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Original research article

Decoding lung lesions: A triangular study of cytology, histology, and radiological insights

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Abstract

Background: Initial assessments of pulmonary lesions involve imaging studies such as X-rays, CT scans, and MRIs, which can reveal abnormalities like atypical opacities in the lungs. While chest X-rays are often the first tool used for detection, CT scans offer better resolution. Definitive diagnosis requires a biopsy. Diagnosing lung lesions in rural and economically disadvantaged areas in India can be challenging due to limited access to advanced imaging technologies, leading to delays. In this context, Fine Needle Aspiration Cytology (FNAC) emerges as a vital and cost-effective method for early detection.

This study aims to compare FNAC with established diagnostic modalities, correlating cytological findings with radiological assessments and using histopathology as the gold standard. This approach could help clinicians develop targeted treatment strategies and predict patient prognosis more accurately.

Materials and Methods: In this study, various lung lesions identified through radiological examination were assessed using cytology and histology. Patients with suspected lung lesions or incidental findings on radiological scans were included in the research, with a total of seventy cases evaluated over an eighteen-month period. The data was meticulously recorded, and an appropriate statistical analysis plan was implemented.

Result & Conclusion: The study found among the malignant lung lesions, adenocarcinoma, was most common, especially in males aged 61 to 70. Smokers were significantly affected by these malignancies. Radiological findings often matched histological results. The study concluded that fine-needle aspiration cytology (FNAC), used with radiology, provided reliable diagnoses for lung lesions in terminal patients, offering valuable information to families about the disease and prognosis. While histology is the gold standard, FNAC is advantageous for its accuracy and the potential for immunohistochemistry in classifying malignancies.

Keywords: Lung lesions, FNAC

1. Introduction

Lung lesions can be identified using imaging methods like X-rays, CT scans, and MRIs. These lesions may be cancerous (such as primary lung cancers like SCLC and NSCLC, metastatic lesions, and lymphomas) or non-cancerous (including hamartomas, granulomas, cysts, and adenomas). Malignant lesions consist of primary lung cancers, such as small cell lung carcinoma (SCLC) and non-small cell lung carcinoma (NSCLC), along with metastatic lesions and lymphomas [1]. Non-cancerous growths often result from infections or inflammatory disorders, while cancerous lesions are linked to smoking, radiation, and pollution [2]. Diagnosing lung lesions involves imaging studies, with CT scans offering more detail than X-rays. PET scans assess cell activity to differentiate between types of lesions, and biopsies provide a definitive diagnosis [3]. In India, lung cancer represents a significant health challenge and ranks fourth among cancers in men [4]. While pulmonary cysts and hamartomas are relatively uncommon, they can sometimes mimic tumors. Lung cancer primarily occurs in two forms: non-small cell lung cancer (NSCLC), which is more frequently diagnosed, and small cell lung cancer (SCLC) [5].

Challenges in diagnosis arise in rural areas due to limited access to advanced imaging and conditions like

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tuberculosis, which may mimic cancer signs. Cytology, particularly Fine Needle Aspiration Cytology (FNAC), plays a crucial role in evaluating lung lesions, offering a minimally invasive and cost-effective diagnostic option. It aids in early lung cancer detection but has challenges in accuracy. Therefore, combining FNAC with other diagnostic methods is important for effective treatment planning and prognosis prediction.

II. Objective

In this study, samples from different lung lesions by trans-thoracic fine needle aspiration along with core biopsies with the aid of various imaging techniques were collected morphologically to evaluate them and then compare the findings with radiological results.

III. Materials and Methods

This observational descriptive study with a cross-sectional design was conducted over eighteen months in the Pathology and Radiology Departments of a Kolkata medical college. A total of seventy symptomatic individuals with lung lesions and asymptomatic patients with incidental lesions were evaluated. After obtaining ethical approval, data was collected using a proforma covering patient demographics, clinical history, and investigation details. FNA and core biopsies were guided by CT or USG, and cytopathology and histopathology slides were examined microscopically. The Pearson Chi-square test and independent t-test were used for significance testing, with data analyzed using IBM SPSS-20.

IV. Observations and Results

In a study of seventy cases, five did not undergo proper cytologic evaluation - four cases had blood obscuration and one sample was inadequate. Of the remaining cases, fifty-seven were malignant and eight benign. Further analysis revealed three unreported cases were malignant and two benign based on core biopsy. A hydatid cyst fluid sample yielded notable cytological findings and a case of pulmonary aspergillosis was noted in an elderly, immunocompromised patient who sadly succumbed to multi-organ failure. The mean age of patients was 57.6 years, primarily in the 60-69 or ≥70 age groups (27.1%), while those under 40 constituted only 12.9% (Table 1).

In the study population, 64.3% were smokers, with 54.3% of smokers being males. Females accounted for 34.3%, mainly as nonsmokers (Table 2). Most mass lesions identified on radiography (97.1%) were single-focus, mostly unilateral (97.1%), with 60% in the left lung (Table 3 & 4).

On computerized tomography (CT), 87.1% of masses showed heterogeneous enhancement. Spiculation was noted in 80%, indicating potential malignancy, while 80% of the masses were suspected to be malignant (Table 5&6). Cytologically, 80% of the 70 cases were malignant; adenocarcinoma being the most common (35.7%). Histologically, the findings were similar, with 87.1% malignant lesions and adenocarcinoma (40%) being the most frequent diagnosis. One case of Aspergillosis was also identified (Table 7 & 8).

Table 9 reveals that out of 70 cases, 56 (80%) were malignant both radiologically and cytologically. By cytology, 9 (12.8%) were reported as benign, whereas by radiological studies 14 (20%) were found to be non-malignant. Tissue core biopsies served as the standard for comparison in these.

Statistical analysis using Fisher's Exact Test showed a significant result for CT scans and core biopsy ($p = 0.0127$). The sensitivity and positive predictive value of CT scans for diagnosing lung lesions were 91.22% and 92.85%, respectively, while specificity was 55.55%, leading to an accuracy of 81.42%. Agreement between CT and core biopsy was slight, as indicated by a low Cohen's Kappa value.

In contrast, cytology had a sensitivity of 98.24%, specificity of 100%, and an accuracy of 98.46%. The Cohen's Kappa value for the agreement between cytology and core biopsy was 0.78, indicating substantial agreement.

Table 1: Age distribution of study subjects having a lung mass on radiology

Age groups (years)	Number of Cases	Percentage %
<40	9	12.9
41-50	11	15.7
51-60	14	20.0
61-70	20	28.5
>70	16	22.9
Total	70	100.0

Table 2: Distribution of study subjects based on smoking status

Sex	Number of Cases		Percentage %	
	Non-smoker	Smoker	Non-smoker	Smoker
Males	8	38	11.4	54.3
Females	17	7	24.3	10.0
Total	**70**		**100.0**	

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Table 3: Distribution of lung masses based on the focality of the lesion

Focality of Mass	No. of cases	Percentage (%)
Single Focus	68	97.1
Multi Focal	2	2.9
Total	**70**	**100.0**

Table 4: Distribution of lung masses according to laterality of the lesion

Laterality of mass	No. of cases	Percentage (%)
Left	42	60.0
Right	26	37.1
Bilateral	2	2.9
Total	**70**	**100.0**

Table 5: CT findings of the lung masses

Radiological feature	Category	No. of cases	Percentage (%)
Enhancement pattern of the mass	Heterogeneous	61	87.1
	Homogenous	9	12.9
Spiculated mass	Present	56	80
	Absent	14	20

Table 6: Distribution of study subjects based on computed tomography findings

Radiological diagnosis	No. of cases	Percentage (%)
Benign	14	20.0
Malignant	56	80.0
Total	**70**	**100.0**

Table 7: Lung lesions based on cytological (FNAC)

Cytological diagnosis		No. of cases	Percentage (%)
Benign (Total 9 Cases)	Hydatid cyst	1	1.4
	Non-specific inflammation/ Pneumonitis	4	5.7
	Tuberculosis	4	5.7
Malignant (Total 56 Cases)	Adenocarcinoma	25	35.7
	Squamous cell carcinoma	18	25.7
	Small cell carcinoma	5	7.2
	Large cell anaplastic	1	1.4
	Metastatic ductal carcinoma (Breast)	2	2.9
	Non-Hodgkin's lymphoma	1	1.4
	Non-small cell carcinoma (Uncategorised)	4	5.7
Unsatisfactory sample	Hemorrhagic smears	5	7.2
Total		**70**	**100.0**

Table 8: Lung lesions based on based on Core Biopsy

Histological diagnosis		No. of cases	Percentage (%)
Benign (Total 9 Cases)	Aspergillosis	1	1.4
	Hydatid cyst	1	1.4
	Non-specific inflammation/ Pneumonitis	4	5.8
	Tuberculosis	3	4.3
Malignant (Total 61 Cases)	Adenocarcinoma	28	40.0
	Squamous cell carcinoma	20	28.7
	Small cell carcinoma	4	5.8
	Large cell anaplastic	1	1.4
	Broncho alveolar carcinoma	1	1.4
	Metastatic deposits	2	2.8
	Non-Hodgkin's lymphoma	1	1.4
	Poorly differentiated carcinoma	2	2.8
	Carcinoid	1	1.4
	Spindle cell carcinoma	1	1.4
Total		**70**	**100.0**

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Table 9: Comparative Study of Radiological, Cytological & Histopathological Evaluation

Cases	Radiology No. of Cases	Cytopathology No. of Cases	Histopathology No. of Cases
Benign	14	9	9
Malignant	56	56	61
Inadequate	-	5	-
Total	**70**	**70**	**70**

Table 10: Comparative Study of CT scan and Core biopsy in the diagnosis of lung lesions

	Histopathology Malignant Lesions	Histopathology Benign Lesions	Total
Radiology Malignant Lesions	52	4	56
Radiology Benign Lesions	09	5	14
Column Total	61	9	70

Statistical evaluation of CT scan and Core biopsy in the diagnosis of lung lesions.

Sensitivity	91.22%
Specificity	55.55%
Positive Predictive Value	92.85%
Negative Predictive Value	35.71%
Accuracy	81.42%
Cohen's Kappa	0.16

Table 11: Comparative Study of Core biopsy & Cytology in the diagnosis of lung lesions

	Histopathology Malignant Lesions	Histopathology Benign Lesions	Total
Cytology Malignant Lesions	56	00	56
Cytology Benign Lesions	01	08	09
Column Total	57	08	65

Statistical evaluation of Core biopsy & Cytology in the diagnosis of lung lesions.

Sensitivity	98.24%
Specificity	100%
Positive Predictive Value	100%
Negative Predictive Value	88.88%
Accuracy	96.46%
Cohen's Kappa	0.78

V. Conclusion

The study "A Comparative Study of Lung Lesion Diagnosis through Cytology, Histology, and Radiological Impression" aimed to evaluate lung lesions using cytomorphology and histopathology methods while assessing the accuracy of radiological diagnoses in pulmonary conditions. Conducted at a tertiary care centre in Kolkata, India between November 2022 and May 2023, the research involved 70 patients presenting with lung complaints, who underwent investigations including chest X-rays or CT scans and fine-needle aspiration cytology (FNAC) for positive lesions.

The study found that malignancies, particularly adenocarcinoma, were prevalent among patients, with age and smoking as contributing factors. FNAC is recommended as an efficient primary screening tool, although core biopsies may be necessary in cases where cytological findings conflict with clinical suspicion. Overall, FNAC is positioned as a straightforward and effective approach to diagnosing lung lesions, especially in economically challenged regions.

V. References

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