



## Sensitivity and Specificity of Pleural Fluid Cytology to Histopathology Examination in Lung Tumor Patients at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia

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### ABSTRACT

**Introduction.** Lung tumors are pathological growths in the lung that are strongly associated with lung cancer. In 2018, lung cancer, a form of lung tumor, had the greatest occurrence among all types of cancer. It accounted for 2,093,876 new cases, which represented 11.6% of all cancer cases. The objective of this study was to assess the sensitivity and specificity of pleural effusion cytology testing compared to histopathological examination in patients with lung malignancies at Dr. Mohammad Hoesin General Hospital in Palembang, Indonesia. **Methods.** This study was a retrospective analytical-observational study. This study encompassed a cohort of 35 patients who fulfilled the specified inclusion criteria. We used the SPSS version 22.0 for Windows application to perform bivariate analysis in data processing and analysis. **Results.** The study yielded a sensitivity score of 13.63%, indicating the pleural fluid cytology method's accuracy in detecting lung cancer in individuals with low values. This study demonstrates a specificity value of 100%, indicating the frequency at which the pleural fluid cytology approach accurately identifies cancer. **Conclusion.** The use of cytology as a screening tool for identifying lung tumor illnesses is limited, although it demonstrates a high level of specificity in ruling out healthy individuals.

### 1. Introduction

Lung tumors are pathological growths that occur in the lung. Lung tumors are intricately associated with lung cancer. Lung cancer is the primary cause of malignancy globally, representing around 13% of all cancer cases. Lung cancer is responsible for one-third of all cancer fatalities in males. In 2018, lung cancer, a kind of lung tumor, had the highest occurrence rate among all types of cancer.

There were 2,093,876 new cases, accounting for 11.6% of all cancer cases.<sup>1</sup>

Histopathological evaluation is the definitive method for diagnosing lung malignancies. Clinicians in Indonesia clinically diagnose lung tumors and subsequently conduct cytological investigations. Analyzing the patient's medical history, primary complaint, physical examination, and radiological assessment establishes the clinical diagnosis of a patient with a lung tumor. Examiners establish the

cytological diagnosis by examining individual cells or clusters of cells obtained from tumor samples or adjacent tissue.<sup>1,2</sup>

The choice of a suitable sample technique might impact the outcomes of the cytologic diagnosis achieved. Recent studies show that looking at cells in the pleural fluid after the first thoracentesis procedure can find lung cancer 60% of the time.<sup>3,4</sup> The value exhibits an increment to 75% with repetition. Obtaining histologic or cytologic confirmation increases rates of targeted oncology therapy for patients with lung cancer.<sup>4-6</sup> The objective of this study was to find out how sensitive and specific pleural effusion cytology testing was compared to histological investigation in lung cancer patients at Dr. Mohammad Hoesin General Hospital in Palembang, Indonesia.

## 2. Methods

This study was a retrospective analytical observational study that used medical records to examine the sensitivity and specificity of pleural effusion cytological analysis compared to histological examination in patients with lung malignancies at Dr. Mohammad Hoesin General Hospital in Palembang, Indonesia. The study had 35 participants who matched the specified inclusion criteria. The inclusion criteria consisted of patients with lung tumors who received pleural fluid cytology and histopathology follow-up examinations and were above 18 years of age. The medical and health research ethics committee of Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia, granted approval for this study. We used the SPSS version 22.0 for Windows application to process and analyze the data. The study employed bivariate analysis to investigate the correlation between two variables, specifically the dependent variable and the independent variable. The study presented the data in distribution tables and narratives.

## 3. Results

Table 1 presents a sample distribution consisting of 28 men (80%) and 7 women (20%). Meanwhile, the most common age group was the 59-78 age group (45.7%), the most common occupations were farmers (20%), and the most commonly performed surgical technique was thoracotomy (91.4%) compared to VATS (8.6%). Table 2 shows that the prevalence of lung tumor cell types based on fluid cytology examination is as many as 16 (45.7%), atypical as many as 16 (45.7%), and malignant as many as 3 (8.6%). Table 3 also shows that the distribution of lung tumor tissue types based on histopathological examination is as follows: normal tissue types as many as 9 (25.7%), atypical as many as 4 (11.4%), and malignant as many as 22 (62.9%).

The distribution of lung tumor types presented in Table 4 shows that adenocarcinoma was the most common tumor type at 21.8%. The least common tumor type was a neuroendocrine tumor (4.4%). Diagnostic testing yielded a sensitivity value of 13.63% and a specificity of 100%, with 19 false negatives and 3 false positives among the patients (Table 5). Calculation of sensitivity and specificity values using the Thornier-Remain screening method. The calculation of sensitivity and specificity values is as follows:

$$\text{Sensitivity} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}} \times 100\%$$

$$\begin{aligned} \text{Sensitivity} &= \frac{3}{3 + 19} \times 100\% \\ &= 13,63\% \end{aligned}$$

$$\text{Specificity} = \frac{\text{True Negative}}{\text{False Positive} + \text{True Negative}} \times 100\%$$

$$\begin{aligned} \text{Specificity} &= \frac{13}{0 + 13} \times 100\% \\ &= 100\% \end{aligned}$$

Table 1. Patient characteristics.

<b>Characteristics</b>	<b>N (%)</b>
<b>Age (years)</b>	
19-38	4 (11.4)
39-58	15 (42.9)
59-78	16 (45.7)
<b>Gender</b>	
Male	28 (80.0)
Female	7 (20.0)
<b>Occupation</b>	
Private employee	2 (5.7)
Housewives	4 (11.4)
Farmers	7 (20.0)
Labourer	2 (5.7)
Self-employed	3 (8.6)
Civil servants	5 (14.3)
Honorary firefighter	1 (2.9)
BUMN employees	1 (2.9)
Unknown	10 (28.5)
<b>Surgery procedure</b>	
Thoracotomy	32 (91.4)
VATS	3 (8.6)

Table 2. Frequency distribution of cell types of lung tumor patients based on fluid cytology examination.

<b>Cell type</b>	<b>Frequency</b>	<b>Percentage</b>
Normal	16	45.7
Atypical	16	45.7
Malignant	3	8.6
<b>Total</b>	<b>35</b>	<b>100</b>

Table 3. Frequency distribution of cell types of lung tumor patients based on histopathology examination.

<b>Cell type</b>	<b>Frequency</b>	<b>Percentage</b>
Normal	9	25.7
Atypical	4	11,4
Malignant	22	62,9
<b>Total</b>	<b>35</b>	<b>100</b>

Table 4. Lung tumor type distribution.

<b>Tumor type</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Neuroendocrine tumor	1	4.4
Non-keratinizing squamous cell carcinoma	4	17.4
Adenocarcinoma	5	21.8
Squamous cell carcinoma	3	13
Non-small cell carcinoma	3	13
Poorly differentiated carcinoma	3	13
Teratoma	1	4.4
Metastasis	3	13
<b>Total</b>	<b>23</b>	<b>100</b>

Table 5. Sensitivity and specificity of fluid cytology to histopathology in lung tumor patients.

<b>Fluid Cytology</b>	<b>Histopathology</b>		<b>Total</b>	<b>Sensitivity (%)</b>	<b>Specificity (%)</b>
	<b>Positive</b>	<b>Negative</b>			
Positive	3	0	3		
Negative	19	13	32	13,63	100
Total	22	13	35		

#### 4. Discussion

Male patients have traditionally had a higher incidence of lung tumors, although there has been a significant reduction in the gender disparity in lung tumor frequency. However, males continue to predominantly experience late-stage lung cancer diagnoses. Men with lung cancer had a worse prognosis and greater mortality rate compared to women, despite advancements in therapy and lower mortality for all types of cancer. Within this study, the male population exhibited the highest prevalence of lung tumors, and the occurrence of lung tumors rose in tandem with the advancing age of the patients.

Lung tumors are intricate conditions; hence, the reasons behind the observed disparities between sexes are likely to be multifaceted, including a blend of many environmental and biological components. These factors encompass disparities in health behaviors depending on sex, such as smoking, food, the influence of sex hormones, and variations in immunological response. We conducted tissue harvesting using two methods: VATS and thoracotomy. Conventional thoracotomy operations accounted for a higher frequency (91.4%) compared to VATS procedures (8.6%). The VATS treatment has grown quickly and has replaced the traditional thoracotomy as the standard method for most thoracic procedures, such as taking lung samples for diagnostic purposes.<sup>7-9</sup>

The sensitivity of fluid cytology testing to histopathology examination in this research was 13.63%, while the specificity was 100%. The sensitivity value varies from other research due to several factors that influence the outcomes of pleural fluid cytology investigations. Several factors can cause confusion in pleural fluid cytology investigations, including the type of fluid fixation medium used, the amount of fluid present, the length of the lab test, and the origin of the pleural fluid (from the main tumor or the metastatic stage of a disease). Additionally, the process of interpreting the data may also introduce confounding effects. Previous research has also shown that sampling by fluid cytology, especially in pleural effusion fluid, has a sensitivity of 63%, which is the same as what this study found. Prior research has also

indicated that the sputum technique demonstrates a sensitivity of 66% and a specificity of 99%. The outcomes can also differ based on the frequency of sputum collection. Performing the sputum examination three times will enhance the sensitivity of the examination to 60%.

The selection of the specimen collection strategy for fluid cytology investigation directly impacts the outcomes of cytological diagnosis. This is due to the fact that each approach exhibits distinct sensitivity and specificity values when it comes to diagnosing lung cancer. Furthermore, the frequency of sampling also has an impact on the sensitivity and specificity of the diagnosis. The majority of the strategies employed in this investigation included the utilization of pleural fluid. Previous research indicates that pleural fluid sampling methods have a sensitivity rate of 63%, whereas bronchoscopy has a sensitivity rate of 53%. The TTB has an accuracy rate of 78%, the FNAB has an accuracy rate ranging from 56% to 90%, and the sputum test has an accuracy rate of 66%. Additional variables that might impact the precision of the diagnosis include fluid volume, tumor placement, and the procedure of analyzing the sample. Hence, the choice of cytological testing methods should take into account the patient's state and the accessibility of examination instruments and materials.<sup>10-16</sup>

The small sample size of patient data limits the performance of diagnostic tests on each cytological examination technique in the study. Consequently, the study is unable to provide doctors with more precise insights. Discrepancies in the final results might arise due to variations in sampling methodology and the interpretation of different samples. Furthermore, we conducted comprehensive diagnostic tests for many tumor types, including lung cancer.

However, these tests did not yield more precise information on the selection of examination approaches that may potentially offer superior outcomes. This is a result of the constraints imposed by the data used in the study.

## 5. Conclusion

The use of cytology as a screening method has limited effectiveness in identifying lung tumor illnesses, but has a high specificity in excluding healthy patients.

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