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" *Diagnostic Value of Thoracoscopic Biopsy in Patients with Undiagnosed Exudative Pleural Effusion* "

Authors

Muhammed Abdul Moniem Khattab [1], Ramadan mahmoud Nafae [2], Mamdouh El Nahas [3], Eman M. Mahmoud [4]

[1] Chest diseases, faculty of medicine, Portsaid University

[2] Chest diseases, faculty of medicine, Zagazig University

[3] Internal medicine, faculty of medicine, Portsaid University

[4] Chest diseases, faculty of medicine, Portsaid University

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ABSTRACT:

Background: Pleural effusion of unclear cause remains a diagnostic challenge. Even after thorough evaluation, etiology may be unidentified. Cytology detects metastatic pleural disease in only 60–80% of cases and mesothelioma in 20%, making thoracoscopy often necessary for diagnosis and therapy.

Aim: To assess the diagnostic value of thoracoscopic biopsy in undiagnosed exudative pleural effusion.

Patients and Methods: In this single-center, prospective trial (July 2022–December 2023), 100 adults (>18 years) with undiagnosed exudative pleural effusion at Suez Canal University Teaching Hospital underwent medical thoracoscopy. Exclusion criteria included trapped lung, unstable cardiovascular disease, severe COPD, bleeding diathesis, transudative effusions, and advanced uncontrolled illnesses. Data included demographics, history, examination, imaging, pleural fluid analysis, and biopsy findings.

Results: Mean age was 58.19 ± 10.99 years; 52% were male. History of cancer was present in 38%, tuberculosis in 6%, and smoking in 21%. Thoracoscopic pleural biopsy achieved 95.0% diagnostic accuracy, with 93.8% sensitivity, 100.0% specificity, and 100.0% positive predictive value.

Conclusion: Thoracoscopy is a safe, minimally invasive procedure with high diagnostic yield for undiagnosed exudative pleural effusion and should be performed promptly in suitable patients.

Keywords: Thoracoscopic Biopsy, Undiagnosed Exudative Pleural Effusion.

Introduction

A pleural effusion is a pathological buildup of fluid in the pleural cavity, which is the space between the parietal and visceral pleura. It may happen on its own or as a consequence of an inflammatory illness, infection, or cancer that affects the surrounding parenchyma. According to Patel et al. **(1)**, pleural effusion is a leading cause of pulmonary mortality and morbidity. A little quantity of pleural fluid is present in every healthy person, lubricating the area and enabling regular lung motions while breathing. Oncotic and hydrostatic pressure, as well as lymphatic drainage, maintain this delicate fluid balance; disruptions in any one of these systems may result in an accumulation of pleural fluid **(2)**.

Between 25% and 57% of patients with a non-malignant pleural effusion die within a year. In every situation, the cause of a pleural effusion must be properly identified since it greatly influences the need of treating it and the available treatment alternatives **(3)**.

Because pleural effusions may have a wide range of clinical manifestations and etiologies, from a straightforward inflammatory response to more dangerous conditions like cancer and TB, diagnosing them is crucial for thoracic surgeons and pulmonologists **(4)**.

According to Jany and Welte **(3)**, thoracoscopy is often required for both diagnostic and therapeutic purposes. For the identification of undetected pleural effusions, thoracoscopy is a useful technique, especially in individuals with a high risk of cancer. Thoracoscopy is more cost-effective overall because of its higher yield and shorter hospital stay **(5)**.

Because it is easy to examine the pleural surface and choose a representative sample, thoracoscopy therefore becomes a valuable tool **(6)**. Therefore, the purpose of this prospective, interventional, single-center research was to ascertain if thoracoscopic biopsy is a useful diagnostic procedure for unexplained exudative pleural effusions.

Aim

This study aimed for assessing diagnostic value of thoracoscopic biopsy in patients with undiagnosed exudative pleural effusion.

Patients and Methods

This is a single-center, prospective, interventional trial. During a specified time period (July 2022–December 2023), data was gathered from one hundred (100) patients with undetected exudative pleural effusions at Suez Canal University Teaching

Hospital, Cardio-thoracic Department, Cardio-thoracic Clinic, and Emergency Unit, meeting the sample objective. following up with those patients following thoracoscopy and acquiring laboratory and histological data. Known patients with exudative pleural effusion who visited Suez Canal University Teaching Hospital between July 2022 and December 2023 but whose precise diagnosis could not be made using standard diagnostic techniques.

The study comprised individuals over the age of 18 with exudative pleural effusion and undiagnosed pleural effusion. The study did not include patients with transudative pleural effusion for any reason (cardiac, hepatic, renal, etc.), cases that were unsuitable for surgery (high coagulation profile, advanced uncontrolled chronic illnesses, advanced cancer cases), trapped lung syndrome, unstable cardiovascular diseases, severe chronic obstructive pulmonary disease, bleeding diathesis, etc.

All patients were subjected to complete history taking, clinical examination, and chest examination,

Investigational studies including laboratory investigations as complete blood picture (CBC), renal function test, liver test profile and thoracocentesis and pleural fluid analysis (physical, microscopical, biochemical). Radiological investigations as Ultrasound, chest X-ray and Echocardiography.

Surgical procedures

- In the contralateral decubitus position, the patients received general anesthesia and double-lumen endotracheal intubation, which was confirmed by fiber-optic bronchoscopy.
- For trocar secured thoracoscopic access to the pleural depth, the sixth or seventh intercostal space in the mid-axillary line was frequently used.
- To prevent damage to the underlying lung tissue, subsequent intercostal access was performed at 1-2 locations under the coordinate thoracoscopic vision.
- A thorough examination of the entire hemithorax was conducted. Any fluid was drawn out and sent for analysis in cytology and microbiology. The pleura and lung surface were thoroughly inspected, and biopsies were collected from suspicious lung or pleural tissue in a similar way. These samples were then sent for histological analysis.
- Additionally, if necessary, decortications or wedge resection were performed at that time with the use of VATS for the pericardial window. In accordance with intraoperative findings, chemical pleurodesis using three to five grams of talc powder was performed.
- One or two chest tubes were inserted via one or more of the intercostal opening sites under the vision to promote appropriate drainage once the VATS procedure was finished and complete hemostasis was achieved.
- At that moment, the aseptic dressing was applied and the thoracic cavity was closed in layers.



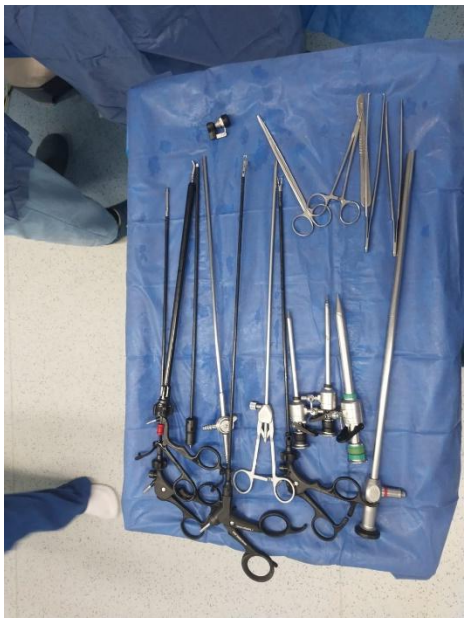

Figure 1: Operative tray.

Histological analysis

Histological analysis was carried out in accordance with standard procedure. After being fixed for the entire night at room temperature in 10% neutral buffered formalin, tissue samples were then embedded in paraffin blocks. Sections were cut to a thickness of 6 µm and stained using a commercial hematoxylin and eosin staining kit (at room temperature, eosin for 2 minutes and hematoxylin for 4 minutes). Slides were seen using an x10 or x20 object lens in a conventional bright-field microscope.

Statistical analysis of the data

SPSS version 27.0 was utilized for the collection and processing of data. Qualitative data was presented as numbers and percentages, whilst quantitative data was presented as means ±SD. A P value of less than 0.05 was regarded as statistically significant. Patients who satisfied the requirements for admission were admitted to the cardio-thoracic surgery department from the emergency room or cardio-thoracic clinic at Suez Canal University Hospital. The Cardio-Thoracic team followed standard

protocols to obtain thoracoscopic biopsies for these patients. All patients had a pleural fluid sample taken, which was then sent for a pleural fluid cytological analysis. Patients who did not receive a diagnosis following pleural fluid cytology had thoracoscopic biopsies.

For histopathological analysis, all biopsies taken from patients with recurrent pleural effusion were sent to a particular lab. Along with a particular neutrophil-lymphocyte ratio in the pleural fluid, a standard complete blood count was performed in the patients' serum. Various diagnoses recorded by the histology lab are regarded as positive results. Results are regarded as negative values if there is no conclusive diagnosis.

Results

Table 1: The Demographic data of patients in this study

Variables		**All patients (n = 100)**	
Demographic			
Age (years)			
Mean ± SD.		58.19 ± 10.99	
Median (IQR)		58.00 (47.50 - 69.00)	
Sex n (%)	male	52	52.0%
	female	48	48.0%
History of malignancy n (%)		38	38.0%
History of tuberculosis n (%)		6	6.0%
Smoking n (%)		21	21.0%
Hypertension n (%)		24	24.0%
DM n (%)		16	16.0%

IQR: **Inter quartile range** , SD: **Standard deviation**.

The demographic characteristics of the 100 patients included in this study are summarized in Table (1). The mean age was 58.19 years, with a standard deviation of 10.99 and a median of 58.00 (IQR: 47.50 - 69.00). 52.0% were males and 48.0% were females. A significant portion of patients, 38.0%, had a history of malignancy, while 6.0% had a history of tuberculosis. Smoking was reported by 21.0% of patients. The prevalence of hypertension and diabetes mellitus (DM) was observed in 24.0% and 16.0% of the participants, respectively.

Table 2: The Laboratory and radiological data of patients in this study

Variables		All patients (n = 100)	
Laboratory			
Hemoglobin (g/dL) Mean ± SD. Median (IQR)		8.05 ± 0.83 8.00 (7.00 - 9.00)	
Hematocrit (%) Mean ± SD. Median (IQR)		32.20 ± 4.38 32.00 (28.00 - 36.00)	
White Blood Cell Count (cells/mcL) Mean ± SD. Median (IQR)		14.42 ± 5.19 14.50 (11.00 - 19.00)	
Platelet Count (cells/mcL) Mean ± SD. Median (IQR)		135.91 ± 25.76 133.50 (115.00 - 158.50)	
Serum Creatinine (mg/dL) Mean ± SD. Median (IQR)		1.98 ± 1.10 1.70 (1.40 - 2.20)	
Blood Urea (mg/dL) Mean ± SD. Median (IQR)		35.91 ± 25.76 23.50 (115.00 - 78.50)	
Radiological			
Chest X-ray (pleural effusion side) n (%)	Right	55	55.0%
	Left	36	36.0%
	Bilateral	9	9.0%

IQR: **Inter quartile range** , SD: **Standard deviation**.

Hemoglobin levels were, for example, 8.05 g/dL on average and 32.00% on average. The platelet and white blood cell counts had respective values of 135.91 and 14.42 cells/mcL. The radiographic evaluation using chest X-rays shows the distribution of pleural effusion, with bilateral involvement of 9.0%, left side involvement of 36.0%, and right side involvement of 55.0% (Table 2).

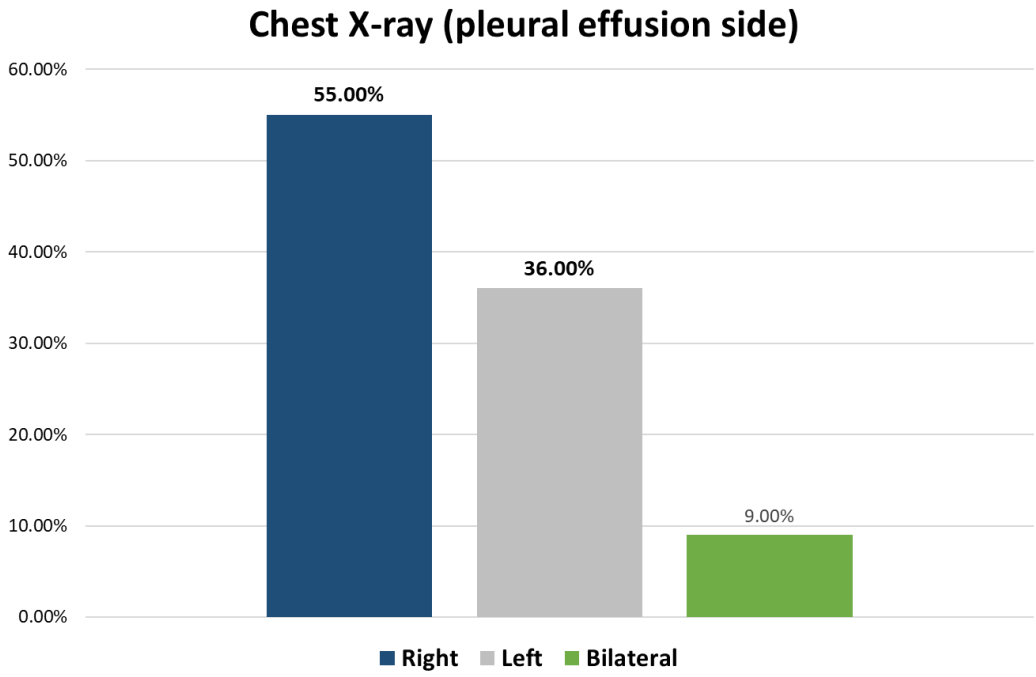

Figure 2: Chest X-ray (pleural effusion side) of patients in this study

Table 3: The pleural fluid examination of patients in this study

Variables		**All patients (n = 100)**	
Macroscopic			
Size of pleural effusion n (%)	Mild	39	39.0%
	Moderate	43	43.0%
	Massive	18	18.0%
Macroscopic appearance n (%)	Serous	53	53.0%
	Serosanguineous	31	31.0%
	Hemorrhagic	12	12.0%
	Whitish (pus or milky)	4	4.0%
Biochemical			
Pleural total protein Mean ± SD. Median (IQR)		5.21 ± 0.77 5.00 (5.00 - 6.00)	
Pleural albumin Mean ± SD. Median (IQR)		3.51 ± 0.50 4.00 (3.00 - 4.00)	
Pleural LDH		1237.14 ± 568.81	

Mean ± SD. Median (IQR)	1298.50 (767.50 - 1713.50)
Pleural total WBCs Mean ± SD. Median (IQR)	4.60 ± 1.61 5.00 (3.00 - 6.00)
Neutrophils (%) Mean ± SD. Median (IQR)	47.74 ± 19.93 47.00 (28.50 - 65.00)
Lymphocytes (%) Mean ± SD. Median (IQR)	49.24 ± 17.50 51.50 (31.50 - 63.00)
Monocytes (%) Mean ± SD. Median (IQR)	8.92 ± 6.01 7.50 (4.00 - 15.00)
Eosinophils (%) Mean ± SD. Median (IQR)	2.53 ± 1.11 3.00 (2.00 - 3.50)
Pleural/serum protein ratio Mean ± SD. Median (IQR)	69.07 ± 7.21 70.00 (63.00 - 75.00)
Pleural/serum LDH ratio Mean ± SD. Median (IQR)	84.52 ± 5.93 84.00 (80.00 - 90.00)

IQR: **Inter quartile range** , SD: **Standard deviation**.

According to pleural fluid macroscopic examination, the majority of patients exhibited moderate-sized plural effusions (43%) followed by mild ones (39%), and finally, huge plural effusions (18%). Furthermore, in terms of the multiple fluid's appearance, the majority of subjects had serous fluid (53%), followed by serosangineous fluid (31%), heamorragic fluid (12%), and whitish fluid (4%). The mean plural total protein was 5.21 ± 0.77, with a median of 5.00 in terms of biochemical characteristics. With a median of 4.00, the mean plural albumin was 5.3±0.50. With a median of 1298.50, the mean Plural LDH was 1237.14±568.81. 3.51 g of median pleural albumin and 5.21 g/dL of mean total protein. The mean total white blood cells (WBCs) in the cell composition were 4.60 cells/mcL, with neutrophils (47.74%), lymphocytes (49.24%), monocytes (8.92%), and eosinophils (2.53%) making up the distribution. The mean values for the pleural to serum protein ratio and LDH were 69.07 and 84.52, respectively (Table 3)

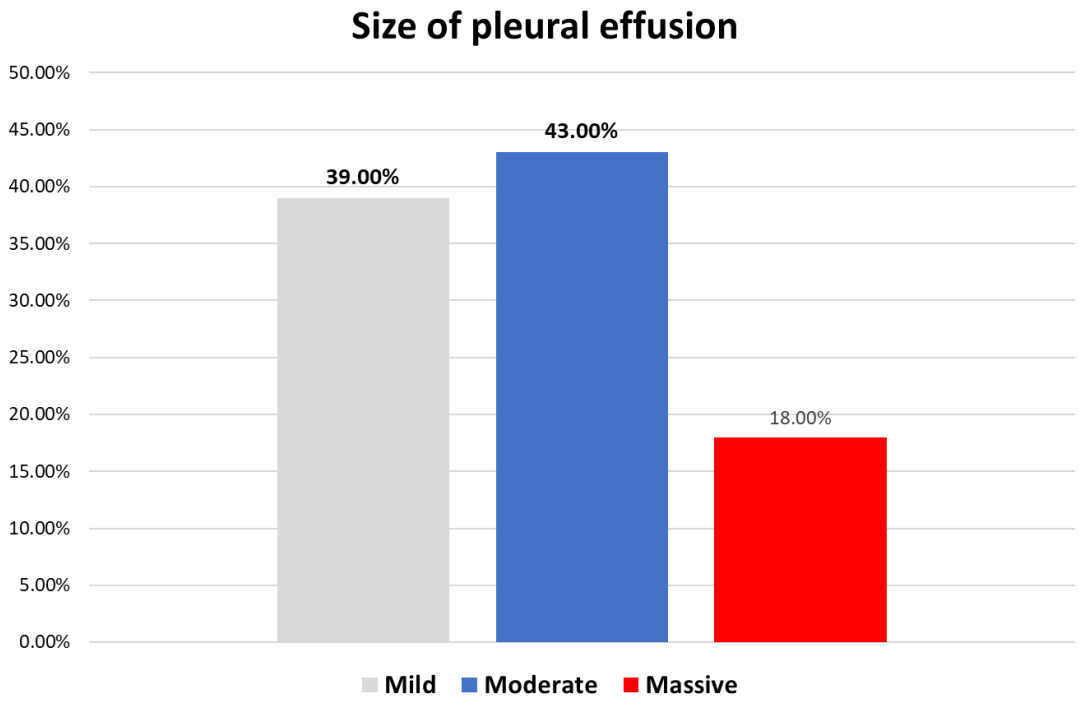

Figure 3: Size of pleural effusion of patients in this study

Table 4: The thoracoscopic findings of patients in this study

Variables		**All patients (n = 100)**	
Thoracoscopic findings			
Nodules n (%)	Absent	27	27.0%
	Solitary	23	23.0%
	Multiple	41	41.0%
	Diffuse	9	9.0%
Masses n (%)	Absent	52	52.0%
	Solitary	13	13.0%
	Multiple	26	26.0%
	Diffuse	9	9.0%
Plaques n (%)	Absent	74	74.0%
	Solitary	12	12.0%
	Multiple	14	14.0%
	Diffuse	0	0.0%
Adhesions n (%)	Absent	67	67.0%
	Present	33	33.0%

Pleural thickening n (%)	Absent	17	17.0%
	Present	83	83.0%

Nodules were seen in different patterns throughout the thoracoscopic findings: 9.0% showed widespread nodular formations, 27.0% showed nodules at all, 23.0% showed solitary nodules, and 41.0% showed numerous nodules. Similarly, masses were distributed as follows: 52.0% had no masses, 13.0% had single masses, 26.0% had many masses, and 9.0% had dispersed masses. In 74.0% of instances, there were no pleural plaques, while 12.0% had single plaques and 14.0% had many. Thirty-three percent of patients had adhesions, while sixty-seven percent did not. 83.0% of patients 17.0% did not exhibit pleural thickening, while 17.0% did (Table 4).

Table 5: Histopathological diagnosis of thoracoscopic pleural biopsy in this study

Variables		**All patients (n = 100)**	
Histopathological diagnosis			
Diagnosis n (%)	Benign/infective	36	36.0%
	Malignant	64	64.0%
Benign/infective n (%)	Tuberculosis	22	61.1%
	Empyema	5	13.9%
	Chronic non-specific inflammation	9	25.0%
Malignant n (%)	Adenocarcinoma	30	46.9%
	Squamous cell carcinoma	14	21.9%
	Malignant mesothelioma	7	10.9%
	Small cell carcinoma	7	10.9%
	Poorly differentiated carcinoma	4	6.3%
	Non-Hodgkin's lymphoma	2	3.1%

64.0% of the thoracoscopic pleural biopsies in this research were found to be malignant, whereas 36.0% were deemed benign or infectious based on histological investigation. With 61.1% of cases, tuberculosis was the most common diagnosis. Moreover, persistent non-specific inflammation was present in 25.0% of patients, and empyema was seen in 13.9% of cases. Adenocarcinoma accounted for 46.9% of malignant cases, making it the most prevalent malignant diagnosis. With corresponding percentages of 21.9% and 10.9%, squamous cell carcinoma and malignant mesothelioma each constituted noteworthy amounts (Table 5).

Table 6: Sensitivity and specificity of thoracoscopic pleural biopsy in this study

Variables	Thoracoscopic pleural biopsy
The diagnostic efficacy of thoracoscopy n (%)	95.0%
Sensitivity	93.8%
Specificity	100.0%
Positive predictive value	100.0%
Negative predictive value	90.0%

Thoracoscopy was 95.0% effective in diagnosing the condition. The procedure's sensitivity was 93.8%. Additionally, there was 100.0% specificity. 100.0% was the positive predictive value, indicating good reliability. 90.0% was the negative predictive value (Table 6).

Discussion

Thoracoscopy is often required for both therapeutic and diagnostic purposes. Thoracoscopy is a useful diagnostic technique for pleural effusions that have gone undetected, especially in individuals who have a high risk of developing cancer. Because of its higher yield and shorter hospital stay, thoracoscopy is more cost-effective overall. Because the pleural surface can be seen and a representative sample can be selected with ease, thoracoscopy therefore becomes a useful tool [(7)].

In order to ascertain the diagnostic utility of thoracoscopic biopsy in instances with unidentified exudative pleural effusion, this prospective, interventional, single center research was conducted. The average age in the present research was 58.19 years, with 48.0% of participants being female and 52.0% being male.

The findings of Alkaaki et al. [(8)] were consistent with this, as they discovered that 36.7% and 63.3% of patients with unidentified exudative plural effusion underwent VATS for a definitive diagnosis. They were 54.5 ±15.1 years old on average. This might be explained by the fact that 64% of patients had malignant plural effusions, with adenocarcinoma being the most prevalent kind.

According to Groner et al.[9], adenocarcinoma is more frequent in adults aged 60 to 70. Males were found to be more prevalent than females, which may be explained by smoking (21%), as well as TB infection (61.1% of patients). Due to greater rates of smoking, occupational exposure (asbestos), and certain types of cancer, men are more likely than women to have several effusions, including exudative ones. Autoimmune disorders are often the cause of effusion in females.

A retrospective analysis of patients who had uniportal VATS for inexplicable pleural effusions was carried out by Özkaya et al.[10]. There were 44.5% females and 55.4% men. They were 64.12 years old on average. Additionally, 40 instances with an unexplained exudative pleural effusion were evaluated by Almashtouly et al.[11]. The study found that 42.5% were women and 57.5% were men. They were 52.90±7.24 years old on average.

Additionally, our findings concurred with those of Salim and Torky [12], who reported that 26.7 percent of patients were female and 73.3% of patients were male. Additionally, Dadaş et al [7] showed that 161 male patients and 102 female patients made up the majority of cases. According to Wang et al. [13], there were 503 male patients and 330 female patients, with an average age of 57.8 ± 14.5 years.

According to Kapp et al. [14], PE was more prevalent in men (68.3%) than in women (31.7%). The mean age of the 12 females and 28 men in the Helala et al. [15] research was 51.3 ±16.3 years. So, guys were more likely than females to have undetected exudative pleural effusions.

Thirty-eight percent of patients had a history of cancer, and six percent had a history of TB. Of the patients, 21.0% reported smoking. A frequent side effect of cancer, especially lung, breast, and lymphoma, is malignant pleural effusion, which is defined by the presence of malignant cells in pleural fluid. It often results in exudative pleural effusion, which is linked to elevated fluid protein levels. The effusion may result from lymphatic or blood vascular involvement, direct tumor invasion of the pleura, or blockage of lymphatic drainage [16],[17].

Exudative pleural effusion is often caused by tuberculosis (TB), especially in areas where the disease is widespread, such as Egypt. A kind of extrapulmonary TB known as tuberculous pleural effusion (TPE) often manifests as fever, coughing, and pleuritic chest discomfort. In TPE, the pleural fluid is usually an exudate with a high protein and lactate dehydrogenase content and a lymphocyte preponderance. Exudative pleural effusions, especially those linked to TB or lung cancer, may be exacerbated by smoking [18].

According to Behera et al. [19], cancer was the most frequent reason for undetected exudative pleural effusion. Lung cancer was the most frequent cause of malignant pleural effusion (66.6%), followed by tubercular plural effusion (36.17%). Twenty-four percent of the individuals had hypertension, and sixteen percent had diabetes mellitus.

Similarly, 34.29% of patients in the Abdelmotaleb [20] research had diabetes mellitus. Pleural effusion risk is elevated in individuals with diabetes, especially those with chronic diabetes. Even though these effusions are often benign, they may be exudative and might be linked to increased capillary membrane permeability or left ventricular failure.

According to laboratory analysis of the pleural fluid of our patients under study, the median hematocrit was 32.00% and the mean hemoglobin was 8.05 g/dL, indicating a spectrum of anemia severity. With values of 14.42 and 135.91 cells/mcL, respectively, the white blood cell and platelet counts provided insight into possible infection or inflammatory processes. The mean total white blood cells (WBCs) in the pleural fluid of our patients under study were 4.60 cells/mcL, according to the findings of microscopic analysis (cytological parameters), with neutrophils (47.74%), lymphocytes (49.24%), monocytes (8.92%), and eosinophils (2.53%) making up the distribution. Additionally, the mean values of the pleural to serum protein and LDH ratios were determined to be 69.07 and 84.52, respectively.

According to the findings of the Kotb et al. [21] study, the mean protein content of the pleural fluid was 4.8 ± 0.63 mg/dl, the mean glucose content was 78 ± 11.2 mg/dl, and the mean LDH content was 485.08 ± 95.3. The microscopic analysis of the pleural fluid of the patients under study revealed that 75% of the patients had leukocytes, 38% mesothelial cells, and 10% inflammatory cells.

This is consistent with the findings of Karaki et al.[22], who discovered that the effusions were mostly leukocyte (lymphocytic) and that the mean levels of protein and glucose were 65.5 mg/dL and 5.6 mg/dL, respectively. The mean value of LDH was 476.4. The average lymphocyte and neutrophil counts were 69% and 29.2%, respectively. The pleural fluid of 60 out of 82 individuals had no red blood cells. The fluid was blatantly hemorrhagic in 22 individuals.

Direct vision was made possible by thoracoscopy in the current study. The gross thoracoscopic picture of the studied group showed nodules in a variety of patterns, with 27.0% showing nodule absence, 23.0% showing solitary nodules, 41.0% showing multiple nodules, and 9.0% showing diffuse nodular formations. Similarly, masses were distributed as follows: 52.0% had no masses, 13.0% had single masses, 26.0% had many masses, and 9.0% had dispersed masses. In 74.0% of instances, there were no pleural plaques, while 12.0% had single plaques and 14.0% had many. Remarkably, there were no diffuse plaques seen. Thirty-three percent of patients had adhesions, while sixty-seven percent did not. Pleural thickness was a common observation, appearing in 83.0% of patients and not present in 17.0% of patients.

Similar findings were made by Sobh et al.[23], who discovered numerous pleural nodules in 265 (48.9%) of the patients. This visualization made it possible to take samples from the aberrant areas in order to properly diagnose the condition.

Dhooria et al. [24] found that adhesions and nodules were present in 65.9% of patients, which is consistent with the same findings. According to Patil et al.[1], pleural nodules and thickened non-smooth pleura were the most frequent gross appearances, followed by black anthracotic patches. These variations result from the pleura's pathogenic involvement varying depending on the geographic location.

Additionally, our results were consistent with a research by Yousef et al. [25] that found a variety of macroscopic characteristics in the pleura, including masses, adhesions, and nodules. Nodules were the most frequent gross lesion, occurring in 27 (75%), whereas adhesions, plaques, masses, and violaceous appearances were seen in 8 (22.2%), 6 (16.7%), and 5 (13.9%) of the patients, respectively.

This might be because there are more metastatic adenocarcinoma instances that mostly manifest as nodules. Adhesions (38.2 and 42.5%, respectively) and nodules (48.5 and 82.5%, respectively) were the most prevalent findings in two studies that provided strong support for our findings: Prabhu and Narasimhan [26] and Mohamed et al.[27].

This study's histological analysis of thoracoscopic pleural samples produced a wide range of classifications. Of the total number of cases, 64.0% were found to be malignant, while 36.0% were found to be benign or infectious. With 61.1% of cases, TB was the most common diagnosis in the benign/infectious category. Furthermore, empyema was identified in 13.9% of instances, and chronic non-specific inflammation was found in 25.0% of cases.

In their research, Kotb et al. [21] discovered that malignant pleural mesothelioma was the most frequent cause of pleural effusion, occurring in 21 (44%) of the patients. This is consistent with the findings of Wang et al.[13], who discovered that malignant pleural effusion was verified in 41.1% of patients. They said that the two most common causes of pleural effusion were TB and cancer. These findings are also consistent with those of a number of studies where the majority of patients with undiagnosed pleural effusions had malignancy as their final diagnosis.

For example, in Helala et al.[15], the percentage of cases of malignant pleural effusion was 70, 74.4, and 83.9%, respectively.

Furthermore, our results of malignant pleuritis are within the range of previous studies, including those by McDonald et al.[28], Menzies and Charbonneau [29], Deschuyteneer and De Keukeleire [6], Harris et al. [30], and Alkaaki et al.[8], which were 60.0%, 54.0%, 44.3%, and 44.2%, respectively. Naturally, this also relies on your patient group, whether the data were gathered in a country where tuberculosis is widespread, and the diagnostic work done before to the thoracoscopy (such as imaging, the number of thoracenteses, and closed pleural biopsy).

Our results are consistent with those of Yousef et al. [25], who discovered that malignancy was the most common histopathological result of diagnosed patients, occurring in 25/36 (69.4%) cases, followed by two (5.6%) cases of tuberculous

pleuritis, one (2.8%) with rheumatoid arthritis, and another (2.8%) with empyema. However, seven (19.4%) patients had nonspecific pleurisy.

These findings were also consistent with those of a number of studies in which the majority of patients with undiagnosed pleural effusion were ultimately diagnosed with malignancy. For example, in the studies by Mootha et al.[31], Helala et al.[15], Mohamed and Shaban [27], and Ali et al. [32], the corresponding numbers of malignant pleural effusion cases were 73, 70, 74.4, and 83.9%, respectively.

Our results for malignant pleuritis were higher than those of the Liu et al. [33] study, where malignant origin ranked first (38.7%) for etiological analysis of pleural effusion, primarily subclassified into inflammatory origin (11.3%), tuberculous origin (19.8%), and lung-originating pleural metastatic carcinomas.

Additionally, Chen et al. [34] found that non-specific pleuritis was 15.1%, tuberculous pleuritis was 23.3%, and cancer metastasis was 43.0%. Additionally, the final histological diagnosis in the Abdelmotaleb [20] research was nonspecific inflammation in 15 patients (14.29%), malignancy in 33 patients (31.43%), and pleural TB in 57 patients (54.29%). Malignant, tuberculous, and inflammatory causes accounted for 56.2%, 21.6%, and 17.5% of the etiological analysis of patients with pleural effusion who received MT in Zhang et al. [35], a meta-analysis encompassing 2380 patients.

According to Wu et al. [36], another large sample research, 38.7% of patients with malignant causes had metastatic carcinomas, mostly from the lung (78.1%). Lung cancer accounts for 85.2% of metastatic cancer in MPE. Adenocarcinoma accounted for 46.9% of malignant cases in this research, making it the most prevalent malignant diagnosis. With corresponding percentages of 21.9% and 10.9%, squamous cell carcinoma and malignant mesothelioma each constituted noteworthy amounts. Additionally, non-Hodgkin's lymphoma, small cell carcinoma, and poorly differentiated carcinoma were found to account for 3.1%, 6.3%, and 10.9% of malignant cases, respectively.

This was consistent with a study by Yousef et al. [25] that found that among patients with malignant pleural effusion, metastatic adenocarcinoma was the most common pleural malignancy, occurring in nine patients (25%) and followed by mesothelioma in six (16.7%), undifferentiated carcinoma in three (8.3%), small cell carcinoma in three (8.3%), squamous cell carcinoma in two (5.6%), and lymphoma in two (5.6%).

The total accuracy and sensitivity of our research were 95.0% and 93.8%, respectively. Similarly, overall sensitivity ranged from 80.9% to 92.4% in the research of Deschuyteneer and De Keukeleire [6].

This is similar to the 93% sensitivity found in the most recent meta-analysis by Wei et al.[37]. However, under general anesthesia, the sensitivity range for video aided thoracoscopy is within the same range or slightly higher (82.3% to 95.2%).

The negative predictive value in our study was 90%, which is similar to the 85%–90% in Menzies and Charbonneau (1991) (95% CI 84% to 96% and 78% to 92%, depending on possible diagnoses in patients lost to follow-up). However, it was likely slightly higher than the negative predictive value in the McDonald et al. [28] study, which ranged from 76% to 57.6% for any diagnosis.

Conclusion

Anytime a pleural effusion goes undetected, a medical thoracoscopy should be done as soon as feasible. A useful diagnostic technique for unidentified exudative pleural effusion is medical thoracoscopy. It is an easy-to-use, secure technique with a good diagnostic yield and little complications. Doctors should allow the right patients to use it.

References

1. **Patel KM, Ullah K, Patail H, Ahmad S**. Ultrasound for Pleural Disease. Beyond a Pocket of Pleural Fluid. Ann Am Thorac Soc [Internet]. 2021;18(5):749–56.
2. **Kashyap MM, Sagar JH, Varadharajulu G**. Effect of Manual Positioning as an Adjunct to Intercostal Drainage tn Hydropneumothorax. Indian J Public Heal Res & Dev [Internet]. 2019;10(7):31.
3. **Jany B, Welte T**. Pleural Effusion in Adults—Etiology, Diagnosis, and Treatment. Dtsch Arztebl Int [Internet]. 2019;
4. **Na MJ**. Diagnostic Tools of Pleural Effusion. Tuberc Respir Dis (Seoul) [Internet]. 2014;76(5):199.
5. **Allen A, Buckley G**. Pleural Effusion [Internet]. Clinical Small Animal Internal Medicine. Wiley; 2020. p. 333–44.
6. **Deschuyteneer EP, De Keukeleire T**. Diagnostic value and safety of thoracoscopic pleural biopsies in pleural exudative effusions of unknown origin, including follow-up. BMJ Open Respir Res [Internet]. 2022;9(1):e001161.
7. **Dadas E, Erdogdu E, Toker A, et al.** Effectiveness of Video-Assisted Thoracoscopic Surgery in Undiagnosed Exudative Pleural Effusions. Turkish Thorac J [Internet]. 2019;20(3):188–91.
8. **Alkaaki A, Gilbert S**. Surgical Management of Pleural Diseases – Primer for Radiologists. Semin Roentgenol [Internet]. 2023;58(4):463–70.
9. **Groner LK, Green DB, Weisman S V, Legasto AC, Toy D, Gruden JF, et al.** Thoracic Manifestations of Rheumatoid Arthritis. RadioGraphics [Internet]. 2021;41(1):32–55.
10. **Özkaya M**. Diagnostic Efficacy of Uniportal Video-Assisted Thoracoscopic Surgery in the Undiagnosed Pleural Effusion. Haydarpasa Numune Train Res Hosp Med J [Internet]. 2018;
11. **Almashtouly ZM, El-Sokkary IN, Zaki I**. Role for Video-Assisted

Thoracoscopy in Undiagnosed Pleural Effusion: An Audit to Represent our Clinical Experience? Int J Med Arts [Internet]. 2021;3(3):1516–24.

12. **Salim EF, Torky AA**. VATS versus ultrasound-guided Abrams needle biopsy in undiagnosed pleural effusion: Old wisdom and new insights. J Egypt Soc Cardio-Thoracic Surg [Internet]. 2018;26(2):151–8.

13. **Wang F, Wang Z, Tong Z, Xu L, Wang X, Wu Y**. A Pilot Study of Autofluorescence in the Diagnosis of Pleural Disease. Chest [Internet]. 2015;147(5):1395–400.

14. **Kapp CM, Lee HJ**. Malignant Pleural Effusions. Clin Chest Med [Internet]. 2021;42(4):687–96.

15. **Helala LA, El-Assal GM, Farghally AA, El Rady MMA**. Diagnostic yield of medical thoracoscopy in cases of undiagnosed pleural effusion in Kobri El-Kobba Military Hospital. Egypt J Chest Dis Tuberc [Internet]. 2014;63(3):629–34.

16. **Harding WC, Halawa AR, Aiche MM, Zafar B, Ali H-JR, Bashoura L, et al.** Pleural Effusion: Shedding Light on Pleural Disease Beyond Infection and Malignancy. Medicina (B Aires) [Internet]. 2025;61(3):443.

17. **Gonnelli F, Hassan W, Bonifazi M, Pinelli V, Bedawi EO, Porcel JM, et al.** Malignant pleural effusion: current understanding and therapeutic approach. Respir Res [Internet]. 2024;25(1).

18. **Jones SA, Biswas N, Davies HE**. Tuberculosis Related Pleural Effusion: An Update. Curr Pulmonol Reports [Internet]. 2025;14(1).

19. **Behera AK, Ganga R, Kumar V, Sahu D, Kiran SS, Gupta RK, et al.** Prospective Evaluation of Safety and Diagnostic Efficacy of Medical Thoracoscopy in Undiagnosed Exudative Pleural Effusion: Experience From a Tuberculosis High-Burden Country. Cureus [Internet]. 2024;

20. **Abdelmotaleb MS**. Video-assisted thoracoscopic surgery for patients with undiagnosed exudative pleural effusion. SVU-International J Med Sci [Internet]. 2022;0(0):0.

21. **Kotb MA, AbdRabouh MM, Abouiznied MAM, Osman DM**. Comparative Study of Aspiration Cytology, Video-Assisted Thoracoscope and Open Biopsy in Undiagnosed Pleural Effusion. Egypt J Hosp Med [Internet]. 2022;89(1):5207–12.

22. **Karki A, Riley L, Mehta HJ, Ataya A**. Abdominal etiologies of pleural effusion. Disease-a-Month [Internet]. 2019;65(4):95–103.

23. **Sobh E, Elsawy S, Ahmed M**. Yield of medical thoracoscopy in undiagnosed exudative pleural effusion: a 3-year retrospective multicenter study. Al-Azhar Assiut Med J [Internet]. 2020;18(2):203.

24. **Dhooria S, Singh N, Aggarwal AN, Gupta D, Agarwal R**. A Randomized Trial Comparing the Diagnostic Yield of Rigid and Semirigid Thoracoscopy in Undiagnosed Pleural Effusions. Respir Care [Internet]. 2014;59(5):756–64.

25. **Yousef AERI, Morsi AF, El-Shabrawy M, El Shahaat HA**. The role of medical thoracoscopy in the diagnosis of exudative pleural effusion at the Chest Department of Zagazig University Hospitals. Egypt J Bronchol [Internet]. 2016;10(3):225–31.

26. **Prabhu VG, Narasimhan R**. The role of pleuroscopy in undiagnosed exudative pleural effusion. Lung India [Internet]. 2012;29(2):128.

27. **Mohamed SA, Shaban MM**. Diagnostic yield of medical thoracoscopy in diagnosis of exudative pleural effusion: One year prospective study. Egypt J Chest Dis Tuberc [Internet]. 2014;63(4):897–905.

28. **McDonald CM, Pierre C, de Perrot M, Darling G, Cypel M, Pierre A, et al.** Efficacy and Cost of Awake Thoracoscopy and Video-Assisted Thoracoscopic Surgery in the Undiagnosed Pleural Effusion. Ann Thorac Surg [Internet]. 2018;106(2):361–7.

29. **Menzies R, Charbonneau M**. Thoracoscopy for the Diagnosis of Pleural Disease. Ann Intern Med [Internet]. 1991;114(4):271–6.

30. **Harris RJ, Kavuru MS, Mehta AC, VanderBrug Medendorp S, Wiedemann HP, Kirby TJ, et al.** The Impact of Thoracoscopy on the Management of Pleural Disease. Chest [Internet]. 1995;107(3):845–52.

31. **Mootha VK, Agarwal R, Singh N, Aggarwal AN, Gupta D, Jindal SK**. Medical Thoracoscopy for Undiagnosed Pleural Effusions: Experience from a Tertiary Care Hospital in North India. Indian J Chest Dis Allied Sci [Internet]. 2022;53(1):21–4.

32. **Ali I, Amrou R, Ibrahim M**. Etiology of Pleural Effusion among Adults in Three University Hospitals in Beirut: A One-Year Retrospective Cross Sectional Analytical Study. Int J Respir Pulm Med [Internet]. 2021;8(1).

33. **Liu X-T, Dong X-L, Zhang Y, Fang P, Shi H-Y, Ming Z-J**. Diagnostic value and safety of medical thoracoscopy for pleural effusion of different causes. World J Clin Cases [Internet]. 2022;10(10):3088–100.

34. **Chen R, Zhang Y, Wang J, Wu H, Yang S**. Diagnostic value of medical thoracoscopy for undiagnosed pleural effusions. Exp Ther Med [Internet]. 2018;

35. **Zhang X, Wang F, Tong Z**. Application of Narrow-Band Imaging thoracoscopy in diagnosis of pleural diseases. Postgrad Med [Internet]. 2020;132(5):406–11.

36. **Wu Y-B, Xu L-L, Wang X-J, Wang Z, Zhang J, Tong Z-H, et al.** Diagnostic value of medical thoracoscopy in malignant pleural effusion. BMC Pulm Med [Internet]. 2017;17(1).

37. **Wei Y, Shen K, Lv T, Liu H, Wang Z, et al.** Comparison between closed pleural biopsy and medical thoracoscopy for the diagnosis of undiagnosed exudative pleural effusions: a systematic review and meta-analysis. Transl Lung Cancer Res [Internet]. 2020;9(3):446–58.