Section: Radiodiagnosis

Original Research Article

COMPUTED TOMOGRAPHY IN EVALUATION OF SUSPECTED NEOPLASTIC LUNG LESIONS AND IT'S CORRELATION WITH HISTOPATHOLOGICAL FINDINGS

Received : 19/03/2025
Received in revised form : 08/05/2025
Accepted : 31/05/2025

Keywords:
Lung cancer, NSCLC, FNAC, Biopsy, CT imaging.

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DOI: 10.47009/jamp.2025.7.3.110

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (3); 575-579

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ABSTRACT

Background: Lung cancer is the second most commonly diagnosed cancer that continues to be the most common cause of cancer-related mortality in developing nations like India. Non-small cell lung cancers (NSCLC) are the most common type of lung cancers. Obtaining a biopsy might not always be feasible in NSCLC, therefore, a different approach was required to correctly diagnose lung cancer, especially in cases when histological exams are not feasible. **Objective:** The present study is being done to find out the accuracy, diagnostic efficacy of CT in lung masses and the complications of CT guided FNAC of chest lesion. **Materials and Methods:** A total of 50 patients who were presented with respiratory complaints and are found to have suspected neoplastic lesions on CT chest and then also underwent an image guided FNAC/Biopsy were included in the study. CT scan was done on 128 multidetector CT Ingenuity (Philips Medical Systems). Image guided FNAC/Biopsy was performed in all the patients. CT findings and histological findings were analyzed and compared. **Results:** The mean age of the patients was 61.50 ± 9.261 years with majority of males (82%). Radiological diagnosis of tumor indicated malignant findings in 84% cases and benign findings in 16% cases. CT guided FNAC indicate malignant findings in 82% cases and benign findings in 12% cases while findings were inconclusive in 6% cases. CT imaging demonstrated a sensitivity of 95.12% and a specificity of 62.5%. The positive predictive value (PPV) was 92.86%, while the negative predictive value (NPV) was 71.43%. The overall diagnostic accuracy of CT imaging was calculated to be 93.62%. **Conclusion:** When it comes to properly diagnosing lung nodules, CT is a highly sensitive and moderately specific diagnostic modality with a high positive predictive value. CT offers information on disease stage in addition to morphological assessment. Correct clinical and radiological correlation can help avoid the diagnosis errors.

INTRODUCTION

According to GLOBOCAN 2020 report, 19.3 million new cancer cases were reported and almost 10.0 million cancer deaths occurred in 2020.[1] Lung cancer is the second most commonly diagnosed cancer, with an estimated 11.4% new cases. With an expected 1.8 million fatalities (18%), lung cancer continues to be the most common cause of cancer-related mortality Developing nations are likely to see a higher increase in cancer cases—64–95%—than developed ones—32–56%.[2,3] The majority of symptomatic lung cancer patients experience hemoptysis, coughing, dyspnea, chest discomfort, and recurring infections.[2,4]

Lung cancers are broadly classified into two types: Small cell lung cancers (SCLC) Non-small cell lung cancers (NSCLC).[5] NSCLC is the most common type of lung cancers and accounts for about 80% of all lung cancers. NSCLC can be divided into three main types: adenocarcinomas, squamous cell carcinomas and large cell carcinomas. Up to 50% of NSCLC is made up of adenocarcinomas, which develop in the outside, or peripheral, regions of lung. Bronchioloalveolar carcinoma is a subtype of it that often arises at many locations in the lungs and spreads along the alveolar walls. Adenocarcinomas can occasionally develop around scar tissue and are linked to asbestos exposure. About 30–40% of initial lung tumors are squamous cell carcinomas, sometimes referred to as epidermoid carcinomas. This kind of cancer typically develops in the core regions around the main bronchi in a pseudoductal or stratified configuration. With individual cell keratinization, the cells create an epithelial pearl. The tumor cells in large cell carcinomas are large and lack any other distinguishing morphological characteristics. They are the least prevalent kind of NSCLC and are occasionally referred to as undifferentiated carcinomas.[5]

The initial test in the workup of a suspected case of lung cancer is a chest x-ray (CXR). Because of its ubiquitous availability, technological viability, minimal risk, and inexpensive price it has been widely used in the past.[2] Compared to chest radiography or standard CT scanning, multi detector computed tomography (MDCT), commonly referred to as multi-detector CT, frequently yields additional information. When comparing CT to traditional radiography as an imaging modality, there are clear benefits in terms of lung architecture and disease depiction. The CT cross-sectional format makes it possible to visually inspect the lung without being hindered by features like the heart, pulmonary arteries, or the chest wall. Its advantages include excellent contrast resolution and limitless picture manipulation capabilities.[6]

Martin and Ellis were the first to employ FNAC as a diagnostic tool. The diagnostic lung puncture method was first used in Leyden in 1883 and Menbriel in 1986 to diagnose infections and malignancies.[7] Because FNAC of pulmonary mass has improved the diagnostic value of clinical cytology in the detection of lung and mediastinal cancer, it has acquired pace and acceptability on a global scale. The non-surgical confirmation of primary and metastatic thoracic lesions is accomplished by the use of FNAC (8). One unique benefit of FNAC is its ability to identify certain tumor forms, such as small cell carcinoma and lymphomas, which are better treated with chemotherapy than surgery.[9,10] A sensitive and reliable method of detecting thoracic cancer is CT guided FNAC. When compared to a biopsy for the detection of a lung mass, this non-operative approach causes roughly half the pain.[8]

Numerous positive cases cannot be verified for a number of reasons. A few of these variables are the tumor minuscule size, the challenge of locating it, the presence of critically sick patients, and the patient reluctance to have invasive treatments like FNAC or biopsy. As such, a large number of positive cases remain unverified. Obtaining a biopsy might not always be feasible, particularly when the tumor is quite tiny or located in a difficult-to-reach area. Therefore, a different approach was required to correctly diagnose lung cancer, especially in cases when histological exams are not feasible. A high-resolution computed tomography (HRCT) chest CT scan can be used to detect the presence of such a malignant tumor. The present study is being done to find out the accuracy, diagnostic efficacy of CT in lung masses and the complications of CT guided FNAC of chest lesion.

MATERIALS AND METHODS

Study design: A total of 50 patients who were presented with respiratory complaints and are found to have suspected neoplastic lesions on CT chest and then also underwent an image guided FNAC/Biopsy were included in the study. A detailed history was elicited from all patients, relevant past and personal history was also record as per proforma attached. Thorough General Examination and Systemic Examination was carried out in every case. Basic lab investigations like Hb, TLC, DLC, sputum examination, pleural aspirate cytology was recorded in all cases. Chest x-ray (PA) view was taken for all cases supplemented by special views when found necessary. Ultrasound was done wherever indicated.

Technique of CT examination: CT scan was done on 128 multidetector CT Ingenuity (Philips Medical Systems). A topogram was taken after keeping proper position of the patient. Then, based on the results of the topogram and chest x-ray, a few NCCT slices were obtained in the region of interest. After administering 80ml of nonionic contrast (Iohexol, 300 mg% Iodine) as a single bolus through an intravenous line, slices were obtained using Pitch 0.765, Collimation 0.625, and 5mm thickness increments at 120 KV and 200 MAS. The CECT region covered was then from the lung apex to the diaphragm dome. The axial images that were reconstructed were examined in depth. For permanent record the relevant images of each case were recorded. The images were viewed with multiple windows setting primarily the lung window, bone window and mediastinal window, so as not to miss associated mediastinal, chest wall and other body lesions.

FNAC/Biopsy: Image guided FNAC/Biopsy was performed in all the patients. The site of the lesion is determined, the shortest/safest route is chosen passage of needle avoiding vascular structures, tissues and bullae. Whenever vertical approach is not possible a non-vertical approach is taken. The lesion was located on the scan taken through the lesion at normal end expiration for the image-guided FNAC/biopsy. The point was then found on the skin once the precise entrance location was selected from the image. A 22-gauge LP needle was inserted following the cleaning of the needle entrance site with povidone iodine solution and the anesthesia of the subcutaneous tissue with a 2% xylocaine solution. The material was aspirated from the lung nodule or opacity by the LP needle once the imaging confirmed that the needle tip location was appropriate. The sample was acquired by producing suction and repeatedly puncturing the lesion with a series of quick up-and-down and rotator actions. 17G coaxial biopsy needle was placed within the lesion and confirmed on imaging. Using 18G Biopsy disposable core 3 biopsy punch was taken. The syringe needle combination was immediately handed to the cytologist who then ejected the aspirated material onto the glass slides.

Statistical Analysis: Statistical analysis of data was done using SPSS software. Mean and SD was calculated for quantitative variables whereas qualitative variables was analyzed using the number and percentage. Chi-square test was used to analyze association between two qualitative variables whereas Pearson's correlation was used for quantitative variables. Unpaired t-test was used to compare two groups by taking the p value<0.05 as statistically significant.

RESULTS

The mean age of the patients was 61.50 ± 9.261 years. Most of the patients belong to the age group of 61-70 years (36%) while least number of cases was observed in age group of >70 years (18%). A high male dominance was observed with male accounting for 82% while female accounting for 18% of study population. Smoking history was present in the 60% of patients while rest of the 40% patients lack the history of smoking [Table 1].

Table 1: Sociodemographic determinants of the enrolled patients

Variable	Domain	Number	Percentage
Mean age		61.50 ± 9.261	
Age group	<=50 Years	11	22.0
	51-60 Years	12	24.0
	61-70 Years	18	36.0
	>70 Years	9	18.0
Gender	Male	41	82.0
	Female	9	18.0
Smoking history		30	60.0

Mediastinal involvement was observed in 50% patients while rest of 50% patient lack mediastinal involvement. Attenuation / occlusion of bronchus was observed in 44% patients while rest of 56% patient lack attenuation / occlusion of bronchus. Vascular encasement was observed in 22% patients while rest of 78% patient lack vascular encasement. Extra pleural findings indicated pleural deposits in 10% of cases and pleural tags in 6% of cases. Edge/margins of the tumor were lobulated in 64% patients, irregular in 22% patients and was smooth in 14% patients. Enhancement was heterogenous in 64% cases while in rest of 36% cases, the enhancement was homogenous. Radiological diagnosis of tumor indicated malignant findings in 84% cases and benign findings in 16% cases. [Table 2]

Table 2: MDCT findings

Variable	Domain	Number	Percentage
Mediastinal involvement		25	50.0
Attenuation / occlusion of bronchus		22	44.0
Vascular encasement		11	22.0
Extra pleural findings	Pleural deposits	5	10.0
	Pleural tags	3	6.0
Edge/margins	Lobulated	32	64.0
	Irregular	11	22.0
	Smooth	7	14.0
Enhancement	Heterogenous	32	64.0
	Homogenous	18	36.0
Radiological diagnosis of tumor	Malignant	42	84.0
	Benign	8	16.0

CT guided FNAC indicate malignant findings in 82% cases and benign findings in 12% cases while findings were inconclusive in 6% cases. CT guided FNAC indicate squamous cell carcinoma in 30.0% cases, adenocarcinoma in 20.0% cases, small cell carcinoma in 16.0% cases, benign in 12.0% cases, metastasis in 12.0% cases, inconclusive in 6.0% cases, and poorly differentiated carcinoma in 4.0% cases. Pneumothorax complication was observed in 6% cases. Hemorrhage complication was observed in 4% cases. [Table 3]

Table 3: CT guided FNAC findings

Variable	Domain	Number	Percentage
CT guided FNAC	Malignant	41	82.0
	Benign	6	12.0
	Inconclusive	3	6.0
Tumor type	Squamous cell carcinoma	15	30.0
	Adenocarcinoma	10	20.0

ISSN (O): 2687-5365; ISSN (P): 2753-6556

	Small cell carcinoma	8	16.0
	Benign	6	12.0
	Metastasis	6	12.0
	Inconclusive	3	6.0
	Poorly differentiated carcinoma	2	4.0
Complications	Pneumothorax	3	6.0
	Hemorrhage	2	4.0

The diagnostic performance of CT in predicting neoplastic lung lesions was evaluated against the gold standard FNAC/biopsy findings. CT imaging demonstrated a sensitivity of 95.12% and a specificity of 62.5%. The positive predictive value (PPV) was 92.86%, while the negative predictive value (NPV) was 71.43%. The overall diagnostic accuracy of CT imaging was calculated to be 93.62%. [Table 4]

Table 4: Accuracy of CT as compared to the FNAC

Statistic	Value
Sensitivity	95.12%
Specificity	62.5%
Positive Predictive Value	92.86%
Negative Predictive Value	71.43%
Accuracy	93.62%

DISCUSSION

In the current situation, MDCT created a new avenue for the non-invasive assessment of intrathoracic masses.[11] Patients frequently have guided biopsies or other tests performed, which postpones the disease early identification and treatment. In order to prevent needless inquiries into benign lesions and to save time for more questionable lesions, it is imperative that these lesions be characterized based on CT results.[12] Therefore, present study was conducted to characterise suspected neoplastic lung lesions on basis of CT findings and to do comparative evaluation of radiological and cytological findings after performing image guided FNAC/biopsy.

In our study, radiological diagnosis of tumor indicated malignant findings in 84% cases and benign findings in 16% cases. CT guided FNAC indicate malignant findings in 82% cases and benign findings in 12% cases while findings were inconclusive in 6% cases. CT guided FNAC indicate squamous cell carcinoma in 30.0% cases, adenocarcinoma in 20.0% cases, small cell carcinoma in 16.0% cases, benign in 12.0% cases, metastasis in 12.0% cases, inconclusive in 6.0% cases, and poorly differentiated carcinoma in 4.0% cases. Similar to the current study, the Gharraf et al. investigation found that SCC was the most prevalent subtype, with ADC coming in second at 45% and 32%, respectively (13). SCC accounted for the greatest number of cases in the Narayanaswamy et al. research, with 28 cases (46.7%), followed by adenocarcinoma (33.3%), and large cell carcinoma (3.33%) (14). According to Vinay and Sowmya study, squamous cell carcinoma affected 66% of patients, adenocarcinoma affected 28%, small cell carcinoma affected 2%, and undifferentiated large cell carcinoma affected 4% of patients.[15] In Adenocarcinoma (41%) was the most frequent histological finding of lung nodule examination in the research by Gupta et al., followed by other types of cancer.[11] Twenty (42.55%) and 27 (57.3%) of the patients in the Lal et al. investigation were found to have benign and malignant lesions, respectively.[12] Adenocarcinoma was identified in 21 patients (42%), according to Mishra study. Eleven patients (22%) had small cells. BAC in 10 patients (20%). Eight individuals (16%) were identified as having squamous cells.[16] Squamous cell carcinoma was the most prevalent histological type in the Yadav et al. research, occurring in 16 (53.3%) of the patients, followed by adenocarcinoma in 8 (26.7%), small cell carcinoma in 3 (10%), and large cell carcinoma in 1 (3.3%).[17]

In our study, the diagnostic performance of CT in predicting neoplastic lung lesions was evaluated against the gold standard FNAC/biopsy findings. CT imaging demonstrated a sensitivity of 95.12% and a specificity of 62.5%. The positive predictive value (PPV) was 92.86%, while the negative predictive value (NPV) was 71.43%. The overall diagnostic accuracy of CT imaging was calculated to be 93.62%. Two cases in the Narayanaswamy et al. research that were first identified as malignant on CECT ended out being abscesses. CECT has a 95.5% positive predictive value and a 100% sensitivity in identifying malignant lesions.[18] Based on MDCT examination, 100% of the patients in Vinay and Sowmya research were suspected of having bronchogenic carcinoma, and histological evaluation verified the diagnosis in all 100% of the patients. As a result, MDCT has a 100% sensitivity and positive predictive value in assessing bronchogenic carcinoma, demonstrating its effectiveness.[15] The Gupta et al. study found that CT had a high positive predictive value (96%) and was a highly sensitive (95.45%) and moderately specific (75%).[11] Of the 50 patients in the Kumar et al. research, 44 had a CT scan that identified them as having bronchogenic carcinoma, which was verified by a cytological analysis, yielding a true positive result. Two patients had a CT diagnosis of bronchogenic malignancy; however, the cytological study could not corroborate the diagnosis (false positive). CT has a 96% sensitivity in diagnosing bronchogenic malignancies. Accuracy was 96%, PPV was 92%, and specificity was 86%.[19] In 28 patients (93.3%) in the research by Yadav et al., the final histopathological/cytological diagnosis and the preliminary diagnostic of bronchogenic carcinoma on MDCT were shown to be completely correlated. As a result, there were 28 genuine positive results and 2 false positive cases. True negative and false negative diagnoses were not made for any patient. Because of the limited sample size, the CT sensitivity for bronchogenic cancer was high and was 100%. When it came to assessing bronchogenic carcinoma, CT showed a high predictive value of 93.3% and an accuracy of 93.3%.[17]

The major limitation of the present study was the small sample size due to which the results of present study could not be generalized and require validation with further study with ample sample size. Present study was a single centric study and thus represent limited geographic distribution of patients. A multicentric study could be helpful in eliminating the bias that may be originated due to the sociodemographic variations.

CONCLUSION

When it comes to properly diagnosing lung nodules, CT is a highly sensitive and moderately specific diagnostic modality with a high positive predictive value. CT offers information on disease stage in addition to morphological assessment. Lung nodule FNAC guided by CT is a minimally invasive, safe tool that has a good diagnostic accuracy. In cases with hilar and mediastinal nodules, the use of CT-guided FNAC can save needless exploratory surgery for staging and also result in a less expensive diagnosis. Based on histology, it offers precise subclassification of different lung nodules and relatively early detection. This approach may also be used to definitively detect benign lesions such as pneumonitis, lung cysts, and TB. Correct clinical and radiological correlation can help avoid the diagnosis errors.

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