



## Aetiological spectrum of patients of pleural effusion – An observational study

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### Abstract

**Background:** Pleural effusion is a clinical condition that is a manifestation of various aetiologies and pathologies. The aetiologies vary in different geographical areas and different age groups. The goal of this study was to evaluate the aetiological spectrum of patients with pleural effusion presenting in the Department of TB & Respiratory Medicine.

**Materials and methods:** 120 patients were involved in current study in which the detection of pleural effusion has been done based on the history, physical examination, and radiography. Pleural fluid was aspirated under USG guidance and then analyzed for various parameters.

**Results:** The study showed male preponderance (70%). The commonest age group involved was between 31 to 40 years (25.83%). Most cases showed exudative effusion (96%). Tuberculosis was the most common aetiology (80%).

**Conclusion:** Different geographical areas may have a different aetiological spectrum of pleural effusion. Tuberculosis is the most prevalent pleural effusion cause in our area involving middle age group with a male preponderance.

**Keywords:** transudate; tuberculosis; exudate; pleural effusion; adenosine deaminase

### Introduction

A pleural effusion results from the accumulation of abnormal fluid volumes (> 10-20ml) in pleural space. Pleural effusion is caused by either excessive formation or inadequate absorption of pleural fluid. Excessive formation occurs either because of increased hydrostatic pressure or decreased oncotic pressure as in extra pulmonary (cardiac, hepatic, and renal) diseases. The excessive formation also occurs as a result of increased microvascular leakage as in inflammatory conditions. Lymphatic blockage resulting in less drainage of fluid is the usual cause of malignant conditions. Sometimes the fluid movement from peritoneal cavity may result in pleural effusion. Therefore, pleural effusion is not a specific disease but it is a manifestation of some pathological process undergoing in the body. The patients of pleural effusion usually come in the chest and respiratory medicine out patient department (OPD) but sometimes may present to other specialists also, since the pleural fluid accumulation is not an illness, but

a symptom of underlying pathology [1]. It is crucial to identify the pleural effusion cause to administer proper treatment. Pleural fluid aspiration & analysis of fluid is the most common and most important method to establish the reason for pleural effusion.

The most prevalent reason for pleural effusion in developed nations like UK and USA is cardiac failure

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Received 5 January 2023; Revised 11 March 2023; Accepted 17 March 2023;  
Published 24 March 2023

**Citation:** Bansal KL, Bansal S, Bansal S, Sahay S. Aetiological spectrum of patients of pleural effusion – An observational study. J Med Sci Res. 2023; 11(2):72-75. DOI: <http://dx.doi.org/10.17727/JMSR.2023/11-14>

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followed by pneumonia, malignancy, and pulmonary embolism. In our country, patients presenting with pleural effusion have completely different clinical profiles. Hence this research was conducted to see aetiological spectrum of patients with pleural effusion in our geographical area. The study compared aetiological trend of pleural effusion in different parts of the country. A comparison of causes of pleural effusion in our area with other developing and developed nations has also been attempted in the research.

This was a prospective observational cross-sectional research to see the aetiological spectrum of patients of pleural effusion coming to TB and Respiratory medicine OPD of GS Medical College & Hospital, Pilkhuwa, Uttar Pradesh, India.

### Materials and methods

All patients attending TB & Respiratory Medicine Outpatient Department (OPD) were evaluated routinely. Detection of pleural effusion has been carried out by detailed history, physical examination, and radiography and confirmed on USG. The study was conducted from 1<sup>st</sup> June 2021 to 30<sup>th</sup> November 2022. The study has been approved by the ethical committee of the institute. Informed consent was obtained from each patient.

Pleural fluid aspiration was done in all the patients under USG guidance. The procedure was carried out on an OPD basis. The pleural fluid was evaluated for appearance, cytology, biochemistry, and microbiology. Exudates and transudates were distinguished using Light's criterion. The diagnostic focus was to recognize the aetiology of pleural disease. Tubercular pleural effusion is very common in our country hence a special focus was kept on its diagnosis.

The gold standard for TPE (Tuberculous Pleural Effusion) detection, like any other microbial disease, remains the detection of the bug (*Mycobacterium tuberculosis*) in pleural biopsy specimens, or pleural fluid, either by culture and/or microscopy. The presence of acid-fast bacilli (AFB) and caseating granulomas in the pleura is additional evidence of tuberculosis [2]. But the detection rate of *Mycobacterium tuberculosis* is very low (about 8%) in pleural fluid. The pleural biopsy needs more expertise and is more invasive. It also needs admission because of the danger of serious complications. Estimation of  $\gamma$ -interferon is a good way to make a diagnosis of tuberculosis but it is quite expensive and not easily available. CBNAAT, though a good test and easily available has a very low sensitivity [3]. There is no single test that is sensitive as well as specific for TPE. Molecular tests are having good specificity but

low sensitivity. ADA, IL-27 and IFN- $\gamma$  are excellent biomarkers but lack specificity when considered alone. They are expensive as well [4]. Tuberculosis is not a usual cause of hemorrhagic effusion, but it is suggested that all patients of hemorrhagic pleural effusion who reside in tuberculosis-endemic parts should be subjected to ADA estimation also to look for the TPE possibility [5].

It can be agreed that adenosine deaminase (ADA) levels above 60 IU/L in exudative, lymphocytic-predominant pleural fluid are the quickest means to diagnose TPE in regions with a high tuberculosis prevalence [6]. We also used this criterion in our study to make a diagnosis of TPE.

Inclusion criteria (indications for aspiration) [7] were (i) Unilateral Effusion, (ii) Very asymmetric bilateral effusion, (iii) Effusions associated with chest pain or fever, (iv) Supposed cardiac failure effusion patients who did not respond even after 72 hours of diuresis. Exclusion criteria was Supposed cardiac failure effusion patients who responded to diuresis.

Light's Criteria for exudates [8] were ratio of pleural fluid/ serum LDH > 0.6, ratio of pleural fluid/serum protein > 0.5, and pleural fluid LDH > 2/3<sup>rd</sup> of serum LDH's upper limit

Normal range of ADA (For serum, pleural, pericardial and ascetic fluid) were negative = less than 40 IU/L, equivocal = between 40-60 IU/L, and positive = greater than 60 IU/L.

### Results

A total of 120 cases were observed from June 2021 to November 2022. There were 84 male & 36 female patients (Table 1).

**Table 1:** Pleural effusion Incidence based on sex.

Sex	Number	Percentage
Female	36	30
Male	84	70

The average age was 42.42 years (range 14 to 90 years) (Table 2).

In 96 patients ADA was > 60 IU/L (positive). All these patients had lymphocytic predominance as well, therefore, anti-tubercular treatment (ATT) was given to them. Twelve patients had ADA ranging from 40-60 IU/L (equivocal). Rest 12 patients had ADA < 40 IU/L (negative) (Table 4).

**Table 2:** Pleural effusion Incidence based on age group.

Age group	Number	Percentage
10-20	20	16.66
21-30	15	12.5
31-40	31	25.83
41-50	14	11.66
51-60	10	8.33
61-70	5	4.16
>70	25	20.83

In all 115 (95.83%) patients had exudative effusion and 5(4.16%) patients had transudative effusion as per Light's criteria (Table 3).

**Table 3:** Distribution as exudates/ transudates based on Light's Criteria.

Type of pleural fluid	Number	Percentage
Exudate	115	95.83
Transudate	5	4.16

**Table 4:** Distribution of cases based on ADA.

ADA	Number	Percentage
>60 (Positive)	96	80.00
40-60 (Equivocal)	12	10.00
<40 (Negative)	12	10.00

Five patients were diagnosed as having malignancy. One patient has rheumatoid factor positive in pleural fluid and serum. Diagnosis could not be established in 18 patients, and they were referred to a higher centre for thoracoscopic evaluation (Table 5).

**Table 5:** Distribution of cases based on aetiology.

Aetiology	Number	Percentage
Tuberculosis	96	80.00
Rheumatoid Arthritis	1	0.83
Malignancy	5	4.16
Undiagnosed	18	15

Certain other parameters like CBNAAT positivity (18.33%), lymphocyte predominance (94.16%), and coagulum formation (90%) were also observed (Table 6). Coagulum formation was seen in all patients who have lymphocytic predominance and ADA more than 60 IU/L.

**Table 6:** Additional important parameters.

Parameter	Number	Percentage
CBNAAT Positive (No rifampicin resistance)	22	18.33
Coagulum Formation	108	90
Lymphocytic Predominance (>70%)	113	94.16

## Discussion

The present study was conducted on an OPD basis. The pleural fluid aspiration was done under USG guidance. No post-aspiration complication was observed except for giddiness in 9 patients. All patients were sent home after 2 hours of observation. Most patients were between the ages of 31 and 40 (25.83%). In other research done by Jayant K Golwalker et al, the pleural effusion incidence was highest in the age group from 41 - 50 years (39%) [9]. There was a male predominance in our study (70%). Similar observations were achieved in other analyses made by Tandon RK et al [10]. Similar observations were also made by Sharma et al [11]. In our study exudative effusion (95.83%) vastly outnumbered transudative effusion (4.16%) by a wide margin. This was probably because we didn't aspirate patients with cardiac failure who responded to 72 hours of diuretic therapy as is the standard practice in pleural effusion management. In current analysis, tuberculosis was the main prevalent cause (80%). This could explain the higher occurrence of exudative effusions. Malignancy (4.16%) and rheumatoid arthritis (0.83%) also contributed to the same. Amongst undiagnosed patients, 6 out of 18 (33.33%) also had ADA in the equivocal range (40-60 IU/L). These also might have been tubercular contributing to an excessive number of exudative effusions.

The trend of aetiology of pleural effusion in the present study has been similar to other geographical areas of the country. A study conducted in Bengaluru by Anushree Chakraborty et al [12] demonstrated 70% were diagnosed with TPE. This study also found male preponderance. Kaushik Saha et al [13] conducted a study in Kolkata and they made diagnosis based on histopathology, again seeing the diagnosis of TPE as most common (60.9%). Jindal S et al [14] from Ahmedabad (Gujarat) also found TPE (44%) as the most prevalent cause followed by malignancy. Rahul Gupta and associates [15] while working in Jammu & Kashmir found 69.4% of cases suffering from TPE out of total of 1000 cases of pleural effusion.

When we compared the study with other developing countries like Qatar, Bangla Desh, and Nigeria the infectious causes outnumbered the non-infectious causes. TPE stood out to be the major cause out of all. In a Qatar analysis, carried out by Khan FY et al [16], infectious causes contributed to 120 of 200 (60%) cases of pleural effusion. TPE was diagnosed in 65 of 200 (32.5%) cases. Similarly in a study in Bangla Desh by PK Chowdhury et al [17], out of 54 cases of pleural effusion, infectious causes were more common i.e. 35 of 54 (64.81%). TPE was the most cause 25 of 54 (46.29%) of all. In a Nigerian study of 199 patients, the

author found infectious causes as more common 112 of 199 (56.28%). Here again, TPE was the most common cause 84 of 199 (42.2%) [18].

Western countries like UK show different data for pleural effusion. Bintcliffe et al. carried out research in Bristol (UK) and showed distribution of potential aetiologies (after excluding effusions caused by trauma or malignancy) as post-CABG in 4 (1.2%), pulmonary embolism in 6 (1.8%), renal failure in 10 (3.1%), liver cirrhosis in 13 (4%), benign asbestosis pleural effusion in 27 (8.3 percent), idiopathic pleuritis/undiagnosed in 41 (12.5 percent), congestive cardiac failure in 81 (34.8 percent), and pleural infection in 131 patients (40 percent) [19].

In the current research, pleural infections constituted the major cause for pleural effusion (80%), maybe even more as some cases were undiagnosed (15%); some of them showed features suggestive of tuberculosis though no conclusive evidence was seen, while, in Bintcliffe et al. analysis, congestive cardiac failure (34.8%) and pleural infections (40%) together constituted main reasons of pleural effusion [19]. In the current research, infections constituted the main reason for pleural effusion, as tuberculosis is most frequent & widespread contagious disease in India. In Shimon Izhakian et al study [20], 44 (18%) were detected with transudative effusion, and (73.7%) were detected with exudative effusion, while in the present analysis, exudates and transudates are 95.83 % & 4.16% respectively. In current study, the main cause of exudative pleural effusion is tuberculosis 80 %, while, in Shimon Izhakian et al research, the main cause is malignant effusion 53.1%. In Jinlin Wang et al study, malignancy is the main cause of pleural effusion, while in the current study, pleural infections i.e. tuberculosis is the main cause of pleural effusion [21]. In Jinlin Wang et al research, Pleural tuberculosis is the second most common pleural effusion cause, while, in the current study, malignancy is second most prevalent pleural effusion cause. In a research done by Jiang Zhang et al, 242 patients were involved, of whom 134 (55.37%) were detected with MPE (Malignant Pleural Effusion) and 108 (44.63%) were detected with TPE [22].

**Strength of the study:** The study has compared patients not only from within different geographical areas of the country but also from various developing and developed nations.

**Limitations of the study:** The study has been conducted in a resource-scarce area and some patients could not be diagnosed because of lack of thoracoscopy. This data was collected from OPD in limited patients; a multi-centre study with more patients will give more precise results.

## Conclusion

The current study shows the causes of pleural effusion may be different in different geographical areas. We have found that it is heavily tilted towards tuberculosis in Western Uttar Pradesh. There is a male preponderance. Maximum patients were detected in middle age group.

## Conflicts of Interest

Authors declare no conflicts of interest.

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