



Original Research Article

ETIOLOGICAL PROFILE OF PLEURAL EFFUSION AMONG ADULT PATIENTS IN A TERTIARY CARE CENTER

Article History:

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Received: 14-11-2025

Revised: 26-11-2025

Accepted: 12-12-2025

Published: 31-12-2025

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INTRODUCTION

Pleural effusion is a common clinical problem encountered in hospital practice and refers to the pathological accumulation of fluid within the pleural space¹. The etiology of pleural effusion is diverse, ranging from relatively benign conditions such as viral pleuritis to serious and prognostically significant diseases like congestive heart failure and malignancy. Under normal physiological conditions, the pleural space contains a small amount of fluid that facilitates frictionless movement between the visceral and parietal pleurae.² The average rate of pleural fluid production and absorption is approximately 0.2 mL/kg/hour. The parietal pleura plays the dominant

Abstract: Pleural effusion is a common clinical problem encountered in hospital practice and refers to the pathological accumulation of fluid within the pleural space. **AIM:** The aim of study is etiology of pleural effusion among adult patients in tertiary care center. **METHODOLOGY:** The present study was conducted as a cross-sectional observational study at the department of general medicine, govt medical college, jaisalmer. The study was carried out over a period of 6 months, from April 2025 to sept 2025. **RESULT:** Exudative pleural effusion was the predominant type (75%), with tuberculosis being the most common etiology, commonly presenting as right-sided effusion and associated with increasing severity and higher morbidity. **CONCLUSION:** Early etiological diagnosis and appropriate management of pleural effusion are essential, as exudative effusions, particularly tuberculous and infective causes, contribute significantly to disease burden, complications, and mortality.

Keywords: Pleural effusion, exudative, Etiology

role in both production and resorption of pleural fluid through its systemic capillaries and lymphatic stomata³. However, in pathological states leading to pleural effusion, fluid accumulation is primarily derived from the visceral pleura due to altered Starling forces and increased permeability. The volume of pleural fluid is regulated by the balance between hydrostatic and oncotic pressures across the pleural membranes, as well as lymphatic drainage.⁴ Pleural fluid is normally resorbed through lymphatic vessels in the parietal pleura, maintaining equilibrium between production and absorption.⁵ A pleural effusion develops when this balance is disturbed, either due to increased fluid formation, reduced resorption, or both. Pathophysiological mechanisms contributing to pleural effusion include

elevated pulmonary capillary pressure, reduced plasma oncotic pressure as seen in hypoalbuminemia, increased capillary permeability, lymphatic obstruction, and alterations in intrapleural pressure.⁶ These mechanisms form the basis for differentiating pleural effusions into transudates and exudates. Clinically, the manifestations of pleural effusion depend largely on the underlying cause rather than the effusion itself. Many patients may be asymptomatic. When symptoms are present, pleuritic chest pain is common in inflammatory conditions and originates from the parietal pleura, as the visceral pleura lacks nociceptive fibers.⁷ This pain is typically sharp, localized, and exacerbated by respiration, often subsiding once a significant effusion develops. Dyspnea is another frequent symptom, although its severity correlates poorly with the size of the effusion. Notably, rapid symptomatic improvement is often observed following therapeutic drainage. Other symptoms may include dry cough and disturbed sleep, particularly in large effusions. On physical examination, pleural effusion is suggested by diminished or absent breath sounds, stony dullness to percussion over the affected area, and reduced chest expansion.⁸ A pleural rub may be heard in the early stages of a parapneumonic effusion. Pleural fluid resembles plasma but contains a lower protein concentration. Effusions are classified as transudative or exudative using Light's criteria, with exudates reflecting increased capillary

permeability and inflammation.⁹ Common causes of transudative effusions include heart failure, cirrhosis, and nephrotic syndrome, while exudative effusions are commonly due to pneumonia, malignancy, pulmonary embolism, and tuberculosis. Early recognition of the etiology is crucial, as delayed diagnosis significantly increases morbidity and mortality.

AIM

The aim of study is etiology of pleural effusion among adult patients in tertiary care center.

MATERIAL AND METHODS

The present study was conducted as a cross-sectional observational study at the department of general medicine, govt medical college, jaisalmer. The study was carried out over a period of 6 months, from April 2025 to sept 2025. Adult patients of both sexes aged 18 years and above were enrolled in the study after obtaining informed consent. Inclusion in the study required a confirmed diagnosis of pleural effusion. Patients who did not provide consent for diagnostic thoracentesis were excluded from the study. This selection ensured that only consenting patients with radiologically proven pleural effusion and adequate clinical evaluation were included for analysis.

RESULTS

Table 1: Diagnosis using Light's Criteria cross tabulation across Age Categories

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Age Groups	21-30 Years	29	97%	1	3%	30	27%
	31-40 Years	21	84%	4	16%	25	23%
	41-50 Years	15	75%	5	25%	20	18%
	51-60 Years	11	50%	11	50%	22	20%
	61-70 Years	6	46%	7	54%	13	12%
	Total	82	75%	28	25%	110	100%
P value		0.0001					

The majority of pleural effusion cases were observed in younger and middle-aged adults, with the highest proportion seen in the 21–30 years age group (27%), followed by the 31–40 years age group (23%). Exudative effusions predominated in all age groups, particularly in younger patients, whereas a relatively higher proportion of transudative effusions was observed in the older age groups. ($p < 0.0001$)

Table 2: Effusion profile according to the diagnosis using Light's Criteria

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Side of Effusion	Bilateral	9	26%	25	74%	34	31%
	Left sided	16	89%	2	11%	18	16%
	Right sided effusion	57	98%	1	2%	58	53%
	Total	82	75%	28	25%	110	100%
P value		0.0001					

Right-sided pleural effusion was the most common presentation, accounting for 53% of cases, followed by bilateral effusion in 31% and left-sided effusion in 16%. Exudative effusions predominated overall and were particularly frequent in right-sided (98%) and left-sided (89%) effusions, whereas bilateral effusions showed a higher proportion of transudative fluid (74%). ($p < 0.001$)

Table 3: Etiological Profile of effusion cross tabulation with diagnosis using Light's Criteria

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Etiology of effusion	CHF	2	18%	9	82%	11	10%
	CKD	3	30%	7	70%	10	9%
	Idiopathic	6	75%	2	25%	8	7%
	Liver Cirrhosis	2	29%	5	71%	7	6%
	Malignancy	11	92%	1	8%	12	12%
	Pancreatitis	1	33%	2	67%	3	3%
	Sub pneumonic effusion	8	89%	1	11%	9	8%
	TB	49	98%	1	2%	50	45%
	Total	82	75%	28	25%	110	100%
P value		0.0001					

Tuberculosis was the most common etiology of pleural effusion, accounting for 45% of cases, followed by malignancy (12%), congestive heart failure (10%), and chronic kidney disease (9%). Exudative effusions predominated in tuberculosis, malignancy, and parapneumonic effusions, whereas transudative effusions were more frequently associated with congestive heart failure, liver cirrhosis, and chronic kidney disease. ($p < 0.001$)

Table 4: Profile of Severity of effusion across diagnosis using Light's Criteria

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Severity of effusion	Mild	20	51%	19	49%	39	35%
	Moderate	29	81%	7	19%	36	33%
	Severe	33	94%	2	6%	35	32%
P value		0.0001					

Moderate and severe pleural effusions constituted the majority of cases, accounting for 33% and 32% respectively, while mild effusions comprised 35% of the study population. Exudative effusions showed an increasing predominance with severity, rising from 51% in mild effusions to 94% in severe effusions, whereas transudative effusions were more common in mild cases. ($p < 0.001$)

Microbiological analysis showed that the majority of pleural effusions were culture-negative (58%), followed by AFB-positive effusions (25%). Exudative effusions predominated in AFB-positive and culture-negative cases, whereas transudative effusions were more frequently associated with Streptococci-positive samples. ($p < 0.0001$)

Table 5: Micro Biology across diagnosis using Light's Criteria

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Micro-Biology Report	AFB	20	71%	8	29%	28	25%
	Negative	54	84%	10	16%	64	58%
	Staphylococcus Positive	5	83%	1	17%	6	6%
	Streptococci Positive	3	25%	9	75%	12	11%
	Total	82	75%	28	25%	110	100%
P value		0.0001					

Table 6: Treatment Profile cross tabulation with diagnosis using Light's Criteria

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Treatment	Antibiotic	21	81%	5	19%	26	24%
	Antibiotic and Diuretic	14	48%	15	52%	29	26%
	ATT	42	88%	6	12%	48	44%
	Diuretic	5	71%	2	29%	7	6%
	Total	82	75%	28	25%	110	100%
P value		0.0001					

Anti-tubercular therapy was the most commonly administered treatment, given to 44% of patients, followed by combined antibiotic and diuretic therapy (26%) and antibiotics alone (24%). Exudative effusions predominated among patients receiving antibiotics and ATT, whereas transudative effusions were more frequently managed with combined antibiotic and diuretic therapy. ($p < 0.0001$)

Table 7: Morbidity and Mortality analysis across diagnosis using Light's Criteria

Parameters		Pleural Fluid Analysis					
		Exudative		Transudative		Total	
		No.	%	No.	%	No.	%
Morbidity and Mortality	Empyema	8	89%	1	11%	9	8%
	Heart Failure	3	37%	5	63%	8	7%
	Lung Damage	1	33%	2	67%	3	3%
	Pleural Thickening	5	100%	0	0%	5	5%
	Pneumothorax	2	67%	1	33%	3	3%
	Mortality	12	71%	5	29%	17	15%
	No	51	78%	14	22%	65	59%
	Total	82	75%	28	25%	110	100%
P value		0.100					

More than half of the patients (59%) had no morbidity or mortality, while mortality was observed in 15% of cases. Exudative effusions were predominantly associated with complications such as empyema, pleural thickening, and mortality, whereas transudative effusions were more commonly seen in cases related to heart failure and lung damage. ($p = 0.100$)

DISCUSSION

The age-wise distribution of patients with pleural effusion showed a predominance of exudative effusions across most age groups. In the 21–30 years age group, the majority of patients had exudative effusion (97%), while transudative effusion was uncommon. A similar trend was observed in the 31–40 years and 41–50 years age groups, where

exudative effusions constituted 84% and 75% respectively. In contrast, an equal distribution of exudative and transudative effusions was noted in the 51–60 years age group. Among patients aged 61–70 years, transudative effusions were slightly more common than exudative effusions. Khan F et al (2011) in their study in Qatar found that the malignant effusions, and transudate effusions caused

by cardiac failure were more frequent among older age groups (> 50-years-old) which is consistent with our results.

In the present study, right-sided pleural effusion was the most common presentation, accounting for more than half of the cases (53%), followed by bilateral effusion (31%) and left-sided effusion (16%). Exudative pleural effusions predominated overall, comprising 75% of all cases, while transudative effusions constituted 25%. Among patients with right-sided effusion, an overwhelming majority were exudative in nature (98%), indicating a strong association with underlying inflammatory or infective etiologies. Left-sided effusions were also predominantly exudative (89%), whereas bilateral effusions showed a higher proportion of transudative effusions (74%). This finding suggests that bilateral involvement is more commonly associated with systemic conditions such as cardiac or renal disease. Similarly Porcel JM et al¹¹, in their study found that exudative pleural effusion was unilateral in majority of cases whereas transudative pleural effusion was mainly bilateral which is consistent with our results. Tuberculosis was the most common etiology of pleural effusion in the present study, accounting for 45% of cases, and was predominantly exudative in nature (98%). Malignancy constituted 12% of cases and also showed a strong association with exudative pleural effusion. Cardiac and systemic causes such as congestive heart failure and liver cirrhosis were more frequently associated with transudative effusions, contributing 82% and 71% of cases respectively. Chronic kidney disease showed a similar trend, with transudative effusions seen in 70% of patients. Parapneumonic effusion and idiopathic cases were largely exudative, reflecting underlying inflammatory pathology. Pancreatitis was an infrequent cause but demonstrated a mixed pattern with a predominance of transudative effusion. Similar to our results Heidari B¹² (2007) in their study in Iran found that tuberculosis and malignancy are the main cause of exudative pleural effusion though the prevalence were different than our study.

The severity of pleural effusion in the study population showed a fairly even distribution across mild, moderate, and severe categories. Mild pleural effusion constituted 35% of cases, with nearly equal proportions of exudative (51%) and transudative (49%) effusions. Moderate effusion accounted for 33% of cases and demonstrated a clear predominance of exudative fluid (81%) compared to transudative effusion (19%). Severe pleural effusion was observed in 32% of patients and was overwhelmingly exudative in nature, comprising 94% of cases. The proportion of transudative effusion progressively decreased with increasing severity of effusion.

The microbiological analysis of pleural fluid revealed

that the majority of samples were microbiologically negative, accounting for 58% of cases, indicating a substantial proportion of non-bacterial or previously treated effusions. Acid-fast bacilli (AFB) positivity was observed in 25% of patients, highlighting tuberculosis as a significant cause of pleural effusion in the study population. Exudative effusions predominated among AFB-positive cases (71%), supporting the inflammatory nature of tuberculous pleural effusion. Staphylococcal growth was identified in 6% of cases, with most of these effusions being exudative (83%). In contrast, Streptococcal-positive effusions, comprising 11% of cases, showed a predominance of transudative fluid (75%). Mocelin HT¹³ in their study found that microbiology report was positive in 48% of cultures from empyema and 31% of cases were positive from all other origins of effusion.

The treatment profile of patients with pleural effusion showed that anti-tubercular therapy (ATT) was the most commonly administered treatment, accounting for 44% of cases, reflecting the high prevalence of tuberculous etiology in the study population. Antibiotic therapy alone was given to 24% of patients, predominantly those with exudative effusions secondary to infective causes. A combination of antibiotics and diuretics was used in 26% of cases, with a relatively higher proportion of transudative effusions in this group. Diuretics alone were administered in a small proportion of patients (6%), mainly those with transudative effusions. Similar to our results Ali IBRAHIM et al¹⁴ (2021) in their study reported a high incidence of use of antibiotics in the transudative group (38%) which is consistent with our results.

Morbidity and mortality were observed in a substantial proportion of patients with pleural effusion, with 41% of cases experiencing at least one complication or death. Mortality was reported in 15% of patients, with the majority (71%) occurring in those with exudative pleural effusions. Empyema was the most common complication, accounting for 8% of cases, and was predominantly associated with exudative effusions. Pleural thickening was seen exclusively in exudative effusions, while pneumothorax and lung damage were less frequent complications. Heart failure-related morbidity was more commonly associated with transudative effusions. The mortality in Ali IBRAHIM et al¹⁴ (2021) study was 165 which is higher than our results. The difference in mortality rates among various studies could be explained on the basis of differences in sample size, etiology, age group composition.

CONCLUSION

The present study highlights that pleural effusion is a

common clinical entity with a wide etiological spectrum, in which exudative pleural effusions predominated, accounting for nearly three-fourths of cases. Younger age groups showed a clear predominance of exudative effusions, whereas transudative effusions were more frequent in older patients, reflecting the influence of systemic comorbidities. Right-sided pleural effusion was the most common presentation and was strongly associated with exudative pathology, while bilateral effusions were more often transudative, suggesting underlying cardiac, renal, or hepatic disease. Tuberculosis emerged as the leading cause of pleural effusion in this study, followed by malignancy, emphasizing the continued burden of infectious etiologies in developing countries. Increasing severity of effusion showed a strong correlation with exudative fluid, particularly in severe cases. Microbiological analysis reinforced the role of tuberculosis and bacterial infections, although a significant proportion of effusions were culture-negative. Treatment patterns reflected the etiological profile, with anti-tubercular therapy and antibiotics being the most commonly used modalities. Morbidity and mortality were mainly associated with exudative effusions, especially empyema and severe infections, while transudative effusions were more commonly linked to systemic complications such as heart failure.

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