Section: Pathology

Original Research Article

# DIAGNOSTIC EFFICACY OF CT GUIDED LUNG BIOPSY- AN EXPERIENCE AT A TERTIARY CARE HOSPITAL

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ABSTRACT

**Background:** Lung lesions can range from infectious to neoplastic, making diagnosis difficult at times for patient care. Therefore, a precise diagnosis is crucial for receiving the right care. An important part of diagnosing these patients is the use of FNAC and biopsies. Lung biopsy is now required even for molecular analysis, in addition to making a diagnosis of the histologic subtypes of lung cancer with immunohistochemistry for therapeutic purposes. **AIM**: To determine the experience at a tertiary care hospital in the use of Computed Tomography (CT) guided transthoracic lung biopsies in the diagnosis of various lung diseases.

**Materials and Methods:** This 3.5-year hospital-based descriptive study was conducted in the pathology department of the Sheri Kashmir Institute of Medical Sciences in Soura, Srinagar. It lasted from January 2021 to June 2024. A total of 136 CT-guided biopsies were carried out. Data analysis and histopathologic analysis were done.

**Results:** 3.7:1 male-to-female ratio. Patients ranged in age from 25 to 83 years old, with the majority of instances occurring in the fifth and sixth decades of life. 105 (77%) were neoplastic, compared to 21 (15.6 %) who were not, and 10 (7.4%) who had unclear results. The most common malignancy of the lung was squamous cell carcinoma, constituting 38.2%. The 4 benign neoplasms diagnosed in our study included two cases of solitary fibrous tumor. In non-neoplastic cases, granulomatous inflammation was the most common diagnosis, accounting for 6% of cases, followed by nonspecific inflammation in 5% of cases.

**Conclusion:** CT-guided lung biopsy is reliable with high accuracy for diagnosis and subtyping of lung tumors. Histopathological examination is pivotal in making an accurate diagnosis of various lung lesions. Although the Hematoxylin and eosin (H&E) stain is the gold standard used for diagnosis. For targeted chemotherapeutic options, Immunohistochemistry (IHC) has an important complementary role in the classification of Non-small cell Lung Cancer (NSCLC).

**Keywords:** Computed Tomography, Lung cancer, Percutaneous transthoracic needle biopsy.

## INTRODUCTION

The most prevalent and dangerous health issue in the world is lung cancer. Since 1985, lung cancer has been the cancer that is most frequently diagnosed and fatal worldwide. Lung cancer is the leading cause of cancer-related mortality, accounting for 28% of all

cancer-related deaths, with 2.5 million new cases and 1.8 million deaths per year worldwide. It is the cause of 5.9% of cancer cases and 8.1% of cancer-related deaths in India. Lung cancer is the top cancer in Kashmir, accounting for 10.6% of all cancer cases and ranking first among the top 10 malignancies 1, With the development of diffusion spiral Computed Tomography (CT) and Positron Emission Tomography (PET) scans, there has been a substantial increase in the detection of lung lesions. The correct diagnosis of neoplastic lesions and nonneoplastic diseases, such as infectious pathology, remains challenging for patient care. Small cell and squamous cell carcinomas (SCC) exhibit a strong correlation with smoking. Occupational exposures and air pollution cause 2% to 9% of lung malignancies, respectively. Approximately 85% of lung cancer patients present with symptoms. Lung cancer is identified in the remaining patients through histological analysis and radiography. The locoregional growth of the tumor, lymphatic invasion, haematogenous distant metastatic spread, distant para-neoplastic effects from tumour products, or immunological cross-reaction with tumor antigens all contribute to the clinical characteristics of carcinoma lung.[5,6] The most frequent and initial lung sample taken when a radiologic anomaly is found and a tissue diagnosis is required is a small lung biopsy.[7] Lung biopsy can be obtained by Endobronchial biopsy, Video-assisted thoracoscopic biopsy, and Transthoracic CT-guided biopsy.[8] It has been established that core needle biopsies and CT-guided Fine needle aspiration (FNA) are both useful for diagnosing peripheral lung lesions, including both benign and malignant lesions. In comparison to CT-guided FNA, CT-guided biopsy may provide more tissue for molecular and/or immunohistochemical analysis. When compared to FNACs, image-guided biopsies are less prone to false-negative or false-positive diagnoses.[9] The histological diagnosis of thoracic masses can be made with a high degree of accuracy using CT-guided percutaneous transthoracic needle biopsies. Percutaneous transthoracic biopsy also lessens the need for more invasive surgical treatments and has an acceptably low complication rate.[10]

**Aim:** To determine the experience at a tertiary care hospital in the use of CT-guided transthoracic lung biopsies in the diagnosis of various lung diseases.

## MATERIALS AND METHODS

This study was carried out retrospectively over a 3.5-year period, from January 2021 to June 2024, at the Department of Pathology, Sheri- Kashmir Institute of Medical Sciences, Soura, Srinagar. All CT-guided core needle lung biopsies that were obtained by the Department of Pathology's histopathology division were included in the study material. The samples underwent conventional tissue processing, 10% formalin fixation, Hematoxylin and eosin (H&E) staining, and slide preparation. From the records, data such as age, sex, core size, and histological diagnosis were gathered. Additionally, the radiological results and clinical history were collected.

## RESULTS

During the study period, a total of 1812 cases of Lung cancer were registered at SKIMS hospital. Out of 1812 cases, 136 core biopsies were received at our department.

Among 136 cases, 107 (79%) were males and 29 (21%) were females with a male-to-female ratio of 3.7:1. Age of the patients ranged from 25- 83years, with the majority of cases falling in the 5th and 6th decades of life. On contrast-enhanced computed tomography (CECT), the size of the lesions ranged from 9mm to 8cm, and the lesions were mostly located in the right lobe in 89(66%) cases. Radiologically, in 88(65%) cases, the lesions were solid and 116(86%) cases were malignant (figure 1). The size of the cores ranged from 0.5 to 1.5cm. Out of 136 biopsies received, 105 (77%) were neoplastic, 21(15.6%) were non-neoplastic, and 10 (7.4%) were inconclusive. Among the neoplastic lesions, 105 (96%) were malignant and 4 (4%) were benign. Histological diagnosis patterns and percentage of benign and malignant diagnoses are tabulated in Tables 1 and 2. The most common malignancy of the lung was squamous cell carcinoma with 52 (38.2%) (figure 2) cases, followed by adenocarcinoma with 25 (18.3%) cases (figure 2), and small cell carcinoma with 12 (8.8%) cases, and 8 (5.9%) cases of metastatic carcinoma were diagnosed. Among the metastatic cases, two cases were metastatic from clear cell renal carcinoma (Figure 3), and 2 cases of squamous cell carcinoma from the esophagus (Table 3). Immunohistochemistry (IHC) was done in fifteen cases of primary carcinomas and all cases of metastatic carcinomas. All malignancies were predominant in male patients. The inflammatory cases were distributed in the study as given in Table 4. The diagnostic accuracy, sensitivity, and specificity are given in Table 5.

**Table 1: Distribution of histological diagnosis of lung lesions**

| Histological diagnosis | Number of cases n (%) |
|---|---|
| SCC | 52 (38.2%) |
| Adenocarcinoma | 25 (18.3%) |
| Small cell carcinoma | 12 (8.8%) |
| Large cell neuroendocrine tumor | 7 (5.1%) |

| | |
|---|---|
| Metastasis | 8 (5.9%) |
| Adenoid cystic carcinoma | 1 (0.7%) |
| Neoplastic benign | 4 (3%) |
| Inflammatory and infective | 17 (12.6%) |
| Non -diagnostic | 10 (7.4%) |
| Total | 136 |

**Table 2: Distribution of frequency of benign lung lesions**

| Histological diagnosis | Number of cases n (%) |
|---|---|
| Solitary fibrous tumor | 2 (50%) |
| Carcinoid | 1 (25%) |
| Hemartoma | 1(25%) |
| Total | 4 (100%) |

**Table 3: Distribution of frequency of specific diagnoses of metastatic lung lesions**

| Specific diagnosis of metastatic lesions | Number of cases n (%) |
|---|---|
| Clear cell RCC | 2(29%) |
| Carcinoma esophagus | 2(29%) |
| Carcinoma cervix | 1(14%) |
| Ewing sarcoma | 1(14%) |
| Cholangiocarcinoma | 1(14%) |
| Invasive mammary carcinoma | 1(14%) |
| Total | 8(100%) |

**Table 4: Distribution of frequency of inflammatory and infective lesions of the lung**

| Nature of disease | Number of cases n (%) |
|---|---|
| Granulomatous | 8 (47%) |
| Inflammatory and vasculitides | 7(41%) |
| Others | 2(12%) |
| Total | 17(100%) |

**Table 5: Diagnostic efficacy of CT-guided lung biopsies and comparison with other studies**

| Study | No of cases | Diagnostic accuracy | Sensitivity | Specificity |
|---|---|---|---|---|
| Present study | 136 | 92 | 91.7 | 94.7 |
| B Christina, 2022,[11] | 183 | 82 | | |
| Gaurav V 2019,[22] | 166 | 93 | 91 | 100 |
| Gupta et al, 2018 (India),[23] | 50 | 84 | | |
| David M et al. 2015 (World),[24] | Meta analysis | 88.7 | 91 | 97 |
| Stanly EK et al, 2013 (UK),[25] | 349 | 96.8 | 95 | 100 |

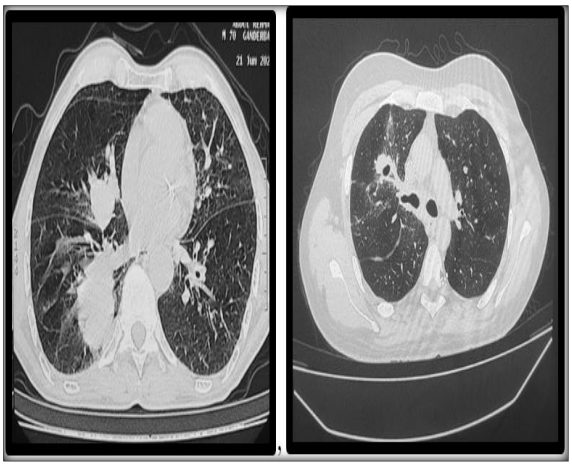

**Figure 1 -a) Axial slice of CT thorax showing two mass lesions in the right lower and middle lobe – adenocarcinoma; b) Axial section of CT thorax showing a mass lesion in right middle lobe with central area of cavitation- squamous cell carcinoma.**

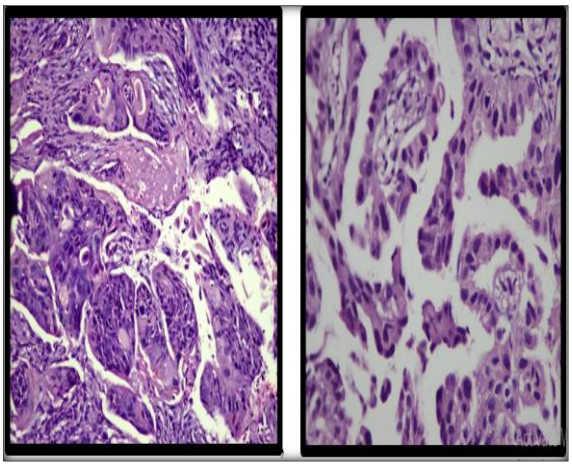

**Figure 2– a) Microphotograph revealing tumor cells in nests with individual cell keratenisation- SCC (HPE-20x); b) Microphotograph revealing tumor cells arranged in glands -Adenocarcinoma (HPE-40x)**

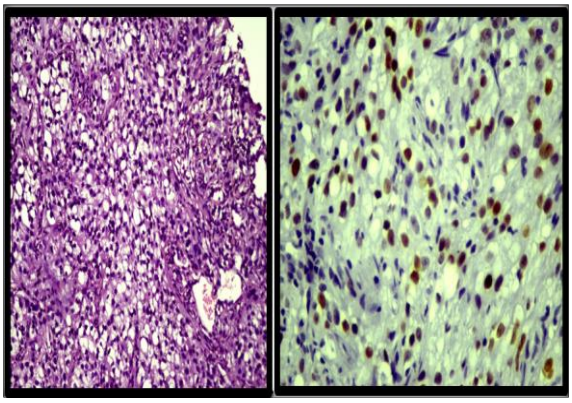

**Figure 3– a) Microphotograph revealing lung tissue replaced by sheets of tumor cells with clearing of cytoplasm (HPE-40x). b) Tumor cells are positive for Pax 8; RCC metastasis (IHC-Pax 8).**

## DISCUSSION

A significant technique for the diagnosis and treatment of numerous pathological lesions is acknowledged as being lung biopsy. When the diagnosis cannot be made using non-invasive approaches and the diagnosis would change the stage of the disease or affect the therapeutic approach, tissue sampling is advised. For the majority of patients who present with lung masses, a preoperative biopsy of the lesion is necessary to make the therapeutic decision.[11] Excisional biopsy, bronchoscopy-guided biopsy, and CT-guided biopsy are all options for doing a lung biopsy. The diagnosis of benign and malignant lesions can be made using a CT-guided percutaneous needle biopsy of the lung, which is frequently performed as an outpatient diagnostic procedure.[8,11] It is also an effective way to obtain tissue samples of sufficient quantity and quality to enable molecular analysis of biomarkers. Additionally, image-guided methods enable biopsy from representative viable tumor sites while avoiding necrotic regions. Tru-cut biopsy is less invasive than an excisional biopsy and particularly beneficial in early diagnosis.[11,12] There is a lot of research being done to improve lung cancer treatment outcomes. Lung cancer continues to be the most common cancer-related killer worldwide, and despite newer methods of diagnosis and treatment, it is becoming more common in India.[2] Accurate diagnosis, using a mix of clinical, radiographic, and histological data, is essential for maximizing outcomes in the management of lung tumors.

136 CT-guided lung samples were examined for the current study. Among 136 cases, 107 (79%) were males and 29 (21%) were females, with a male-to-female ratio of 3.7:1. Agarwal JP et al. and Dhandapani S et al. both observed similar features and male-to-female ratios of 3.5:1 and 3.9:1 in their research, respectively.[13,14] Patients in our study ranged in age from 25 to 83, with the majority of instances occurring in the fifth and sixth decades of life. This was analogous to research done by Shah HS et al and Rai U et al. We found 17 non-neoplastic lesions, the most frequent of which were granulomatous with 8 (47%), followed by inflammatory and vasculitis 7(41%), and other lesions 2(12%). Our findings were equivalent to those of B. Garima et al.[17]

The most prevalent subtype of lung cancer, adenocarcinoma, has changed the pattern of the disease globally. Lung cancer was ranked as the second or third most prevalent cancer in men in earlier hospital-based studies done in this area, with 80% to 85% of cases being non-small cell lung cancer.[2,18] In our investigation, squamous cell carcinoma (38.2%), adenocarcinoma (18.3%), and small cell carcinoma (8.8%) were the three most frequent diagnoses out of 105 malignant neoplastic lesions. Squamous cell carcinoma was identified as the most prevalent malignant lesion in investigations undertaken in India by Gupta R et al., Mir et al., and Sarfaraz S et al.[19,20,21] An earlier five-year study from our hospital on the profile of lung cancer had 321 patients with lung cancer, of whom 55 cases (17.1%) were of the small cell type, and the rest were NSCLC (n = 266; 82.9%), with the majority being squamous cell lung cancers (n = 248; 93.2%), and adenocarcinomas constituted 6.4%. In our study, we found 8 cases (5.9%) of metastatic carcinoma to the lung; in studies conducted by Agarwal A et al and Sarfaraz S et al, the diagnosis of metastatic carcinoma was made in 6.4% and 6.25% respectively.[13,21]

## CONCLUSION

CT-guided lung biopsy is reliable with high accuracy for diagnosis and subtyping of lung tumors. Histopathological examination is pivotal in making an accurate diagnosis of various lung lesions. Although the H&E stain is the gold standard used for diagnosis. For targeted chemotherapeutic options, IHC has an important complementary role in the classification of Non-Small Cell Lung Cancer.

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