Computed Tomography Guided Fine Needle Aspiration Cytology of Mass Lesions of Lung: A Study of 56 Cases

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Abstract

Background: Fine needle aspiration cytology (FNAC) determines the type of tumour and affirms the diagnosis. Computed tomography (CT)-guided FNAC of suspicious lung masses is a widely employed, inexpensive diagnostic procedure.

Objective: To evaluate the age, sex, topographic distribution, size, and cytopathological diagnosis of lung mass lesions using CT-guided FNAC.

Methods: This descriptive cross-sectional study included 56 individuals with pulmonary mass lesions, most of which were presumably caused by neoplastic disease, as evidenced by chest radiographs and CT scans. The study was conducted between June 2022 and June 2024.

Results: The mean age of the study participants was 63.6±11.8 years, with more than half (51.8%) falling within the 46–65 age group. Lesions were more commonly found in the right lung (57.1%) compared to the left lung (42.9%). The upper lobe accounted for about two-thirds of the lesions (64.3%), while the middle lobe had the fewest (3.6%). Of all cases, 87.5% were malignant, and 12.5% were benign. The most common malignant lesions were squamous cell carcinoma (33.9%), adenocarcinoma (28.6%), and poorly differentiated carcinomas (21.4%). Small cell carcinoma was identified in 3.6% of cases. There was a statistically significant association between age group and type of malignancy ($P<0.05$), with the 46–65 age group showing a higher prevalence of malignant lesions (55.1%).

Conclusion: CT-guided FNAC is a highly effective and comparatively accurate diagnostic technique for pulmonary mass lesions, with a permissible complication risk.

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Introduction

Image guided FNAC is a common investigation modality in deep seated lesions. Among them CT-guided FNACis often the first choice in the lesions located in the lungs, mediastinum and few other organs located within the abdominal cavity. It is very useful in differentiating between inflammatory (non-neoplastic) and neoplastic lung lesions. Furthermore, it can even sub-classify the malignant lesions of lung to a great extent. CT guided FNAC is a widely accepted, simple and less invasive modality for investigation of lung lesions with very minimum complications.[1]

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Literature has shown that CT-guided FNAC is a fairly accurate and sensitive way of diagnosing malignancy of the lungs.[2-4] CT guided FNAC is found to be accurate in diagnosing benign case in approximately 80% cases and malignant cases in approximately 90% cases.[5] Complications following the procedure is usually minimum but pulmonary hemorrhage, hemoptysis, respiratory distress and pneumothorax are common among them.[6] Chronic obstructive pulmonary diseases, contralateral pneumonectomy, severe bleeding diathesis and pulmonary hypertension are the common contraindication for CT guided FNAC.[7]
In our country, CT-guided FNAC is primarily performed at divisional tertiary-level hospitals and select facilities in major cities.The purpose of this study was to establish CT guided FNAC as a safe & accurate diagnostic technique for assessing pulmonary mass lesions as well as to know the disease spectrum in a district level hospital.

Objectives
The objective of this study was to evaluate the age, sex, topographic distribution, size, and cytopathological diagnosis of carefully selected patients of having pulmonary mass lesions as evidenced by Chest X-Ray or High-Resolution CT scan using CT-guided FNAC.

Methods
A descriptive cross-sectional study was conducted to explore the age, sex, topographic distribution, size, and cytopathological diagnosis of lung mass lesions using CT-guided FNAC in a purposively selected private hospital and diagnostic center located in Tangail district.

The study involved 56 patients with pulmonary mass lesions, most of which were likely due to neoplastic disease based on chest radiographs and CT scans. From June 2022 to June 2024, these patients underwent consecutive CT-guided FNAC of lung mass lesions, followed by rapid cytological evaluation.

The aspirations were performed by the pathologist with assistance from an experienced radiology technologist. An initial scan was conducted to precisely locate the lesion, and measurements were taken for the transthoracic needle insertion. After identifying the specific entry point on the chest, the area was cleaned with povidone-iodine solution, and 3 ml of 2% lidocaine was administered for local anesthesia. A 22G spinal needle was inserted into the lesion, followed by a repeat scan to confirm the needle tip's position within the lesion. Once the needle was correctly positioned, aspiration was performed, and smears were prepared on clean glass slides with appropriate labeling. All smears were immediately fixed in 95% ethyl alcohol, and later, Papanicolaou staining was performed for cytological examination. Patients were observed for two hours post-procedure to monitor for any immediate complications, and appropriate measures were taken if needed. The slides were subsequently evaluated by the pathologist, and a cytopathological diagnosis was made.

Data was entered, curated and analyzed using IBM SPSS Version 26 (New York, USA). Descriptive statistics were expressed as frequency (percentage) and mean (±standard deviation, or SD) for categorical and continuous data, respectively. Chi-square test was used, and a p-value of <0.05 at a 95% confidence interval was taken as significant. The results were presented in tables and chart.

Participants were fully informed about the potential risks and encouraged to participate. Written informed consent was taken from each participant. Ethical approval for the study was granted by the Research Ethical Committee of Sheikh Hasina Medical

College, Tangail 1900, Bangladesh. All procedures followed the guidelines set by the Declaration of Helsinki**.**

Results

The study participants' mean age was 63.6±11.8 years. More than half of the participants (51.8%) belonged to the 46–65 age group, and 39.3% were aged over 65. A significant percentage of the participants (8.9%) were below 45 years old. Male participants accounted for 91.1% of the cases, while female participants constituted 8.9%. Compared to the left lung (42.9%), the right lung (57.1%) had more lesions. The upper lobe comprised around two thirds of the lesion (64.3%), while the middle lobe comprised a small number of lesions (3.6%). (Table I)

Of the total cases, most of the cases were malignant (87.5%) and 12.5% were benign. (Figure 1)

Squamous cell carcinoma (33.9%), adenocarcinoma (28.6%), and poorly differentiated carcinomas (21.4%) were the three most prevalent malignant lesions. In 3.6% of cases, small cell carcinoma was identified. (Table II)

Age groups was statistically significant with the type of malignancy ($P<0.05$). The age group of 46–65 years aged had a higher prevalence of malignant lesions (55.1%). (Table III)

Table I: Outlines of the participants(n=56)

Traits		Frequency (n)	Percent (%)
Age groups	≤45 years	5	8.9
	46–65 years	29	51.8
	>65 years	22	39.3
	Mean±SD	63.6±11.8	
Gender	Female	5	8.9
	Male	51	91.1
Lung site	Left	24	42.9
	Right	32	57.1
Lobe zone	Lower	18	32.1
	Middle	2	3.6
	Upper	36	64.3

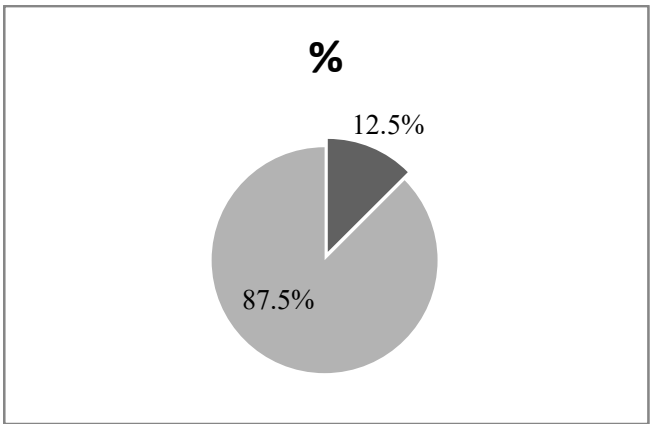

Figure 1. Type of malignancy (n=56)

Table II: Diagnosis of the study participants (n=56)

Traits		Frequency (n)	Percent (%)
Diagnosis	Benign lesion		
	Pulmonary tuberculosis (PTB)	2	3.6
	Pulmonary abscess	2	3.6
	Inflammatory lesion	3	5.4
	Malignant lesion		
	Squamous cell carcinoma (SCC)	19	33.9
	Adenocarcinoma	16	28.6
	Poorly differentiated carcinoma (PDC)	12	21.4
	Small cell carcinoma	2	3.6

Table III: Association of age groups with type of malignancy (n=56)

Traits		Type of tumor		$\chi 2$ value	p-value
		Benign	Malignant		
		n(%)	n(%)		
Age groups	≤45 years	3(42.9)	2(4.1)	7.729	*0.014
	46–65 years	2(28.6)	27(55.1)		
	>65 years	2(28.6)	20(40.8)		
	Total	7(100)	49(100)		

Fisher exact test value, *Statistically significant value

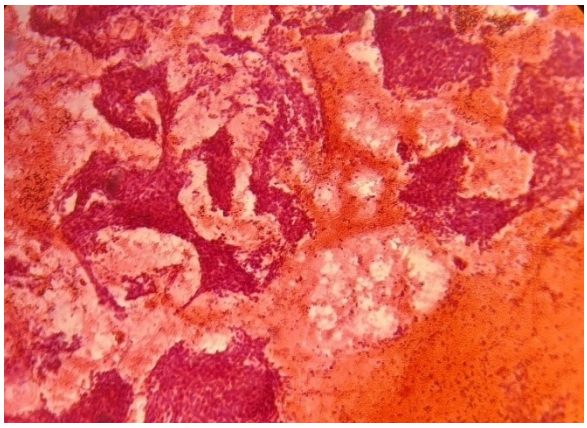

Figure 2. Photomicrograph showing squamous cell carcinoma of lung (Pap's stain, 40x)

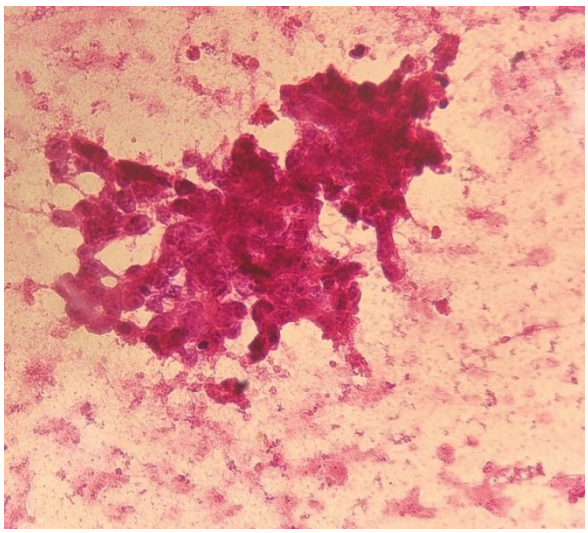

Figure 3. Photomicrograph showing adenocarcinoma of lung (Pap's stain, 40x)

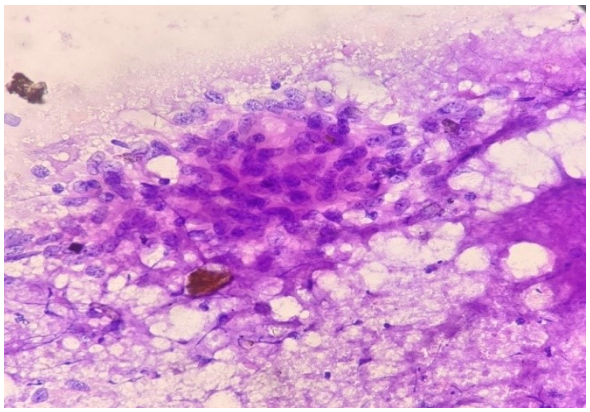

Figure 4. Photomicrograph showing tubercular granuloma (Pap's stain, 40x)

Discussion

CT-guided FNAC is a widely accepted diagnostic method known for its accuracy and safety. In this study, the mean age of participants was 63.6 years, which was higher than reported in other studies. For instance, Mondal et al., Singh et al., and Ahmed et al. found mean ages of 56.6 years,[8] 56.4 years,[9] and 54.34 years,[10] respectively, all of which were lower than the mean age in our study.

Among the 56 cases, 91.9% were male and 8.1% were female. The proportion of male patients in this study was slightly higher compared to Saha et al. (78.9%),[11] Tan et al. (71.1%),[12] and Bandhopadhay et al. (80.6%).[13]

In our study, we found that 87.5% of the cases were malignant and 12.5% were benign. Mondal et al. reported similar findings, with 91.93% of cases being malignant and 8.07% benign.[8] In contrast; Ahmed et al. found that only 68% of cases were malignant, which was lower than our results.[10] Among the benign cases, non-specific inflammatory lesions were the most common (5.4%), followed by pulmonary tuberculosis and lung abscess, each accounting for 3.6%.

In the malignant cases, SCC was the most prevalent, accounting for 38.9%, followed by adenocarcinoma (28.6%), poorly differentiated carcinoma (21.4%), and small cell carcinoma (2.6%). Shah et al. reported SCC as the most common malignant tumor (45%), followed by adenocarcinoma (22%), which aligns with our findings.[14] Similarly, Ahmed et al. found SCC (35.0%) to be the most common, followed by adenocarcinoma (25%), which was consistent with our study.[10] In contrast, Madan et al. identified adenocarcinoma as the most common malignant tumor (30%), followed by SCC (22.5%), differing from our results.[15]

Conclusion

CT-guided FNAC is a reliable and fairly accurate method for diagnosing pulmonary lesions. With proper technique and accurate localization of the lung lesion, sufficient material can be obtained, allowing for a confident cytomorphological diagnosis. This procedure can effectively differentiate between benign and malignant lesions and can often sub-classify malignant neoplasms. Patient compliance is generally high, and the complication rate is relatively low, with most complications manageable through conservative treatment.

Limitations of the study

Although the sensitivity and specificity of CT-guided FNAC are high, core biopsy is often necessary for confirmation. CT-guided FNAC may not be able to distinguish between certain poorly differentiated or undifferentiated carcinomas. Additionally, it cannot differentiate between primary lung adenocarcinoma and metastatic adenocarcinoma. In such cases, histopathology and immunohistochemistry are frequently required.

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