superior spatial resolution, allowing detailed assessment of morphology, margins, enhancement and local invasion. Histopathology remains the definitive diagnostic tool, but CT assists in predicting the likely pathology, guiding biopsy, and staging. This study aimed to analyze CT features of lung lesions and correlate them with histopathological findings to improve diagnostic accuracy and patient management.

MATERIALS AND METHODS

Study Design

A cross-sectional study was conducted in the **Department of Radiodiagnosis, Government Medical College, Nagpur**, over two years (2022–2024). Seventy-two patients with lung lesions identified on chest radiography or CT were included after obtaining informed consent.

Inclusion Criteria:-

1. Discovery of an abnormality on the chest radiograph.
2. Pneumonia
a. Pneumonia not completely resolving with antibiotics.
b. Associated with volume loss and absence of air bronchograms.
3. Patient with normal chest X-ray, but positive sputum cytology or extra-thoracic phenomenon that could be caused by bronchogenic carcinoma.
4. In cases of opaque hemithorax to rule out an underlying carcinoma.
5. Bronchus 'cutoff' with distal collapse consolidation seen on chest Xray.
6. For further characterization of solitary pulmonary nodule on chest X-ray.

Exclusion Criteria:

1. Patient not fit to undergo CT-guided lung biopsy.
2. Patient with poor respiratory efforts.
3. Contraindications to radiation like pregnancy.
4. Patient not willing to give consent.

Imaging Protocol

All patients underwent **contrast-enhanced CT (CECT)** using a multidetector CT scanner. Scans were acquired in full inspiration with 1–2 mm slices. Intravenous non-ionic contrast (1.5 mL/kg) was administered.

CT Parameters Evaluated
Each lesion was analyzed for:
1. **Location** (central or peripheral)
2. **Size, shape, and margins**
3. **Internal characteristics** (homogeneous or heterogeneous)
4. **Cavitation, necrosis, or calcification**
5. **Enhancement pattern**
6. **Associated findings:** collapse, pleural effusion, consolidation, or lymphadenopathy
7. **Chest wall or mediastinal invasion**

Histopathological Correlation
All cases underwent biopsy or FNAC, and histopathological findings were correlated with CT morphology for diagnostic concordance.

RESULTS-

A total of 72 patients with lung lesions were included in this study. The demographic distribution and CT characteristics are summarized in the tables below.

Table 1. Demographic Distribution Of Patients (n = 72)

Parameter	Category	Number of Patients	Percentage (%)
Age Group (years)	31–40	6	8.3
	41–50	12	16.7
	51–60	22	30.6
	61–70	20	27.8
	>70	12	16.6
Sex	Male	46	63.9
	Female	26	36.1
Smoking History	Smoker	44	61.1
	Non-Smoker	28	38.9

Interpretation:
The majority of patients were males (63.9%), and most belonged to the 51–70 years age group. A significant proportion (61.1%) had a history of smoking, which was more common among patients with squamous

cell carcinoma.

Table 2. CT Morphological Characteristics Of Lung Lesions (n = 72)

CT Feature	Category	Number of Cases	Percentage (%)
Shape	Irregular	38	52.8
	Lobulated	24	33.3
	Round/Oval	10	13.9
Margins	Spiculated	40	55.6
	Ill-defined	20	27.7
	Smooth	12	16.7
Density	Solid	58	80.6
	Part-solid	8	11.1
	Ground-glass	6	8.3
Calcification	Present	6	8.3
	Absent	66	91.7
Cavitation	Present	18	25.0
	Absent	54	75.0

Interpretation:
Most lesions were irregular in shape (52.8%) and had spiculated margins (55.6%), which were highly suggestive of malignancy. The majority were solid in density (80.6%) with no calcification (91.7%). Cavitation was noted in 25% of lesions, more frequently in squamous cell carcinoma.

Table 3. Additional CT Findings (n = 72)

Feature	Present (n)	Percentage (%)	Predominant Association
Satellite Nodules	10	13.9	Benign / Granulomatous lesions
Vascular Convergence	30	41.7	Adenocarcinoma
Air Bronchogram	22	30.6	Adenocarcinoma
Pleural Retraction	20	27.8	Adenocarcinoma
Mediastinal Lymphadenopathy	38	52.8	Squamous cell carcinoma, advanced disease

Out of 72 cases, **malignant lesions** constituted the majority, with **adenocarcinoma (45%)** being the most frequent histologic type, followed by **squamous cell carcinoma (35%)**.The remaining cases included benign lesions such as granulomatous inflammation, tubercular nodules, and organizing pneumonia.

CT diagnosis corresponded closely with histopathological findings in the majority of cases, with an overall diagnostic accuracy of approximately **90%** for malignancy detection.

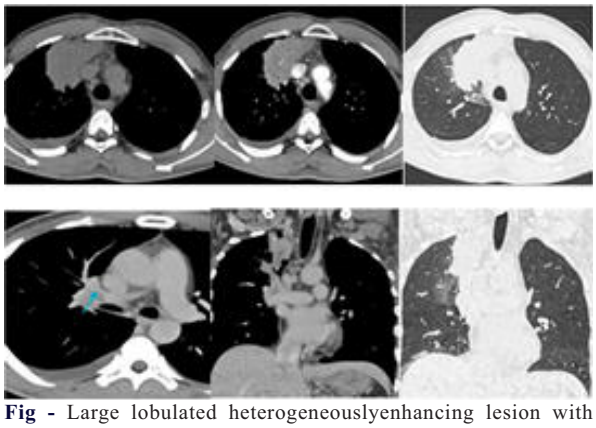

Fig - Large lobulated heterogeneouslyenhancing lesion with spiculated margins with abrupt bronchial cut off in anterior segment of right upper lobe, with surrounding ground glass opacities- Malignant neoplastic lesion- Carcinoma lung – T4N2Mx.Histopathology was done suggestive of squamous cell carcinoma.

CT Findings
Adenocarcinoma was the most common malignant subtype, followed by **squamous cell carcinoma**.

- **Adenocarcinoma:** Predominantly peripheral, irregular or spiculated margins, heterogeneous enhancement, and ground-glass areas. Pleural retraction and vascular convergence were frequently noted.
- **Squamous Cell Carcinoma:** Typically central, showing cavitation, bronchial obstruction, and post-obstructive pneumonia. Irregular margins and heterogeneous enhancement were characteristic.
- **Benign Lesions:** Generally smaller, well-defined, homogeneous, and sometimes calcified.

Table 4. CT Versus Histopathology Diagnosis- Cross Tabulation And Interpretation

Final Confusion Matrix (n = 72)	Histopathology : Malignant	Histopathology : Benign	Total Predicted by CT
CT: Malignant Diagnosis	41 (56.9%)	6 (8.3%)	47 (65.3%)
CT: Benign Diagnosis	0 (0.0%)	25 (34.7%)	25 (34.7%)
Total Actual (HPE)	41 (56.9%)	31 (43.1%)	72 (100%)

DISCUSSION

The present study aimed to characterize various lung lesions on CT and correlate these findings with histopathological diagnoses. Among 72 patients evaluated, the majority were males between 51–70 years of age, consistent with the higher prevalence of lung cancer in older male smokers. Smoking was strongly associated with squamous cell carcinoma, reflecting its well-documented etiologic link with tobacco exposure.

In our study, the majority of malignant lesions were **irregular or lobulated in shape with spiculated margins**, features highly suggestive of malignancy. **Adenocarcinoma** was the most common histologic subtype and typically presented as a **peripheral lesion** with **heterogeneous enhancement**, **spiculation**, and frequent **pleural retraction** and **vascular convergence**. These findings reflect the tumor's origin from alveolar epithelium and its infiltrative growth pattern. The presence of air bronchogram in several adenocarcinoma cases indicated preserved patent bronchi within areas of alveolar tumor spread.

Squamous cell carcinoma was usually **central**, often demonstrating **cavitation** due to necrosis and **bronchial obstruction** leading to distal collapse or consolidation. These imaging features closely matched the histopathologic pattern of endobronchial growth and keratinization. Mediastinal lymphadenopathy was observed more commonly in squamous cell carcinoma and represented either nodal metastasis or inflammatory response.

Benign lesions, such as tuberculous granulomas or organizing pneumonias, showed **smooth margins**, **homogeneous enhancement**, and **occasional calcification**. The presence of **satellite nodules** favored benign etiology, particularly granulomatous infections, and helped distinguish them from malignant lesions.

Limitations:
A relatively small sample size and limited representation of benign lesions were constraints. Advanced imaging like PET-CT or perfusion CT was not included.

CONCLUSIONS

CT is a reliable and indispensable imaging modality for characterizing lung lesions and differentiating benign from malignant causes. In this study of 72 patients, **adenocarcinoma** commonly appeared as a **peripheral, spiculated, heterogeneously enhancing mass**, while **squamous cell carcinoma** was **central, often cavitating, and associated with bronchial obstruction**. CT–histopathological correlation showed strong agreement, confirming that CT morphology can suggest the probable histologic subtype and guide further diagnostic and therapeutic steps. CT thus remains a cornerstone in the evaluation and management of lung carcinoma.

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