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Diagnostic Yield and Outcome of CT Guided Biopsy in a Trans-Thoracic Lung Biopsy in a Teritiary Care Hospital-Record Based Study

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ABSTRACT
Computed tomography (CT)-guided trans thoracic biopsy is a pivotal diagnostic procedure for thoracic diseases, especially lung malignancies. The procedure's minimally invasive nature and precision in targeting lung lesions make it a preferred method for obtaining tissue samples for histopathological examination. This study evaluates the diagnostic yield of CT-guided trans thoracic biopsy in a tertiary care setting, focusing on lung malignancies. This retrospective study was conducted in the Department of Respiratory Medicine at Sree Mookambika Institute of Medical Sciences (SMIMS), Kulasekharam, covering cases from January 2020 to March 2023. Patients who underwent CT-guided trans thoracic biopsy during this period were included. Data were collected from medical records, focusing on demographics, procedure details, histopathological outcomes and post-procedure complications. Descriptive statistics were utilized to analyze the data. The study included 47 patients aged 24-80 years, with a mean age of 59.45 years. Females constituted 55.3% of the cohort. Common symptoms were chest pain (36.2%), cough (29.8%) and breathing difficulty (21.3%), with 12.7% asymptomatic. The procedure was successful on the first attempt in 48.9% of cases. Histopathological examination revealed malignant lesions in 68.1% of cases, benign lesions in 14.9% and other lesions in 17%. The most frequent malignancies were adenocarcinoma and squamous cell carcinoma. Complications were minimal, with chest pain (25.5%) being the most common, followed by cough (6.4%), pneumothorax (4.3%), pulmonary alveolar hemorrhage (4.3%) and hemoptysis (2.1%). No complications occurred in 57.4% of patients. CT-guided trans thoracic biopsy is an effective and safe method for diagnosing lung malignancies, with a high diagnostic yield and manageable complication rates. The study supports its use as a critical diagnostic tool in pulmonary medicine. Further prospective studies with larger sample sizes are recommended to validate these findings.

INTRODUCTION

Computed tomography (CT)-guided trans thoracic biopsy has become an invaluable tool in the diagnosis of thoracic diseases, particularly lung malignancies. This minimally invasive procedure involves using CT imaging to guide the insertion of a needle into the thoracic cavity to obtain tissue samples for histopathological examination. Since its introduction, CT-guided trans thoracic biopsy has significantly advanced the field of pulmonary medicine by enabling precise localization and sampling of lung lesions, which can be challenging to reach with conventional biopsy methods[1,2].

The advent of CT technology has revolutionized the approach to diagnosing lung diseases. The detailed imaging provided by CT allows for accurate targeting of even small or difficult-to-reach lesions, which is particularly crucial in the early detection and characterization of lung cancer[3]. Lung cancer remains one of the leading causes of cancer-related mortality worldwide and early diagnosis is key to improving survival rates. CT-guided biopsy not only facilitates early detection but also aids in the characterization of the lesion, guiding subsequent therapeutic decisions[4,5].

Lung cancer is a major global health issue, with millions of new cases diagnosed each year. According to the World Health Organization (WHO), lung cancer is the most common cancer worldwide, both in terms of incidence and mortality[6]. In 2020, there were an estimated 2.2 million new cases and 1.8 million deaths attributed to lung cancer globally. The high mortality rate associated with lung cancer is largely due to its tendency to be diagnosed at advanced stages, where treatment options are limited and prognosis is poor[7,8]. In many regions, lung cancer is predominantly caused by smoking, which accounts for approximately 85% of cases. However, other risk factors, such as exposure to radon gas, air pollution occupational carcinogens (e.g., asbestos) and, also contribute to its incidence. Despite advances in imaging and screening techniques, many lung cancers are still diagnosed at a late stage due to the lack of specific symptoms in the early stages of the disease[9,10].

The ability to accurately diagnose lung malignancies is of paramount importance given the high burden of lung cancer on global health. CT-guided trans thoracic biopsy plays a critical role in this diagnostic process[11]. The procedure is particularly significant for patients with peripheral lung lesions, where traditional bronchoscopy may not reach. Additionally, it is valuable for diagnosing lesions in patients who are not suitable candidates for surgical biopsy due to comorbidities or other risk factors[12].

The diagnostic yield of CT-guided trans thoracic biopsy, defined as the proportion of procedures that result in a definitive pathological diagnosis, is a key measure of its effectiveness[13]. High diagnostic yield is essential to ensure that patients receive appropriate and timely treatment. Furthermore, the ability to determine the specific histological type of lung cancer through biopsy can influence treatment decisions, including the use of targeted therapies and immunotherapies, which are tailored to specific cancer subtypes[14].

The rationale for conducting a retrospective study on the experience of CT-guided trans thoracic biopsy in a tertiary care hospital stems from the need to evaluate and improve diagnostic techniques for lung malignancies. Retrospective studies provide valuable insights into the real-world performance of medical procedures, capturing a broad spectrum of cases and outcomes that may not be represented in controlled clinical trials.

This study aims to evaluate the diagnostic yield of CT-guided trans thoracic biopsy for lung malignancies in a tertiary care setting, where a diverse patient population with varying disease stages and comorbidities is managed. By analyzing past cases, we can identify factors that influence the success and accuracy of the procedure, such as lesion size, location, and patient characteristics. This information is crucial for refining biopsy techniques, improving patient selection criteria, and ultimately enhancing diagnostic accuracy.

MATERIALS AND METHODS

This study is a record-based retrospective study designed to evaluate the diagnostic yield of CT-guided transthoracic biopsy in diagnosing lung malignancies. The study was conducted in the Department of Respiratory Medicine at Sree Mookambika Institute Of Medical Sciences (SMIMS), Kulasekharam. The study covers a period of three years, from January 2020 to March 2023. All cases who underwent CT-guided transthoracic biopsy at SMIMS between January 2020 and March 2023 were included.

Inclusion Criteria: Are Patients who underwent CT-guided transthoracic biopsy between January 2020 and March 2023.

Exclusion Criteria: Is Cases with missing or incomplete data. Convenient sampling was used to include all consecutive cases of CT-guided transthoracic biopsy performed between January 2020 and March 2023. After obtaining approval from the Institutional Human Ethics Committee (IHEC) and Institutional Review Committee (IRC), consent was obtained from the head of the institution to access medical records. The data was collected from patient records that met the inclusion criteria.

Approval and Consent: Approval for the research proposal was obtained from IHEC and IRC. Consent was

then obtained from the head of the institution to access patient medical records.

Data Collection Period: Data collection covered the period from January 2020 to March 2023. Collected data were entered into Microsoft Office Excel 2019 and analyzed using SPSS version 20.0.

The Study Focused on the Following Parameters: **Demographic Data:** Age, gender and presenting clinical symptoms.

Procedure Details: Number of attempts, sites of lesions and histopathological examination results. Complications are Post-procedure complications such as chest pain, cough, pneumothorax, pulmonary alveolar hemorrhage, and hemoptysis.

Descriptive statistics were used to summarize the data. Frequencies and percentages were calculated for categorical variables and means with standard deviations were calculated for continuous variables. All analyses were conducted using SPSS version 20.0.

RESULTS AND DISCUSSIONS

The ages of the patients included in the study varied from 24-80 years., with the mean age being 59.45 years (+/-11.9 years).

More than half of the patients were females at 55.3% (26), while 44.7% (21) were males.

The main presenting clinical symptoms were chest pain in 36.2% (17) cases, followed by cough in 29.8% (14) and breathing difficulty in 21.3% (10) cases. However, 12.7% (6) cases were asymptomatic.

Procedure of Thoracoscopic Lung Biopsy: The lung biopsy was done via thoracoscopy successfully in the first attempt in 48.9% (23) cases, second attempt in 44.7% (21) cases and third attempt in 6.4% (3) cases. The sites of lesions in various cases are as described below in Table 1.

The histopathological examination revealed malignant lesions in 68.1% (32) cases, benign lesions in 14.9% (7) cases and other lesions in 17% (8) cases. The detailed description of histopathological diagnoses of the lesions is as shown in Table 2 below.

Complications of Procedure: There were no complications observed in more than half of the patients (57.4%) on whom thoracoscopic lung biopsy was done. Chest pain was the most common complaint post procedure among 12 patients at 25.5%. Cough was seen in 6.4% (3) patients, pneumothorax and pulmonary alveolar haemorrhage in 4.3% (2) patients and hemoptysis in a single patient (2.1%).

The results of our study on CT-guided transthoracic lung biopsy align with the findings of previous studies, providing a comprehensive understanding of the efficacy, diagnostic yield and complication rates associated with the procedure.

The mean age of patients in our study was 59.45 years (±11.9 years), with an age range of 24-80 years. This demographic is consistent with studies by Aykut Recep Aktas[15] and Lee[16], which also reported a similar age range and mean age among patients undergoing CT-guided transthoracic lung biopsy. The gender distribution in our study showed a slight female predominance (55.3% female, 44.7% male), which is in line with some previous studies but contrasts with others that reported a male predominance. This variation may be due to the specific population demographics of the tertiary care center where the study was conducted.

Table 1: Sites of lesions chosen for thoracoscopic lung biopsy

Biopsy Sites	Overall	Left	Right
Lung	32(68.1%)	16	16
Bronchus	7(14.9%)	1	6
Pleura	3(6.4%)	2	1
Supraclavicular Node	2(4.2%)	2	0
Mediastinal mass	3(6.4%)		
Total	47 (100%)		

Table 2: Histopathological diagnoses of the lesions obtained on lung biopsy

Histopathological diagnosis	Frequency	Percent
Malignant lesions		
Adenocarcinoma	1	2.1
Invasive Adenocarcinoma	5	10.6
Moderately Differentiated Adenocarcinoma	1	2.13
Poorly Differentiated Adenocarcinoma	4	8.5
Squamous Cell Carcinoma	4	8.5
Poorly Differentiated Squamous Cell Carcinoma	3	6.4
Small Cell Carcinoma With Squamous Cell	1	2.13
Small Cell Carcinoma	1	2.13
Non Small Cell Carcinoma	7	14.9
Poorly Differentiated Non Small Cell Carcinoma	1	2.13
Spindle Neoplasm	1	2.13
Malignant High Grade Spindle Cell	1	2.13
Malignant Spindle Cell Tumour, Teratoma, Mesothelioma	1	2.13
Malignant Round Cell Tumour	1	2.13
Multiple Carcinoid Tumours	1	2.13
Neurogenic Tumour	1	2.13
High Grade Sarcoma	1	2.13
Teratoma	1	2.13
Benign Lesions		
Atypical Cell	1	2.13
Benign Cystic Lesion	1	2.13
Necrotizing Lesion Atypical Glands	1	2.13
Other Lesions		
Chronic Inflammatory Cells	1	2.13
Collapse Lung Tissue	1	2.13
Emphysema With Organization	1	2.13
Inflammatory Lesion	1	2.13
Inflammatory Polyp	1	2.13
Organising Pneumonia with Interstitial Fibrosis	1	2.13
Organizing Pneumonia with Focal Fibrosis	1	2.13
Normal Bronchus Mucosa	1	2.13
Total	47	100

Table 3: Complications Observation

Complications	Frequency	Percent
Chest pain	12	25.5
Cough	3	6.4
Pneumothorax	2	4.3
Pulmonary alveolar haemorrhage	2	4.3
Hemoptysis	1	2.1
No complications	27	57. 4
Total	47	100

The primary clinical symptoms among our patients were chest pain (36.2%), cough (29.8%) and breathing difficulty (21.3%). These presenting symptoms are consistent with those reported in studies by Borelli[17] and Hwang[18], where respiratory symptoms were commonly observed among patients undergoing lung biopsy. A small proportion of our patients (12.7%) were asymptomatic, similar to findings by Laurent[19]

Our study demonstrated a high first-attempt success rate of 48.9%, with 44.7% requiring a second attempt and 6.4% a third attempt. This is comparable to the success rates reported by Ohno[20] and Lee[16], who documented high procedural success rates with minimal need for multiple attempts . The distribution of biopsy sites in our study showed the lung as the most common site (68.1%), followed by the bronchus (14.9%) and pleura (6.4%). This distribution mirrors the findings of previous studies, indicating a similar pattern in the selection of biopsy sites for thoracoscopic lung biopsies.

Histopathological examination revealed malignant lesions in 68.1% of cases, benign lesions in 14.9% and other lesions in 17%. These results are in agreement with those reported by Ohno[20] and Borelli[17], who also found a higher prevalence of malignant diagnoses in their studies Notably, adenocarcinoma and squamous cell carcinoma were the most common malignant lesions in our study, consistent with the findings of Hwang [18] and Lee[16]. The presence of a variety of other lesions, including inflammatory and benign conditions, highlights the diagnostic versatility of CT-guided biopsies.

The overall complication rate in our study was low, with 57.4% of patients experiencing no complications. The most common complication was chest pain (25.5%), followed by cough (6.4%), pneumothorax (4.3%), pulmonary alveolar hemorrhage (4.3%), and hemoptysis (2.1%). These complication rates are similar to those reported in the literature by Kim[21], where minor complications like chest pain and cough are common and more severe complications such as pneumothorax and hemorrhage occur less frequently. The low incidence of significant complications in our study reaffirms the safety profile of CT-guided transthoracic lung biopsy.

When comparing our findings with previous studies, there is a notable consistency in the demographic characteristics, clinical presentation, procedural success rates, histopathological outcomes and complication rates. Studies by Aneeshkumar[22], Choi[23] and Lee[16]. have similarly highlighted the efficacy and safety of CT-guided transthoracic biopsies in diagnosing pulmonary lesions . Our study adds to the growing body of evidence supporting the use of this minimally invasive procedure, particularly in tertiary care settings with experienced radiology teams.

CONCLUSION

This retrospective study of CT-guided trans-thoracic biopsies in a tertiary care hospital demonstrates that the procedure is effective in obtaining diagnostic tissue samples, with a high success rate on the first attempt in nearly half of the cases. The majority of the lesions were malignant, underscoring the importance of timely and accurate diagnosis. The procedure was generally well-tolerated, with over half of the patients experiencing no complications. The most common post-procedure complication was chest pain, followed by cough, pneumothorax, and pulmonary alveolar hemorrhage. Despite the limitations, including the study's retrospective nature and small sample size, the findings suggest that CT-guided trans-thoracic biopsy is a valuable diagnostic tool with manageable risks, providing critical information for the management of patients with thoracic lesions. Further prospective studies with larger cohorts and long-term follow-up are recommended to validate these findings and enhance the understanding of procedure-related outcomes.

Limitations: The study's retrospective nature, single-center setting, small sample size, selection bias, incomplete data and lack of long-term follow-up may introduce biases. The study's limitations include a single tertiary care hospital, potential underreporting of clinical symptoms or complications and the absence of long-term follow-up data, which could help understand the biopsy procedure's full spectrum.

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