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ORIGINAL ARTICLES

# *Current Situation and Management of Pleural Effusion in PHI Clinical Hospital Tetovoe*

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## *Abstract*

***Introduction:*** Pleural effusion is a disturbance in the balance between fluid production and elimination in the pleural space, resulting in abnormal fluid accumulation. It can result from various medical conditions related to the lungs and pleura or systemic diseases. Identifying the etiology of pleural effusion is essential for effective treatment. According to Light's criteria, pleural effusions are transudative and exudative.

***Material and Methods:*** For this research, we collected data from the existing documentation in the Department of Pulmonology and Respiratory Allergology at PHI Clinical Hospital Tetovo from June 2022 to June 2023. This study included 133 patients with dyspnea, persistent chest pain, fatigue, hemoptysis, cough, a history of past illnesses, and other comorbid conditions. The data collection process was rigorous, and we followed ethical guidelines to ensure the reliability of our findings.

***Results:*** The patients included in our study were between 36 to 84 years old. Of them, 72,9% were males, and 27,1% were females. 85,7% were smokers, and 14,3% were non-smokers. 75,0% of patients complained of dyspnea, and 24,8% had hemoptysis. From the ultrasonography findings, 15,0% had an alteration in the left lung, 11,3% in the right lung, 20,3% of patients were punctuated to the left side, and 24,8% were punctuated to the right lung. In comparison, 1,5% were punctuated to both sides. In 2,3% of the subjects, computed tomography described an effusion in the left lung.

***Conclusion:*** The results suggest that pleural effusion is associated with various diseases, especially heart failure and malignant diseases. Our study underscores the importance of early detection of the cause of pleural effusion and the underlying disease for successfully managing and treating the disease. The insights from our research can guide healthcare professionals in developing effective treatment strategies and improving patient outcomes.

***Keywords:*** pleural effusion, lung cancer, thoracocentesis

## *Introduction*

Pleural effusion, a disturbance in fluid balance in the pleural space, can result from various medical conditions. Identification of its cause is essential for effective treatment. [1]

Healthcare providers play a crucial role in diagnosing pleural effusion, indicating approximately 75% of the causes by analyzing pleural fluid cytology, biochemistry, and the patient's overall clinical presentation.[2]

However, up to 20% of cases remain idiopathic, highlighting the complexity of pleural effusions and the need for thorough investigations.[3] Understanding the characteristics of this fluid and its relationship to the patient's symptoms is integral to the diagnostic process and the identification of the underlying pathology for effective treatment strategies.[4]

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According to Light's criteria, pleural effusions are transudative and exudative. [5, 6]. Transudate effusions are associated with systemic conditions such as congestive heart failure, cirrhosis, ascites, nephrotic syndrome, prothorax, and peritoneal dialysis.[7] Exudate effusions, unlike transudate effusions, are a result of various factors related to the lungs and pleura, such as inflammatory processes, trauma, hemorrhage (hemothorax), chylothorax (surgery, malignancy, idiopathic, congenial, filariasis, trauma), malignancy, congenital diseases. [8]

The clinical presentation of pleural effusion is highly variable and depends on both the volume of the fluid and the underlying medical cause.[8]

Pleural effusions are usually discovered incidentally during imaging studies for other conditions; many patients are asymptomatic. When symptoms do occur, they typically include pleuritic chest pain, dyspnea (shortness of breath), and a dry, nonproductive cough [9].

The presence of pleuritic pain in the chest indicates a pleural effusion resulting from inflammation of the parietal pleura. Such inflammation usually occurs due to friction of the pleural surface during deep inhalation, coughing, and sneezing. The pain is sharp and can be localized or referred to other areas of the chest and back. [8, 9]

The movement will increase this pain, but it may reduce when the thorax is immobilized, or enough fluid is accumulated to keep the pleural surfaces apart so they do not rub against each other. Another common symptom of pleural effusion is dyspnea, which results from fluid pressure on the lungs, limiting lung expansion during inspiration. [10]

The intensity of dyspnea generally correlates with the amount of accumulated fluid; more considerable accumulation causes more pronounced shortness of breath. Because it is a nonspecific symptom that indicates many conditions that involve either the chest or are systemic, taking a medical history and physical examination of the individual plays a significant role. [8, 9, 10, 11]

These include differential diagnoses such as pleural effusion from pneumonia, pulmonary embolism, or cardiac diseases. A diagnostic chest X-ray or CT scan often confirms that someone has fluid in the pleural space and can identify its etiology. [12]

Based on this, in the case of pleural effusion, the management approach usually starts with addressing the underlying cause on the one hand and starting with symptomatic treatment at the same time. Imaging methods are used as tools for accurate diagnosis of pleural effusion. In general, a chest X-ray can confirm the presence of a pleural effusion, with obturation of costophrenic angle and homogenous opacity. [8-12]

Lung ultrasonography is highly sensitive and specific for the detection of pleural effusions and has the advantage of being able to guide and monitor thoracocentesis in real-time.[13] Computed tomography provides a more accurate picture and helps indicate the underlying causes of pleural effusion, such as tumors, and the extent and nature of the effusion, whether fluid or loculated.[14]

Thoracocentesis is performed for diagnostic purposes, including aspiration of pleural fluid to be analyzed. Pleural fluid analysis consists of biochemical tests for protein, LDH, glucose, microbiological culture, cytology, and unique markers for tuberculosis and malignancy. If thoracocentesis does not provide an adequate diagnosis, a pleural biopsy may be performed to obtain specimens for histopathological examination. [14, 15]

Treatment may include removing fluid through thoracocentesis and strategies to prevent accumulation, such as pleurodesis or surgical interventions, depending on the etiology and general condition of the patient [16, 17].

Therefore, healthcare professionals can shape their research and management strategies based on the specifics of symptoms and possible fluctuations in the symptom profile to meet individual needs better. This personalized approach is integral to effective treatment and ensuring its success. [17]

Based on previous research, the most common causes of pleural effusion are congestive heart failure, malignant diseases, pneumonia, and pulmonary embolism.

Other causes of pleural effusion are nephrotic syndrome or pancreatitis. Malignant pleural effusions often develop from lung and breast cancer. Current options for managing malignant pleural effusions are repeated thoracocentesis, chemical pleurodesis using talc as an agent, or placement of a pleural catheter. [18]

The main goal of this research is to direct attention to patients with pleural effusion and the management of this complex health problem. It is essential to determine the cause of the pleural effusion and the type of pleural fluid using clinical diagnostic methods to resolve the effusion.

Detecting the type of effusion and the causative agent, i.e., the underlying disease that led to fluid accumulation, is crucial for managing pleural effusion. Choosing the best and most effective treatment to reduce mortality is also necessary.

## *Material and Methods*

For this research, we collected data from the existing documentation in the Department of Pulmonology and Respiratory Allergology at PHI Clinical Hospital Tetovo for 12 months, from June 2022- June 2023. This study included 133 patients with dyspnea, persistent chest pain, fatigue, hemoptysis and cough, history of past illnesses, and other comorbid conditions. This research was approved by the Ethics Committee at PHI Clinical Hospital Tetovo on 18 Aug 2022 (No 03-2147/5). After the request submitted by Mr. Dr. Ruzhdi Rexhepi, PhD student at the Faculty of Medical Sciences, Goce Delcev University, Stip (No. 03-1288/1 from 13.05.2022), the Ethics Committee allowed him to collect and process data necessary for this research.

The following data were collected from the patients included in the study: age, gender, residency, smoking status, duration of smoking, number of cigarettes smoked per day, dyspnea, hemoptysis, ECG (frequency, axis), past

illnesses, days of hospitalization, X-ray of the lungs, CT of the lungs, laboratory analyses, histological findings, results of bronchoscopy, localization of infiltrative shadow with imaging methods, ultrasonography examination of the lungs, gas analyses, type of treatment and QLQL-LC13 questionnaire.

The structure of the collected data is shown in Table 1.

| Nr. | Category | Options |
|---|---|---|
| 1 | Age | Years |
| 2 | Gender | M/F |
| 3 | Residence | Rural/Urban |
| 4 | Smoking | Yes/No |
| 5 | Years of smoking | 0-60 |
| 6 | Cigarettes per day | 0-60 |
| 7 | Dyspnea | Have /Do not have |
| 8 | Hemoptysis | Have /Do not have |
| 9 | ECG | Frequency |
| 10 | Axis | Left axis deviation/Right axis deviation/Normal axis |
| 11 | Past illnesses | Have/Denies |
| 12 | Hospitalization | Number of days (0-20) |
| 13 | X-ray of the lugs | Basal/Hilar/Apical/Peripheral/ Infiltrative/Right/Left |
| 14 | CT of the lungs | Basal/Hilar/Apical/Peripheral/ Infiltrative/Right/Left |
| 15 | Laboratory findings | Blood count, CRP, LDH |
| 16 | Histological finding | Type of lung cancer |
| 17 | Cytological finding | Classification group (1-5) |
| 18 | Bronchoscopy | Positive finding/Negative finding |
| 19 | Infiltrative shadow | Basal/Hilar/Apical/Peripheral/ Infiltrative/Right/Left |
| 20 | Ultrasonography of | None/Present/Left/Right/Both sides |
| | the lungs | Function Left/Right/Both sides |
| 21 | Gas analyzes | pH, PCO2, PO2 |
| 22 | Treatment | Diuretics, Thoracocentesis, Pleuracan, Talc |
| 23 | QLQL-LC13 score | There is/There is none |

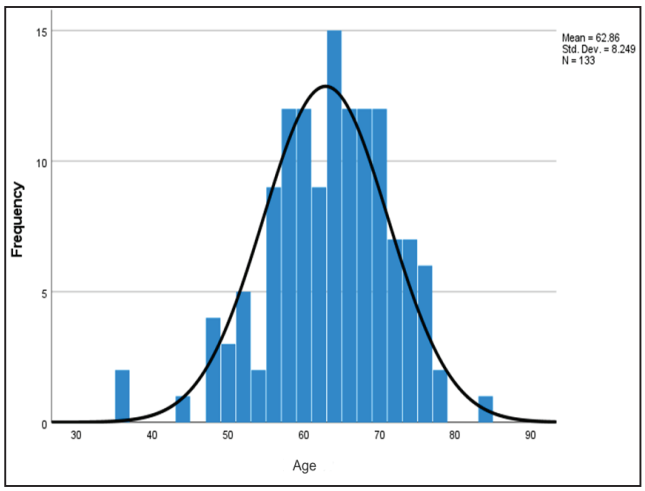
*Table 1. Structure of collected data*

The data were processed using descriptive statistical methods and the software package SPSS.

## *Results*

According to the collected data, our study includes patients aged 36-84 years (Graph 1).

The gender structure of the patients is 72,9% to 27,1% male to female. According to residence, the sample is dominated by patients from rural areas, with 61,7% (82 subjects) against 38,3% (or 51 subjects) living in a city. From the processed responses of the patients, we find that the majority, 85,7% (114 patients), are smokers, while only




*Graph 1. Age of the patients*

14,3% (or 19 patients) are non-smokers. Table 2 shows the data on the number of cigarettes smoked per day.

| No. of cigarettes | Frequency | Percentage |
|---|---|---|
| **0** | 19 | 14,3 |
| **5** | 2 | 1,5 |
| **10** | 2 | 1,5 |
| **15** | 5 | 3,8 |
| **20** | 49 | 36,8 |
| **25** | 3 | 2,3 |
| **30** | 27 | 20,3 |
| **40** | 20 | 15,0 |
| **50** | 2 | 1,5 |
| **60** | 4 | 3,0 |
| **Total** | 133 | 100,0 |

*Table 2. Number of cigarettes smoked per day*

From the processed data from Table 2, the following dominance is established (from 72.1% of subjects):

- Smoking 20 cigarettes per day, 49 subjects, or 36,8%
- Smoking 30 cigarettes per day, 27 subjects, or 20,3%
- Smoking 40 cigarettes per day, 20 subjects, or 15,0%

The duration of smoking ranges from 6 to 60 years, with the predominance of *30 years: 32 subjects (24,1%), 40 years: 18 subjects (13,5%), and 50 years: 18 subjects (13,5%).*

Processing quality-of-life data (anamnesis) allows us to pinpoint the following health conditions that are predominantly present in patients: *dyspnea, hemoptysis, and past illnesses.* These data are shown in Table 3.

| Condition | Have (%) | Do not have (%) |
|---|---|---|
| Dyspnea | 75,0 | 25,0 |
| Hemoptysis | 24,8 | 75,2 |
| Past illnesses | 68,0 | 32,0 |

*Table 3. The health condition of the subjects*

To determine the current situation, the following analyses/findings were made: laboratory analyses, ECG, ultrasonography of the lungs, X-ray, computed tomography, bronchoscopy, and cytological and histopathological findings. The results of the most relevant methods used to determine lung-related diseases are shown in Table 4, Chart 2, Chart 3, Table 5, Table 6, and Chart 4.

| | Frequency | Percentage |
|---|---|---|
| **Alteration-left** | 20 | 15,0 |
| **Alteration-right** | 15 | 11,3 |
| **Punction-left** | 27 | 20,3 |
| **Punction-right** | 33 | 24,8 |
| **Alteration-both sides** | 34 | 25,6 |
| **Punction-both sides** | 2 | 1,5 |
| **Total** | 133 | 100,0 |

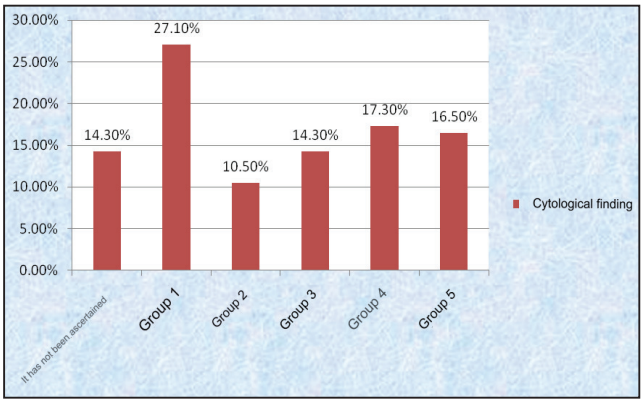
*Table 4. Results of the lung ultrasonography*

According to the lung ultrasonography findings, there was a change in the left lung in 15,0% of the patients, a change in the right lung in 11,3%, and a change in both sides in 25,6%. Punction in the left lung was done in 20,3%, puncture in the right side in 24,8%, and bilaterally in 1,5% of the total number of patients.

Computed tomography as a diagnostic method describes the changes in lung tissue as follows:

- Hilar region, left lung - 14 subjects, or 10,5%
- Hilar region, right lung - 12 subjects, or 9,0%
- Basal region, left lung - 2 subjects, or 1,5%
- Basal region, right lung - 2 subjects, or 1,5%
- The apical region, left lung - 24 subjects, or 18,0%
- The apical region, right lung - 41 subjects, or 30,8%
- Peripheral, right - 1 subject, or 0,8%
- Infiltrative change, left lung - 10 subjects, or 7,5%
- Infiltrative change, right lung - 3 subjects, or 2,3%
- Infiltrative change, both sides - 1 subject, or 0,8%

Computed tomography described an effusion in the left lung in 2.3% of the subjects. According to computed tomography, 15.0% of the subjects had no changes in the lung tissue.



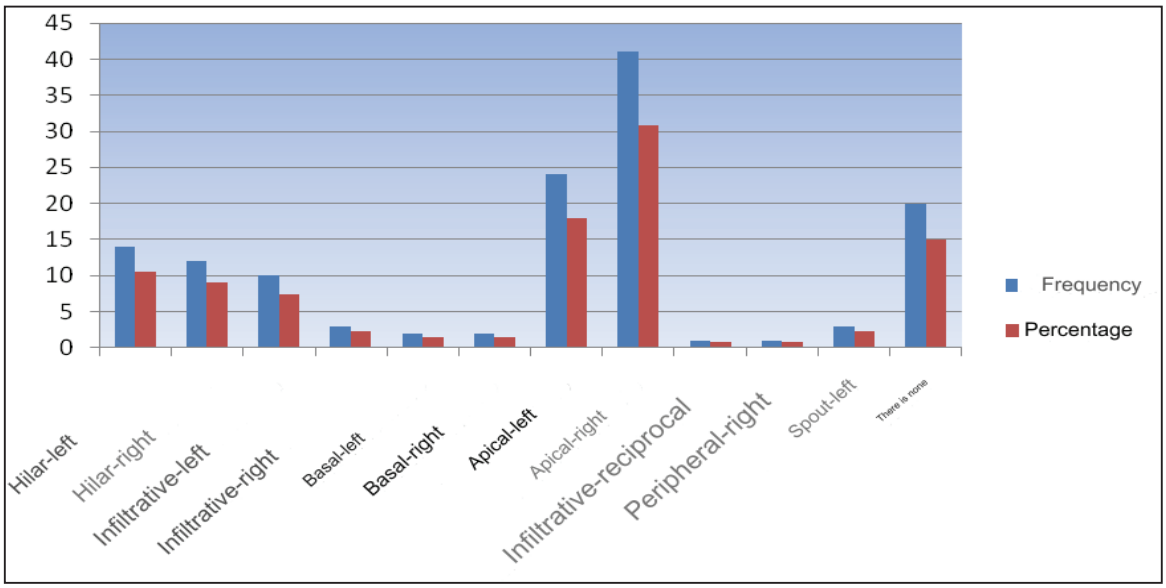

*Graph 3. Results of cytological findings*

From the analyzed data for 133 patients for the performed cytological analysis, the following findings were obtained Classification: Group 1, in 36 patients, or 27,1%; Group 2, in 14 subjects, or 10,5%; Group 3, in 19 subjects, or 14,3%; Group 4, in 23 subjects, or 17,3%; Group 5, in 22 subjects, or 16,5%.

Nothing was found in 19 subjects or 14.3%, or they did not have a cytological analysis.

| | Frequency | Percentage |
|---|---|---|
| **Positive finding** | 110 | 82,7 |
| **Negative finding** | 10 | 7,5 |
| **Have not done** | 13 | 9,8 |
| **Total** | 133 | 100 |

*Table 5. Bronchoscopy findings*




*Graph 2. Results of computed tomography*

From the analyzed information, for 133 patients who did or did not undergo bronchoscopy, we come to the following results: Positive findings in 110 subjects, or 82,7%; Adverse findings, in 10 sub, jects or 7,5%, while 13 subjects, or 9,8%, have not had a bronchoscopy examination.

| | Frequency | Percentage |
|---|---|---|
| **Have** | 112 | 84,2 |
| **Do not have** | 20 | 15 |
| **Have, on both sides** | 1 | 0,8 |
| **Total** | 133 | 100 |

*Table 6. The presence of pleural effusion*

The processed data of 133 subjects regarding pleural effusion allow us to ascertain the following situation: 112 subjects, or 84.2%, were diagnosed with one-sided pleural effusion, while only one subject, or 0.8%, had it bilaterally. This condition has not been verified in the remaining 20 subjects, or 15% of the sample.

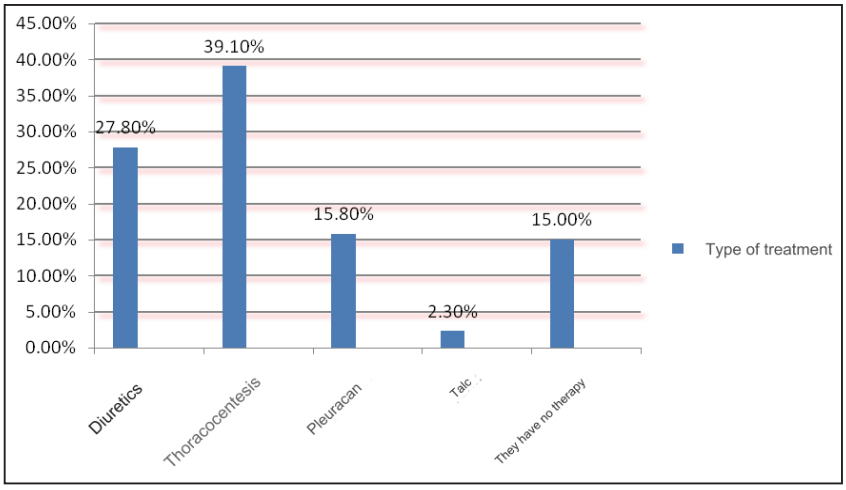



*Chart 4. Methods used to treat pleural effusion*

Regarding the methods used to treat pleural effusion, presented in Chart 4, we conclude: Thoracocentesis - although it is an invasive method to remove fluid or air from the pleural space, it is the most used procedure in 52 subjects or 39,1%; Diuretics - were used in 37 subjects or 27,8%; Pleuracan - was used in 21 subjects or 15,8%; Talc - was used in 3 subjects or 2,3%, or Without medication - were 20 patients, or 15%.

## *Discussion*

The data from the literature indicate that pleural effusion is a condition associated with various diseases, especially heart failure and malignant diseases. Our data presented in this paper show that a high percentage of the patients included in this study have a positive cytological finding. Malignant pleural effusions, in particular, indicate a poor prognosis. Early detection is critical and the key to successful treatment. Of particular importance are a multidisciplinary approach to the patient, a good anamnesis, physical examination and education of the patient for a healthy lifestyle, and screening programs for early detection of various diseases.

The primary diagnostic methods are lung ultrasonography, CT, and pleural fluid cytology. Pleural fluid analysis is the first step in evaluating pleural effusion. Distinguishing a transudative effusion from an exudative effusion is crucial in pleural fluid analysis. Light's criteria have been used to differentiate exudative effusion from transudative effusion since 1972 and have remained the standard method for evaluating pleural effusion. This method has been used for about 50 years due to its high precision and practicality.

In summary, routine pleural effusion analysis should be the standard of care in pleural fluid evaluation. Pleural effusion analysis is not only a diagnostic tool but can also guide the management of pleural infection and malignant pleural effusion. As in other countries, diuretics and thoracocentesis are still the first choice for treatment in our country, but we hope that in the future, new scientific discoveries will offer us new types of diagnosis and treatment that could replace the current methods.

## *Conclusion:*

From the results so far, we can conclude that pleural effusion is a condition that is associated with various diseases, especially heart failure and malignant diseases. Our study underscores the importance of early detection of the cause of pleural effusion and the underlying disease for successfully managing and treating the disease. The insights from our research can guide healthcare professionals in developing effective treatment strategies and improving patient outcomes.

***COI Statement:*** This paper has yet to be submitted in parallel, presented fully or partially at a meeting, podium, or congress, published, or submitted for consideration beforehand.

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