

## RESEARCH ARTICLE

## Etiological Profile of Pleural Effusion: A Single Center Study

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### Abstract

**Background:** Pleural effusion (PE) is the buildup of fluid around the lungs, commonly categorized as exudative or transudative. Exudative PE can result from various factors, while transudative PE is often linked to conditions like heart failure or cirrhosis. Diagnosing PE involves understanding its diverse causes, including infections, inflammation, and malignancies. Around 400,000 to 500,000 cases occur annually in Germany, with non-malignant cases having a significant mortality rate. Understanding PE's etiology is crucial for effective treatment, highlighting the importance of thorough evaluation and management strategies.

**Aim of the Study:** The aims of this study were to determine the etiology of PE and clinical characteristics of individuals admitted to KMCH.

**Methods:** This study, conducted at Khulna Medical College and Hospital, spanned from 2022 to 2023 and involved 33 patients with pleural effusion. Inclusion criteria comprised all types of pleural effusion in individuals aged 18 to over 60, irrespective of gender, while exclusion criteria excluded those under 18, hemodynamically unstable, and pregnant women. Data collection included demographic information, medical history, and diagnostic investigations such as complete hemogram, chest X-ray, and various fluid analyses. Data were organized, inputted into Microsoft Excel, and analyzed using SPSS version 26.

**Results:** The study examined 33 cases of pleural effusion, with a majority aged 21-40 years (51.51%). Males comprised 63.64% of participants. Right-side effusion was most common (63.64%), followed by left-side (33.33%) and bilateral involvement (3.03%). Dyspnea (72.73%) was the most common symptom, followed by cough (57.58%) and fever (51.52%). Straw-colored fluid (49%) was the most prevalent, with tuberculosis as the leading cause (60.61%) of exudative effusion. Transudative causes accounted for 12.12%, including congestive cardiac failure and cirrhosis. Pleural fluid analysis was the most common investigation (51.52%), followed by sputum for AFB and lymph node fine-needle aspiration cytology (18.18% each).

**Conclusion:** This study underscores the diverse causes of pleural effusion, highlighting the need for thorough evaluation for accurate diagnosis and management. Exudative effusions, with tuberculosis as a prominent cause, predominate. Clinical symptoms vary, with dyspnea being the most common. Fluid appearance aids diagnosis. A nuanced approach is crucial for effective treatment and patient outcomes.

**Keywords:** Etiological, Pleural fluid and Pleural Effusion.

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## 1. Introduction

Pleural effusion (PE) is the abnormal accumulation of fluid in the pleural space, the thin membrane surrounding the lungs [1]. It ranks among the most common respiratory symptoms, leading patients to seek admission and evaluation [2].

According to Light's criterion, effusions can be broadly categorized as exudative or transudative. Exudative pleural effusions are frequently associated with factors such as drug-induced reactions, iatrogenic causes, hemothorax, and chylothorax.

On the other hand, transudative pleural effusions are commonly linked to conditions like congestive cardiac failure, cirrhosis, nephrotic syndrome, superior vena cava obstruction, peritoneal dialysis, glomerulonephritis, myxoedema, pulmonary emboli, and sarcoidosis [3,4].

PE poses a significant challenge in clinical practice due to its diverse etiologies, demanding a comprehensive understanding for accurate diagnosis and effective management [5]. Etiology refers to the study of the causes and origins of medical conditions.

It is a crucial aspect of medicine, providing insights into the factors, agents, or mechanisms contributing to health issues [6]. In the realm of pleural effusion, investigating its etiology entails exploring various underlying conditions, such as infectious causes, inflammatory conditions, malignancies, and heart or kidney issues [7].

Registry data from the United States estimates that approximately 400,000 to 500,000 individuals in Germany experience pleural effusion annually [8].

The spectrum of causes ranges from benign viral pleuritis to clinically significant effusions associated with congestive heart failure or cancer. Non-malignant pleural effusions are linked to a one-year mortality rate ranging from 25% to 57% [9].

Leveraging knowledge of pleural fluid cytology, biochemistry, and clinical presentation allows for establishing an etiological diagnosis in approximately 75% of cases. Compared, up to 20% of cases remain without a known cause despite diagnostic efforts [10].

Determining the cause of pleural effusion is imperative for effective treatment [1]. The intricate interplay of clinical presentation, patient history, and physical examination forms the foundation for understanding the etiological landscape of pleural effusion [11].

The prevalence and diversity of etiologies underscore the need for a nuanced understanding to guide effective

management and improve outcomes in patients with pleural effusion. The study aims to determine the etiology of PE and clinical characteristics of individuals admitted to Khulna Medical College and Hospital.

## 2. Methodology and Materials

This cross-sectional study was conducted at the Department of Medicine in Khulna Medical College and Hospital. The study duration was one year, from 2022 to 2023. During the study period 33 patients were enrolled and analyzed in this study.

All the patients were admitted with pleural effusion to the hospital.

- Inclusion Criteria:
- All type of pleural effusion.
- Patients aged from 18 to more than 60 years.
- Both male and female.
- Exclusion Criteria:
- Patients under <18 years.
- Hemodynamically unstable patients.
- Pregnant women.

Historical demographic information was systematically gathered, encompassing primary complaints, presenting illness history, and relevant details such as comorbidities. Various diagnostic investigations were procured, including a complete hemogram, random blood sugar, serum proteins, chest X-ray, pleural fluid analysis, chest and abdomen ultrasound, echocardiogram, chest CT scan, fine needle aspiration cytology, and pleural biopsy reports (if conducted).

Subsequently, the collected data underwent organization, input, and exportation to the data editor page of SPSS version 26. This process involved consolidating and entering the data into a spreadsheet program (Microsoft Excel, 2016) before integration with the statistical analysis software.

## 3. Results

A total of 33 cases of pleural effusion had been included in this study. In terms of age, the majority of participants fell within the range of 21-40 years, comprising 51.51% of the total population. Specifically, 27.27% were aged between 21-30 years, and 24.24% were aged between 31-40 years (Table 1).

Regarding gender distribution, the majority of participants identified as male, constituting 63.64%

of the study population, while 36.36% identified as female (Table 1). The distribution of pleural effusion sites demonstrates a predominant involvement on the right side, accounting for 63.64% of occurrences. Conversely, effusions on the left side were observed in 33.33% of cases, while bilateral involvement was rare, constituting only 3.03% of the total (Table 2).

In our study, most common presenting symptom was Dyspnea (72.73%) followed by cough (57.58%), fever (51.52%), chest pain (45.45%). Anorexia and loss of weight was present in 42.42% and 36.36% of the patients respectively. Pedal edema, hemoptysis and jaundice was present in 5, 2 and 1 patient respectively (Table 3).

The most common appearance was straw-colored fluid, observed in 49% of cases, followed by clear fluid, which constituted 11% of the cohort. Additionally, high-colored fluid was present in 18% of patients, while pus was identified in 6% of cases. Turbid fluid was noted in 14% of individuals, and hemorrhagic fluid was least common, seen in 2% of cases (Table 4).

**Table 1.** Demographical characteristics of the study population (N=33).

Age group	Frequency (n)	Percentage (%)
< 20	2	6.06
21-30	9	27.27
31-40	8	24.24
41-50	7	21.21
51-60	5	15.15
> 60	2	6.06
Gender		
Male	21	63.64
Female	12	36.36

**Table 2.** Site of involvement in cases of pleural effusion (N=33).

Pleural effusion	Frequency (n)	Percentage (%)
Right	21	63.64
Left	11	33.33
Bilateral	1	3.03

**Table 3.** Distribution of patients according to Appearance of pleural fluid

Symptoms	Frequency (n)	Percentage (%)
Dyspnoea	24	72.73
Cough	19	57.58
Fever	17	51.52
Pleuritic chest pain	15	45.45
Anorexia	14	42.42
Weight Loss	12	36.36
Pedal edema	5	15.15
Hemoptysis	2	6.06
Jaundice	1	3.03

The most frequent etiology of Exudative pleural effusion was tuberculosis in 60.61% of patients. Other notable etiologies included pneumonia, malignancy, adenocarcinoma, small cell carcinoma, squamous cell carcinoma, lymphoma, empyema, collagen vascular disease, rheumatic arthritis, pancreatitis, uremia, and cases classified as undiagnosed, each representing 3.03% of the cohort.

Transudative etiologies were less common, comprising 12.12% of cases, with congestive cardiac failure (CCF), cirrhosis of the liver, chronic renal failure, hypothyroidism, and hypoalbuminemia (malabsorption) each contributing to 3.03% of the population. (Table 5).

According to investigations Pleural fluid study compromise 51.52% of the investigations followed by Sputum for AFB and LN: FNAC 18.18% each respectively. Pleural biopsy was performed in 12.12% of the study patients and CT FNAC was done in 6.06% of the study population (Table 6).

**Table 4.** Appearance of pleural fluid (N=330).

Appearance of pleural fluid	Frequency (n)	Percentage (%)
Straw coloured	17	51.52
Clear	3	9.09
High coloured	6	18.18
Pus	1	3.03
Turbid	5	15.15
Hemorrhagic	1	3.03

**Table 5.** Etiology of the study population.

Etiology	Frequency (n)	Percentage (%)
Exudative	28	84.85
Tuberculosis	20	60.61
Pneumonia	1	3.03
Malignancy	1	3.03
Adenocarcinoma	1	3.03
Small cell	1	3.03
Squamous cell	1	3.03
Lymphoma	1	3.03
Empyema	1	3.03
Collagen vascular disease	1	3.03
Rheumatic arthritis	1	3.03
Pancreatitis	1	3.03
Uremia	1	3.03
Undiagnosed	1	3.03
Transudative	4	12.12
CCF	1	3.03
Cirrhosis of liver	1	3.03
Chronic renal failure	1	3.03
Hypothyroidism	1	3.03
Hypoalbuminemia (malabsorption)	1	3.03

**Table 6.** Investigations of the study population.

Investigations	Frequency (n)	Percentage (%)
Sputum for Acid-Fast Bacteria (AFB)	6	18.18
Pleural fluid Analysis	17	51.52
LN: Fine needle aspiration cytology (FNAC)	6	18.18
Pleural biopsy	4	12.12
CT- Fine needle aspiration cytology (FNAC)	2	6.06
Fiberoptic bronchoscopy (FOB)	1	3.03
Echocardiogram (ECHO)	1	3.03

#### 4. Discussion

Our study outcomes offer significant insights into various facets of pleural effusions, encompassing demographics, clinical manifestations, fluid characteristics, and underlying causes.

Demographically, our research participants displayed a diverse age distribution, with a noteworthy proportion falling within the 21-40 age bracket at 51.51%.

A prior investigation also found most cases within this age range, consistent with our findings [12].

Correspondingly, in Nigeria, two surveys reported a median age of around 38 years for individuals with pleural effusions [13,14]. These variations may stem from differences in study populations and the prevalence of predisposing factors for pleural effusions across different regions globally. Additionally, our study observed a male predominance, aligning with existing literature suggesting gender-related disparities in pleural effusion prevalence or presentation [15].

A study in Qatar by Khan et al. reported a 3:1 male-to-female ratio in their sample population [16]. Right-sided effusions were more frequent. The diagnosis of tubercular pleural effusion largely relies on pleural fluid ADA estimation, while malignancy-related effusions can often be diagnosed through closed pleural biopsy and pleural fluid cytology. Although congestive cardiac failure (CCF) is the leading global contributor to pleural effusion, Tuberculosis takes precedence in Asian countries like Bangladesh [17,18].

In our analysis, Tuberculosis emerged as the most common etiology for pleural effusion, consistent with findings from Jindal and Valdés [19,20]. Dyspnea was the most prevalent presenting symptom in our sample (72.73%), followed by cough (57.58%), fever (51.52%), and chest discomfort (45.45%). Weight loss and loss of appetite were present in 36.36% and 42.42% of patients, respectively.

Al Alusi's study with 100 patients reported dyspnea (87%), cough (86%), fever (79%), and chest discomfort (67%) as the most prevalent symptoms [21]. Similarly, Mbata Godwin et al. found cough, chest discomfort, and dyspnea the most common symptoms in 156 patients (78.4%[22].

At the same time, Desalew et al. reported cough, fever, and weight loss in 90%, 77.3%, and 77.3% of cases, respectively, in their study of 110 patients [23]. The colour of the effusion holds diagnostic significance; tubercular effusion tends to be straw-coloured, while malignant effusion appears hemorrhagic. Turbid pleural fluid suggests parapneumonic effusion. Transudative pleural effusions are generally straightforward. In our study, straw-coloured fluid was most common (51.52%), while hemorrhagic and pus were present in 3.03% of cases.

Our study identified Tuberculosis (60.61%) as the leading cause of pleural effusions, highlighting its continued significance in specific populations.

Other notable contributors included pneumonia and various malignancies, such as adenocarcinoma, small cell carcinoma, squamous cell carcinoma,

and lymphoma. Moreover, transudative effusions secondary to congestive cardiac failure, cirrhosis, and other non-inflammatory conditions underscore the importance of considering a broad differential diagnosis for accurate diagnosis and management.

In a related study by Adeoye et al., pneumonia (15%) and cancer (29.1%) were reported as the most frequent causes of pleural effusion, affecting 32.9% and 15.1% of patients, respectively [14].

In a five-year retrospective analysis by Mbata Godwin et al., Tuberculosis was the most frequent etiology, affecting 42.2% of patients [22]. Khan et al. reported Tuberculosis as the cause of pleural effusion in 32.5% of patients, parapneumonic effusion in 19%, malignant effusion in 15.5%, and heart failure in 13% [16]. Al-Alusi's study involving 100 patients revealed malignant illness accounting for 34% of pleural effusion cases, while Tuberculosis occurred in 38% of cases [21].

## 5. Limitations of the Study

The study's limitations include its single-centre design, which may limit the generalizability of findings to other populations. Additionally, the relatively small sample size of 33 patients may need to fully capture the diversity of etiologies and clinical characteristics of pleural effusion. The study's retrospective nature could introduce selection bias and incomplete data collection. Furthermore, the exclusion criteria, such as hemodynamically unstable patients and pregnant women, may have excluded specific population subsets, potentially impacting the study's findings. Lastly, the reliance on data from a single year may not reflect temporal trends or changes in disease patterns over time.

## 6. Conclusion

In conclusion, this study sheds light on the diverse etiological profile of pleural effusion, highlighting the importance of comprehensive evaluation for accurate diagnosis and effective management. Our findings emphasize the predominance of exudative effusions, with tuberculosis emerging as the leading cause, particularly in our study population. Clinical manifestations varied, with dyspnea being the most prevalent symptom, followed by cough, fever, and chest discomfort. The appearance of pleural fluid provided diagnostic clues, with the straw-coloured fluid being the most common. These insights underscore the necessity of a nuanced approach in assessing pleural effusions, considering a broad

range of differential diagnoses to guide appropriate treatment strategies and improve patient outcomes.

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