

Original Article

Combined Pleural Fluid Cholesterol and Total Protein in Differentiation of Exudates and Transudates in Cases Presenting in Tribhuvan University Teaching Hospital

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Abstract: Pleural effusions are very common clinical findings; we came across in clinical practice. Their proper diagnosis based on different parameters like pleural fluid protein, LDH, ADA, cholesterol is very important. Light's criteria though used as standard method in differentiating pleural effusions as exudates and transudates, it usually misidentifies 15-20 % of transudates as exudates. Hence, role of other criteria like combined pleural fluid cholesterol and total protein in differentiation of pleural fluid is studied in this study. The general objective was to study role of combined pleural fluid cholesterol and total protein in differentiation of exudates and transudates in cases presenting in Tribhuvan University Teaching Hospital. 90 patients with pleural effusion were enrolled in this study. Out of 90 patients, 49 patients were from male sex which is equal to 54.4% and 41 patients were from female sex which is equal to 45.6%. Right-sided pleural effusion (66.7%) was predominant in our study. By diagnosis on discharge out of 90 samples 62(68.9%) were exudates and 28(31.1%) were transudates. Based on Light's criteria, 65 (72.2%) pleural effusions were found to be exudates and 25 were found to be transudates, with sensitivity and specificity of 98.4 % and 85.7 % respectively. According to pleural fluid total protein, it classified 62.2 % [n=56] of cases as exudates and 37.8 % [n=34] of cases as transudates. Sensitivity and specificity with 88.7 % and 96.4 % respectively. Based on pleural fluid cholesterol, our study showed 64.4% [n=58] of cases as exudates and 35.6% [n= 32] of cases as transudates with sensitivity and specificity of 93.5 % and 100 % respectively. Combined pleural total protein and cholesterol however classified 57.8% [n=52] of cases as exudates and 42.2% [n=38] of cases as exudates with sensitivity and specificity of 83.9 % and 100 % respectively Though Light's criteria remain the gold standard for distinguishing transudates from exudates, combined pleural fluid cholesterol and total protein examination may improve diagnostic accuracy in circumstances where the diagnosis on discharge differs from the outcome from Light's criteria.

Keywords: Pleural effusion, Exudates, Transudates, Light's Criteria, Protein, Cholesterol

1. INTRODUCTION

Pleural fluid is a thin layer of fluid found in the pleural cavity that acts as a coupling mechanism. When there is an excess of pleural fluid in the pleural space, it is called a pleural effusion (PE). An effusion is a fluid gathering in the pleural space that usually occurs as a result of increased fluid production and impaired lymphatic absorption [1]. It is the most frequent pleural illness presentation, with etiologies ranging from cardiovascular problems to systemic inflammatory syndromes to cancer. The broad differential diagnosis necessitates a holistic approach to the examinations. Playing a vital role in respiration, the potential space of the pleural cavity in healthy patients conjoins the natural outward

movement of the chest wall to that of the natural inward movement of the lungs via two mechanisms. First, the potential space's relative vacuum sustains the visceral and parietal pleurae's extreme adherence and is uninterrupted and not disrupted. Second, a small volume of pleural fluid (calculated at 0.13 mL/kg of body weight under typical situations) serves as the lubricant to facilitate the normal physiologic sliding motion of both pleural surfaces against each other during inspiration and expiration [2]. This small volume of lubricating fluid is maintained via a delicate balance of hydrostatic and oncotic pressure and peripheral sulcal lymphatic drainage; disturbances in any of these mechanisms may lead to pathology and, possibly, manifest as a pleural effusion [2,3]. Usually, only 4-12 mL of fluid is present in the pleural space, representing the balance between (a) hydrostatic and oncotic forces in the visceral and parietal pleural capillaries and (b) persistent sulcal lymphatic drainage. Thus, pleural effusions may result from disruption of this natural balance. The first step in adequately diagnosing pleural effusion is correctly classifying it into exudative and transudative types. For the treatment of pleural effusions efficiently, it is essential to determine its cause. With knowledge of pleural fluid cytology, biochemistry, and clinical presentation, an etiological diagnosis is derived in approximately 75% of patients [4]. In up to 20% of cases, the cause remains unknown despite a diagnostic workup. Pleural transudates are due either to alteration of hydrostatic or colloid-osmotic pressure in pleural capillaries or fluid passing from the peritoneal cavity to pleural cavity through defects in the diaphragm or lymph vessels. In contrast, pleural exudates are secondary to alteration of pulmonary capillary permeability or lymphatic obstruction. This categorization helps define the pathophysiological mechanism and formulate a diagnostic approach to ascertain the etiologic diagnosis. The estimated prevalence of pleural effusion is 320 cases per 100,000 people in industrialized countries, with a distribution of etiologies related to most underlying diseases [5,6]. However, this prevalence is much higher in the developing world. Unfortunately, there are no studies done extensively in Nepal to determine the prevalence and incidence of pleural effusions. Pleural effusion is still a significant burden in Nepal. Most of the cases present to emergency and outpatients are associated with pleural effusions, and they cause considerable distress, morbidity, and mortality among the patients. Thus, their timely diagnosis and differentiation are a keystone in managing the disease process and halting morbidity. However, there is significant difficulty in the diagnosis of pleural effusions using a single criterion [7,8]. Determining the cause of a pleural effusion is facilitated by analysis of the pleural fluid. Thoracentesis is a simple bedside procedure that permits rapidly sampled, visualized, examined, and quantified fluid. Studies of pleural fluid characteristics in patients with diseases of known etiology have been used to develop criteria for separating effusions into transudates and exudates, each of which has a different differential diagnosis. The primary reason to differentiate transudates and exudates is that most transudative effusions imply a non-inflammatory process with no pleural disease involvement and usually require no further investigations as the cause is generally apparent [9]. On the other hand, exudative effusions present more of a diagnostic challenge and need extensive diagnostic studies to determine the specific cause. Some diseases, such as pulmonary embolism, can cause either transudative or exudative effusions. These criteria categorize effusions of unknown etiology as transudates or exudates as the first step in determining a specific etiology. A systematic approach to analyze the pleural fluid in conjunction with the clinical presentation should allow the clinician to diagnose the cause of effusion in about 75 percent of patients at the first encounter [10]. Light's criteria is widely used than any other criteria for differentiating transudates from exudates. In addition, it is still used as a gold standard for diagnosing pleural effusions. However, over last few years, many workers noted even Light's criteria misclassify significant percentage of the pleural effusions to diagnose transudates or exudates [11]. Light's criteria are used in the differentiation of transudates from exudates as follows. Exudative pleural effusions meet a minimum one of the following criteria, but transudative pleural effusions meet none, Pleural fluid protein/serum protein >0.5 , Pleural fluid LDH/serum LDH >0.6 , Pleural fluid LDH $>2/3$ rd normal upper limit for serum [12]. In 1972 found criteria to have sensitivity and specificity of 99% and 98%,

respectively, for differentiating transudative and exudative pleural effusions. However, several researchers have highlighted that even Light's criteria misclassified a considerable percentage of Transudative pleural effusions as Exudative effusions in recent years [13]. However, following Light's criterion, the other research only reproduced specificities of 70–86%. Using Light's criterion, about 25% of transudates were wrongly labeled as exudates. The aim of the study is To find out the role of combined pleural fluid cholesterol and total protein in differentiation of exudates and transudates in cases presenting in Tribhuvan University Teaching Hospital To find out the exudative and transudative nature of pleural effusions on the basis of the Light's criteria. To find out the role of pleural fluid total protein and cholesterol for distinguishing exudative from transudative pleural effusions. To analyze the sensitivity and specificity of Light's criteria and pleural fluid total protein and cholesterol in predicting the nature of the pleural effusion.

2. MATERIALS & METHOD

Emergency and Respiratory ward of Tribhuvan University teaching Hospital. Patients who fall under inclusion criteria (All patient who are diagnosed as a case of pleural effusions from emergency ward and respiratory ward). It is an analytical, cross-sectional observational study. Research Method is Quantitative study. Emergency and Respiratory ward of Tribhuvan University teaching Hospital. Pleural effusion cases are abundant in emergency as well as in medical ward. Being an MDGP resident of IOM, TUTH, I came across so many cases for my study. This institute is tertiary hospital, which allows many patients to be tested and it holds the facility of pleural fluid tapping and analysis.

Sample size calculated by using following formula:

$$n = Z\alpha^2 PQ/d^2$$

$$n = 95$$

Where n = required sample size

$Z\alpha$ = z deviated corresponding to desired reliability level (1.96)

P = estimated proportion in the population

Q = 100-P (if P is in %)

d = maximum tolerable error (10%)

Using the above information, a sample size of 85 was estimated at a 95% level of confidence and a precision of 10% (47). After a brief introduction and highlighting the study to the patient and accompanying relatives, consent was taken for participation. Patients admitted in emergency and respiratory ward of Tribhuvan University Teaching Hospital with clinical signs and symptoms suggestive of pleural effusion were evaluated. Routine investigations including WBC counts and chest x-ray were performed for each patient. Investigations like USG of chest in case of minimal or suspected pleural effusion on chest X-ray were done as appropriate. Thoracentesis was performed on those who had pleural effusion. In inpatient settings, 10 mL of pleural fluid was taken using a disposable plastic syringe while adhering to all aseptic procedures. The plain pleural fluid sample obtained was immediately sent to the laboratory for analysis, and those samples that could not be delivered to the laboratory for analysis were refrigerated until analysis was completed within 24 hours of sample collection. The pleural fluid sample acquired in this manner was immediately forwarded to the laboratory for analysis. Those samples that could not be sent to the laboratory immediately were refrigerated until they could be analyzed within 24 hours after collection. Total protein, LDH, glucose, TC, DC, ADA, Gram's stain, and bacterial culture were all tested in the pleural fluid. TC, DC, Hb, ESR, RBS, Bilirubin total and direct, AST,

ALT, total protein, albumin, and LDH were all tested in the blood. Within 24 hours, serum biochemistry and pleural fluid samples were collected for examination. The Biuret method was used to determine total protein. Cholesterol was measured using an enzyme technique. A total of 90 pleural effusion patients who met the inclusion criteria were included in the study. In a few cases, a complete history and physical examination, as well as a chest radiograph and ultrasonography, were used to diagnose pleural effusion. These cases were followed up on until they were released. Hematological and serum biochemical profiles (protein, albumin, LDH) were recorded in the tabulated proforma. Pleural fluid cholesterol ≥ 45 mg/dl was utilized as a distinct cutoff value in this investigation to categorize pleural fluid as exudates. To determine the efficacy of these multiple characteristics included in Light's criteria in categorizing pleural effusions, the statistical significance of these parameters was measured and compared with the diagnosis on discharge. The results of these samples' pleural fluid total protein content, pleural fluid LDH, and pleural fluid cholesterol are tallied and compared for each patient. Light's criteria and pleural fluid cholesterol were then utilized to classify exudates and transudates, as well as the diagnosis on discharge, using SPSS 22.0 and Microsoft Excel 2016. All information about patient characteristics, clinical and laboratory status were collected in the predesigned case proforma. After completion of the data collection, data was entered in Microsoft excel 2016 where entry, editing and checking of data was done. Coding of data was performed and cross verification of the errors was done. The clean data was analyzed through SPSS version 22 for data analysis. Descriptive statistics such as frequency, percentage, mean, median, SD, were used to describe socio-demographic variables like age, sex, ethnicity. Similarly, in the analysis of other variable's mean, median, frequency, maximum, minimum, standard deviations were part of descriptive analysis. Cross-tabulation was performed while computing different variables. Chi-square test was used to check the significance. Chi-square is a statistical test used to examine the differences between categorical variables from a random sample in order to judge goodness of fit between expected and observed results. It is non-parametric statistical test, also called a distribution free test. The comparative tabular and graphical presentation of data was done as per the requirement.

3. RESULTS & DISCUSSION

The study was conducted at Emergency and Respiratory ward of Tribhuvan University Teaching Hospital in patients presenting with pleural effusions who fulfill the inclusion criteria. Chi-square test was used to check the significance. Total 105 patient were screened for eligibility over the study period of 1 year. Of all screened cases 15 cases did not meet the exclusion criteria. Finally, 90 cases were included, the minimum age of the patient was 24 years and the oldest patient was 92 years.

Table 01: Baseline demographic characteristics of study participants.

Variables	Frequency (n)	Percent (%)
Sex		
Female	41	45.6
Male	49	54.4
Age		
30 and below	9	10.0
31-40	15	16.7
41-50	25	27.8
51-60	12	13.3
61-70	12	13.3
71-80	8	8.9
81 and above	9	10.0
Age Mean (SD): 52.86 ($\pm$ 17.90)		

Ethnicity		
Brahmin	23	25.6
Chhetri	22	24.4
Janajati	41	45.6
Dalits and Others	4	4.4

Among 90 patients studied 54.4% were males [n=49], 45.60% were females [n=41].

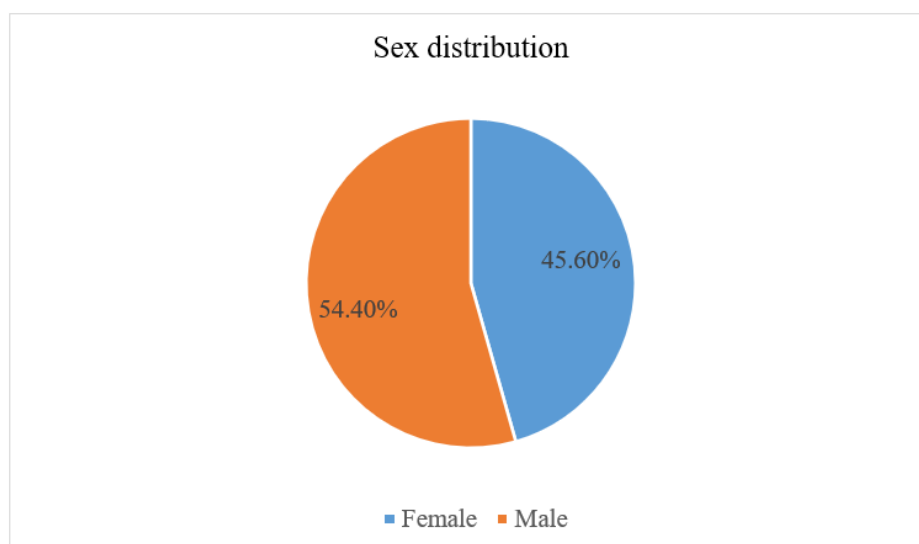


Figure 01: Sex distribution among cases presenting with pleural effusion

In our study, maximum cases were of 41-50 years age group (27.80%) followed by 31-40 years age group (16.7%). The mean age group of the patients was 52.86 ($\pm$ 17.90) years.

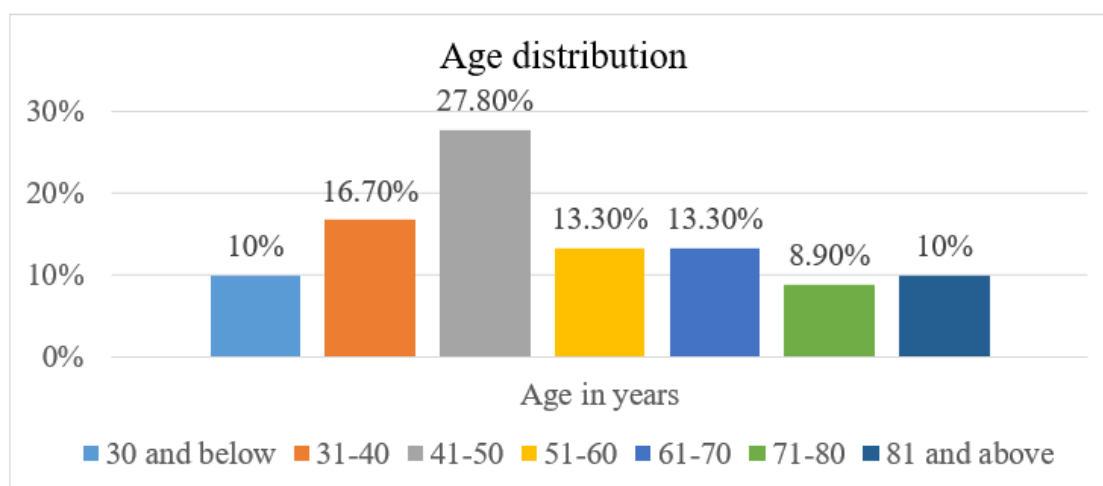


Figure 02: Age wise distribution of study sample

Based on ethnicity, we saw highest number of cases from Janajati (45.60%) followed by Brahmins (25.60%).

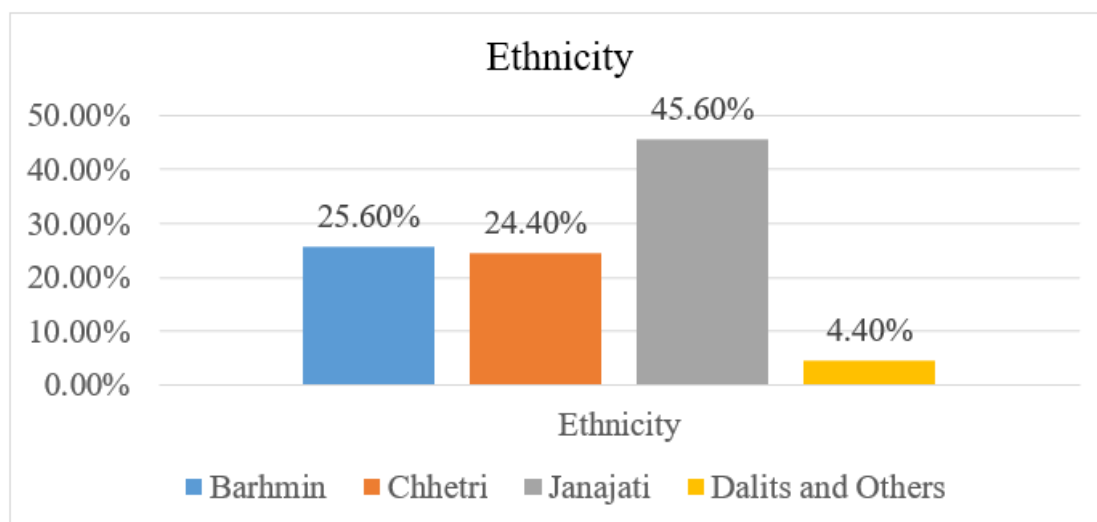


Figure 03: Ethnicity among study samples

Table 02: Personal History of the Participants

Variables	Frequency (n)	Percent (%)
Smoking		
No	47	52.2
Yes	43	47.8
Alcohol Consumption		
No	49	54.4
Yes	41	45.6

In our study, we found most of the patient had smoking and alcohol consumption habit. About 52.50 % patients had smoking history and 54.40 % of patient had alcohol consumption history.

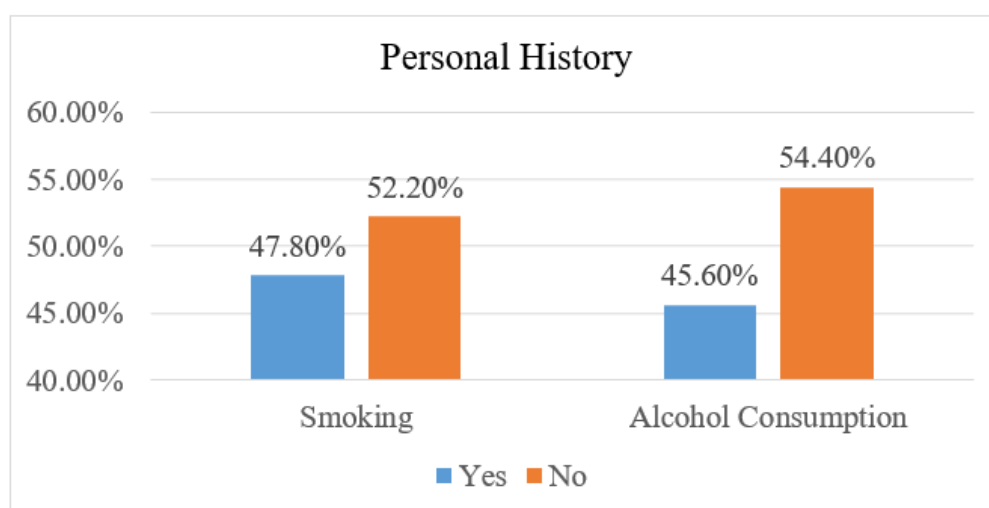


Figure 04: personal history of study participants

Table 03: Effusion types on chest x-ray

Variables	Frequency (n)	Percent (%)
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Chest X-ray		
Bilateral	24	26.7
Left side	6	6.7
Right side	60	66.7

Right sided pleural effusion was found in 66.7 % (n= 60) of the patient followed by bilateral pleural effusion in 26.7 % (n= 24) and 6.7 %(n=6) cases had isolated left sided pleural effusion.

Table 04: Clinical Features of the Participants

Variables	Frequency (n)	Percent (%)
Fever		
No	58	64.4
Yes	32	35.6
Cough		
No	40	44.4
Yes	50	55.6
Hemoptysis		
No	67	74.4
Yes	23	25.6
Dyspnea		
No	31	34.4
Yes	59	65.6
Edema		
No	53	58.9
Yes	37	41.1
Weight Loss		
No	64	71.1
Yes	26	28.9
Pallor		
No	60	66.7
Yes	30	33.3
Icterus		
No	80	88.9
Yes	10	11.1
Lymphadenopathy		
No	73	81.1
Yes	17	18.9
Clubbing		
No	71	78.9
Yes	19	21.1

Most common clinical finding among the patients were dyspnea (65.5 %) followed by cough (55.6 %)

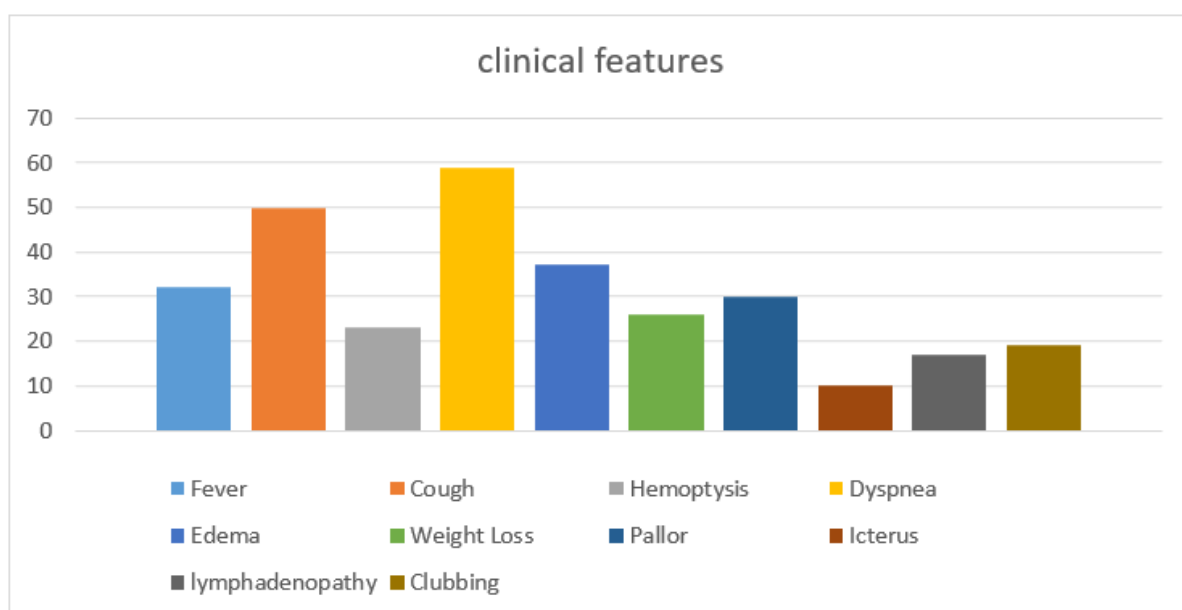


Figure 05: clinical features among effusion samples

Table 05: Disease frequency

Disease	Frequency	Percentage
CA lung	10	11.1%
CCF	9	10.0%
CKD	3	3.3%
CLD	5	5.6%
DCM	3	3.3%
Empyema thoracis	5	5.6%
Liver cirrhosis	2	2.2%
Nephrotic syndrome	7	7.8%
Pneumonia	21	23.3%
SLE	2	2.2%
Tuberculosis	23	25.6%
Total	90	100%

Among 90 patients with pleural effusion, tuberculous pleural effusion was the most common pleural effusion in the study. It counted 23 cases out of 90 cases [25.6%]. Pneumonia was the second most common cause accounting for 23.3% [n=21]. Malignant effusion accounting for 11.1 % [n=10].

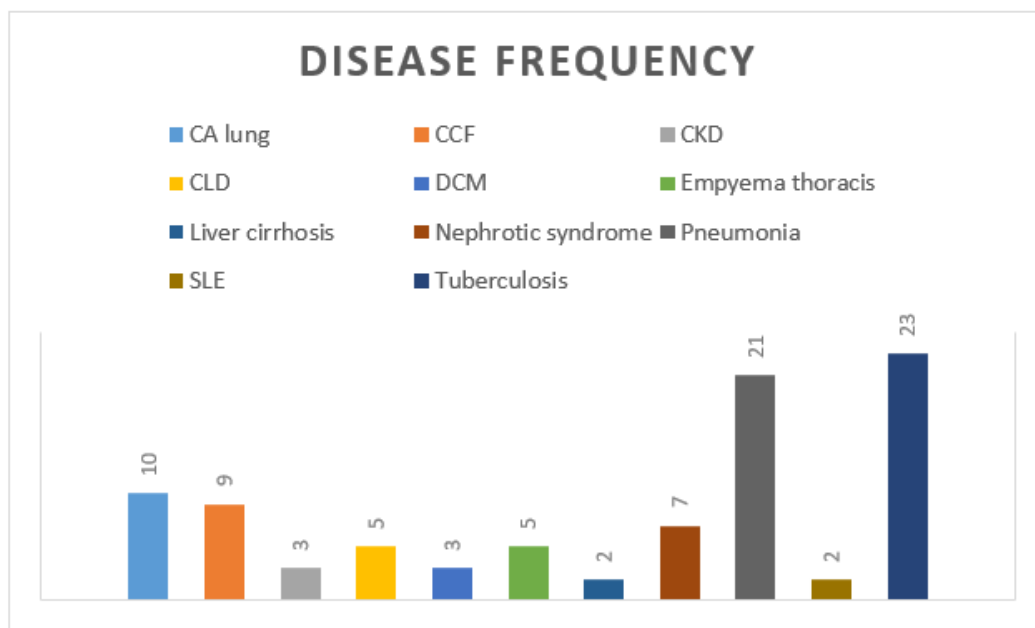


Figure 06: Disease frequency (final diagnosis)

Table 06: Exudative and transudative nature of pleural effusions based on final clinical diagnosis.

Parameters	Exudative	Transudative
Final effusion diagnosis	62 (68.9%)	28 (31.1%)

A total of 90 patients with definite final diagnosis, eligible for the study were included in which 31.1% [n=28] cases were transudates, and 68.9% [n=62] cases were exudates.

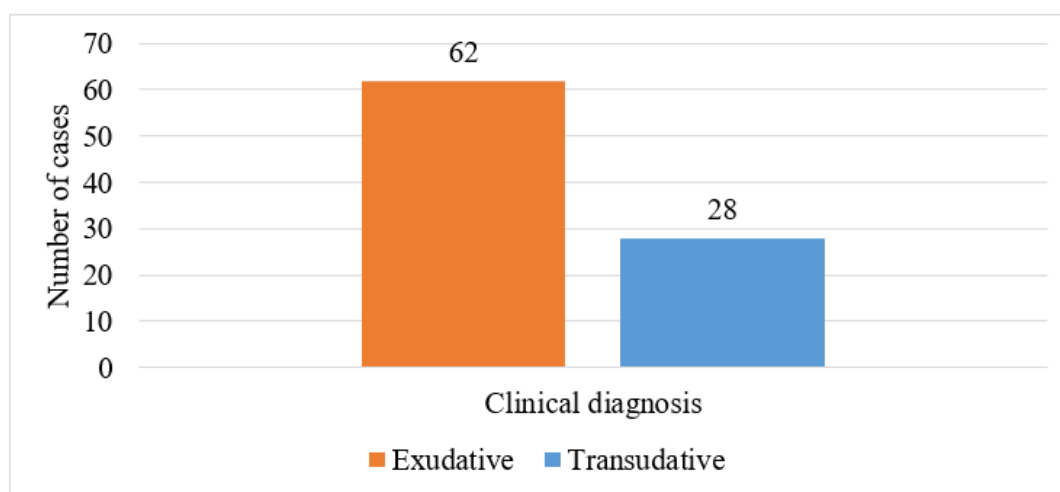


Figure 07: Pleural effusions on the basis of final clinical diagnosis.

For both exudative and transudative effusion, there was male predominance. Among 62 patients with exudative pleural effusion 53.2% [n= 33] were males, 46.8% [n=29] were females. Among 28 patients with transudative pleural effusion 57.14% [n=16] were males, 42.86% [n=12] were females.

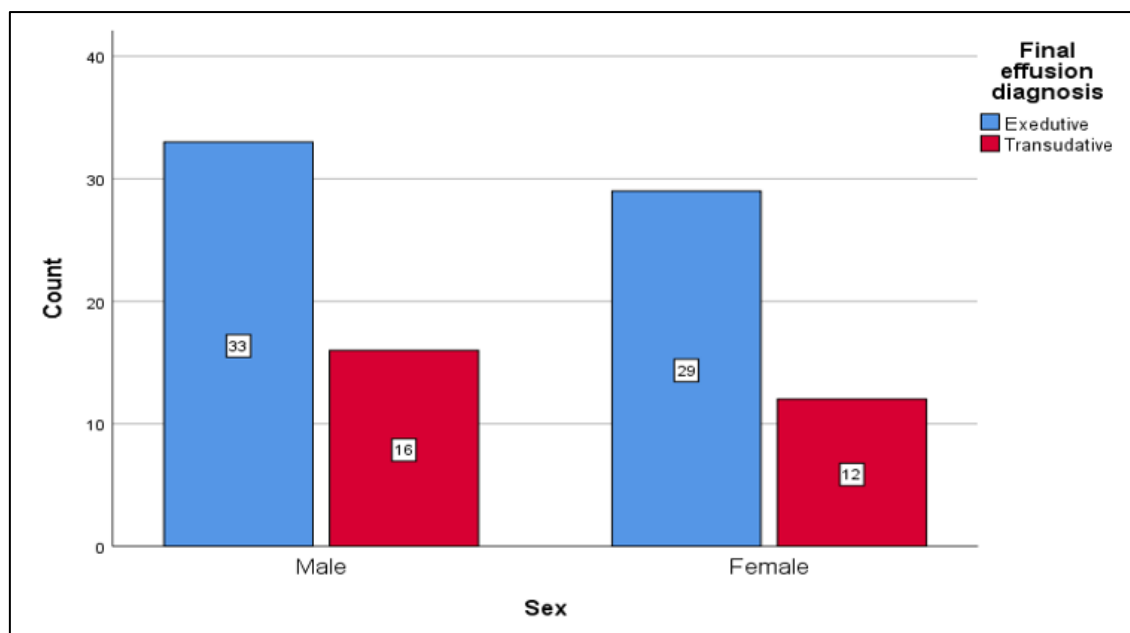


Figure 08: Sex distribution in type of pleural effusion

Table 07: chest x-ray findings based on final diagnosis

Chest X-ray	Final effusion diagnosis	
	Exudates	Transudates
Bilateral	16 (25.8%)	8 (28.6%)
Left side	5 (8.1%)	1 (3.6%)
Right side	41 (66.1%)	19 (67.9%)

In our study we saw right sided pleural effusion was predominant in both types of effusions. Out of 90 cases, Light's criteria diagnosed 72.2 % [n =65] cases as exudates and 27.8 % [n=25] of cases as transudates.

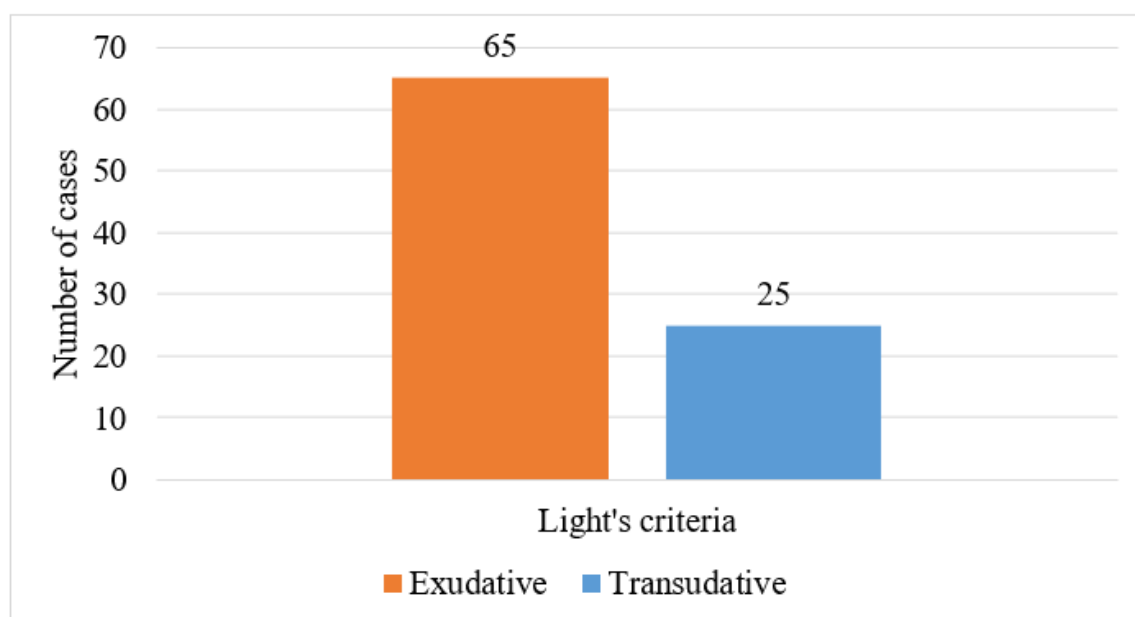


Figure 09: Effusions type based on lights criteria**Table 08:** pleural fluid total protein and effusion types

		Clinical Diagnosis		Total
		Exudate	Transudate	
Pleural Fluid Total Protein	Exudative	55 (88.7%)	1 (3.6%)	56 (62.2%)
	Transudative	7 (11.3%)	27 (96.4%)	34 (37.8%)
Total		62 (100%)	28 (100%)	90 (100%)

According to pleural fluid total protein, it classified 62.2 % [n=56] of cases as exudates and 37.8 % [n=34] of cases as transudates. Sensitivity and specificity with 88.7 % and 96.4 % respectively.

Table 09: pleural fluid cholesterol and type of effusion

		Clinical Diagnosis		Total
		Exudate	Transudate	
Pleural Fluid Total Cholesterol	Exudative	58 (93.5%)	0 (0%)	58 (64.4%)
	Transudative	4 (6.5%)	28 (100%)	32 (35.6%)
Total		62 (100%)	28 (100%)	90 (100%)

Based on pleural fluid cholesterol, our study showed 64.4% [n=58] of cases as exudates and 35.6% [n=32] of cases as transudates with sensitivity and specificity of 93.5 % and 100 % respectively.

Table 10: Effusion based on lights criteria

		Clinical Diagnosis		Total
		Exudate	Transudate	
Light's Criteria	Exudate	61 (98.4%)	4 (14.3%)	65 (72.2%)
	Transudate	1 (1.6%)	24 (85.7%)	25 (27.8%)
Total		62 (100%)	28 (100%)	90 (100%)

Based on lights criteria, our study showed 72.2 % [n=65] of cases as exudates and 27.8% [n=25] of cases as transudates with sensitivity and specificity of 98.4 % and 85.7 % respectively.

Table 11: effusion types based on combined pleural fluid cholesterol and total protein

		Clinical Diagnosis		Total	P value ¹
		Exudate	Transudate		
Pleural Fluid Total Protein and Cholesterol	Exudative	52 (83.9%)	0 (0%)	52 (57.8%)	<0.0001*
	Transudative	10 (16.1%)	28 (100%)	38 (42.2%)	
Total		62 (100%)	28 (100%)	90 (100%)	

¹ denotes for chi-square test; * denotes for statistically significant at p<0.05

Combined pleural total protein and cholesterol however classified 57.8% [n=52] of cases as exudates and 42.2% [n=38] of cases as exudates with sensitivity and specificity of 83.9 % and 100 % respectively.

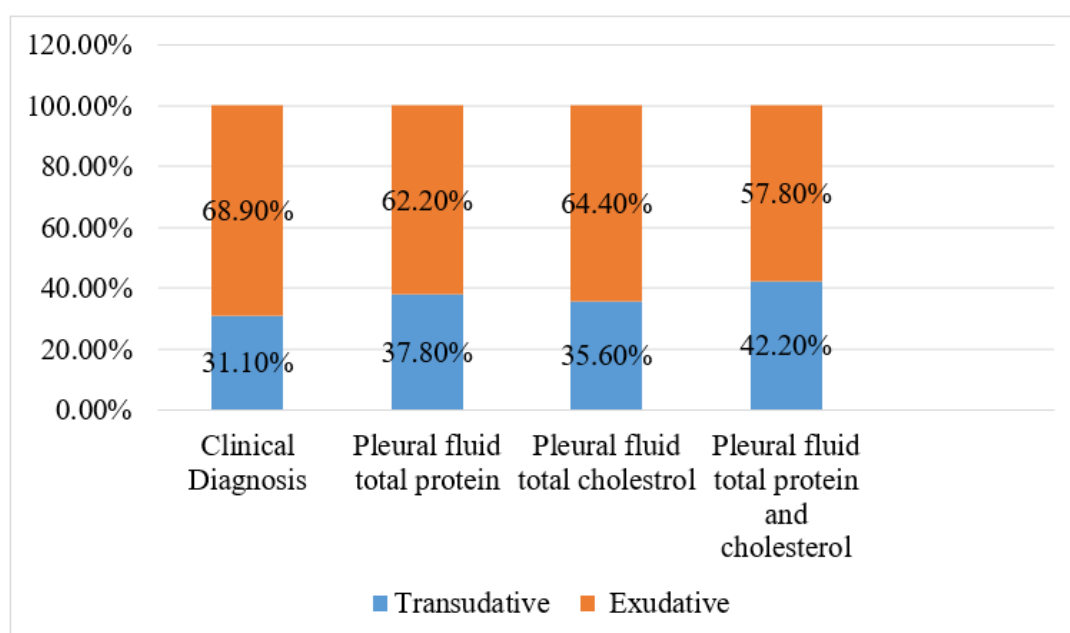


Figure 10: Effusion types comparison among different variables

Table 12: Sensitivity and specificity of Light's criteria and pleural fluid total protein and cholesterol

Parameters	Sensitivity	Specificity	PPV	NPV	P value ¹
Light's criteria	98.4%	85.7%	93.8%	96.0%	<0.0001*
Pleural Fluid Protein	88.7%	96.4%	98.2%	79.4%	<0.0001*
Pleural Fluid Cholesterol	93.5%	100%	100%	87.5%	<0.0001*

¹ denotes for chi-square test; * denotes for statistically significant at p<0.05

Table 13: Mean, median and standard deviation of serum analysis and pleural fluid analysis

	Serum Analysis		Pleural Fluid Analysis				
	LDH (IU/L)	Protein (gm/L)	TC (cells/mm ³)	ADA	LDH (IU/L)	Protein (gm/L)	Cholesterol (mg/dl)
Mean	200.58	63.520	1263.61	41.16	501.93	30.290	60.98
Median	188.50	64.000	1325.00	33.00	542.50	31.850	66.50
Standard Deviation	78.537	7.0581	597.704	24.991	322.208	6.1203	27.348
Minimum	76	39.0	150	9	59	15.2	14
Maximum	390	82.0	2550	114	1055	39.4	112

Table 14: Role of pleural fluid total protein and cholesterol for distinguishing exudative from transudative pleural effusions.

Parameters	Exudative	Transudative
Clinical Diagnosis	62 (68.9%)	28 (31.1%)
Pleural fluid total protein	56 (62.2%)	34 (37.8%)
Pleural fluid total cholesterol	58 (64.4%)	32 (35.6%)

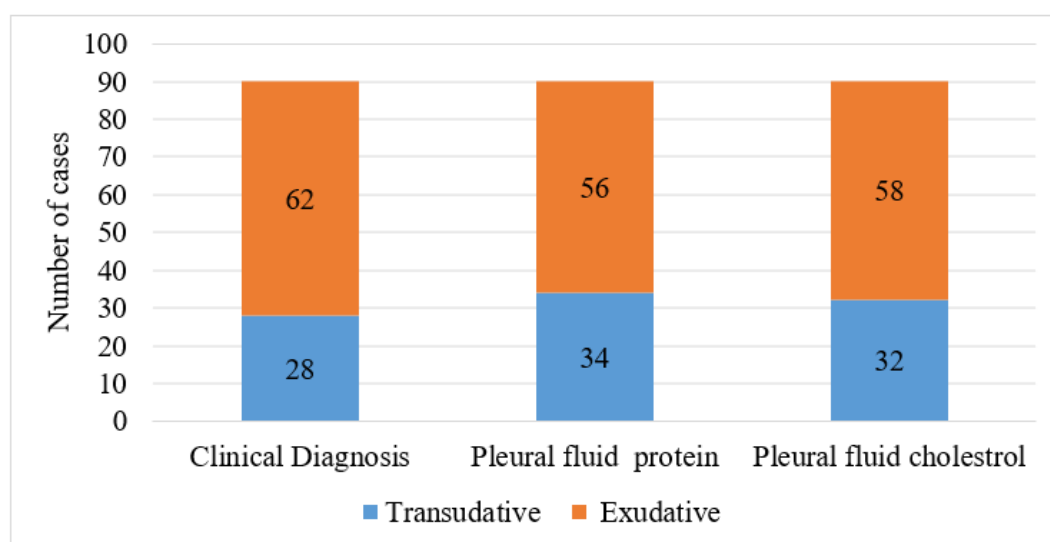


Figure 11: Number of cases according to clinical diagnosis vs pleural fluid protein vs pleural fluid cholesterol

In our study, based on pleural fluid cholesterol and total protein, 58 cases were correctly diagnosed as exudative effusion by pleural fluid cholesterol whereas total protein only diagnosed 56 cases as exudates.

DISCUSSION

In our study, according to clinical diagnosis, 90 individuals were considered, 28 with transudates and 62 with exudates. Male patients were found to be more numerous than females in both exudative and transudative pleural effusions. There were 49 males and 41 females among the 90 patients. The most prevalent age range recorded was 41-50 years old. The patients were 52.86 (17.90) years old on average which is similar to another study [mean age ($\pm$ SD) of 51.2 ($\pm$ 19.2) years] [14,15]. In the study population, 43 patients were smokers and 47 patients were nonsmokers. There were also 41 alcoholics and 49 non-alcoholics among the groups. The most frequent cause of exudative pleural effusion in our study was tuberculosis followed by parapneumonic effusion and lung malignancy with 25.6%, 23.3%, and 11.1% respectively. This was similar to a study done in Malaysia in Causes of pleural exudates in a region with a high incidence of tuberculosis, which showed most frequent cause of exudative pleural effusions was tuberculosis (44.1%) [16]. In 66.7 percent of the cases, a chest x-ray revealed right-sided pleural effusion, and in 6.7 percent of the cases, left-sided pleural effusion. In 26.7 percent of the cases, there was a bilateral pleural effusion. In chest radiography, the majority of patients with both transudative and exudative pleural effusion showed a right sided predominance. In radiology, the majority of patients with transudative pleural effusion had moderate to large pleural fluid, while the majority of those with exudative pleural effusion had mild to moderate pleural fluid. In transudative pleural effusion, the mean pleural fluid protein was 22.9714 gm/L, while in exudative pleural effusion; it was 33.5952 gm/L. The mean pleural fluid LDH in transudative effusion was 140.9643 IU/L, while it was 664.9516 IU/L in exudative pleural effusion. The mean pleural fluid cholesterol in transudative effusion was 28.2857 mg/dl, while it was 75.7419 mg/dl in exudative pleural effusion. Out of 62 cases of exudative pleural effusion by final diagnosis, Light's criteria diagnosed 65 cases as exudates and 1 case as transudate. Out of 28 cases of transudative pleural effusion by final diagnosis, Light's criteria correctly diagnose only 25 cases as transudates and misclassify 3 cases as exudates. According to our study the Light's criteria showed 98.4% sensitivity and 85.7% specificity, PPV 93.8% and NPV 96.0% (P value <0.0001) which was similar to study carried out at Tygerberg Hospital, South Africa in five hundred

pleural effusions [sensitivity and specificity of 98% and 83%, respectively, to detect exudates][17]. For pleural fluid total protein (>3 gm/dl) for exudates, out of 62 pleural exudative effusion by diagnosis on discharge, 55 were correctly classified as exudative effusions and rest 7 were misclassified as transudates. Out of 28 transudates by final diagnosis, 27 were correctly diagnosed as transudates and rest 1 was misclassified as exudates. This criterion had a sensitivity, specificity, positive predictive value and negative predictive values of 88.7%, 96.4%, 98.2% and 79.4% respectively with a significant p value of <0.0001 . Based on pleural fluid cholesterol, our study showed 64.4% [n=58] of cases as exudates and 35.6% [n= 32] of cases as transudates. It classified all 28 transudates correctly and misclassify 4 exudates as transudates. The sensitivity and specificity were 93.5 % and 100 % respectively. The result was similar to study which showed pleural fluid cholesterol had a sensitivity of 88% and a specificity of 100% [18]. But it contradicts with the findings of study done in State University of Rio de Janeiro, Pulmonology Department. The Pleural Cholesterol levels demonstrated a sensitivity of 97.22%, a specificity of 85.71%, a positive predictive value of 98.59% and a negative predictive value of 75%. This may be due to different study settings and place. Another study [19] also showed pCHOL with sensitivity of 97.7% and specificity of 100% for differentiating exudative and transudative pleural effusion. This was consistent with our study. In our study, combined pleural fluid cholesterol and total protein showed 57.8% [n=52] exudates and it misclassify 10 exudates as transudates. We found 42.2% [n=38] transudates, and all 28 transudates by final diagnosis were correctly classified as transudates giving sensitivity and specificity of 83.9% and 100% respectively. This was similar to the study findings [20] which also showed sensitivity and specificity of 96.6% and 100 % respectively. This study revealed that pleural fluid cholesterol alone and in combination with total protein was more specific in differentiating the exudates and transudates in comparison to lights criteria parameters.

4. CONCLUSIONS

Infectious effusions from Tuberculosis and Pneumonia are more common in the emergency department than other etiologies. The most widely acknowledged criteria for distinguishing between exudates and transudates in pleural effusion is Light's criteria. Though Light's criteria are still the gold standard for distinguishing between transudative and exudative pleural effusions, combining pleural fluid cholesterol and total protein yields almost identical results without the need for additional blood tests. In resource-limited settings, combined pleural fluid cholesterol and total protein can be used as an alternative to Light's criteria to avoid the necessity for simultaneous blood sample and simplify the diagnosis procedure. However, larger studies are required before definitive findings can be drawn. In resource-constrained hospitals, pleural fluid cholesterol and total protein can be used to differentiate the kind of pleural effusion and are comparable to light's criteria. Pleural fluid cholesterol alone or in combination with total protein is more helpful in identifying the nature of effusions in resource-limited settings as well as tertiary level hospitals, and we recommend it as a more efficient, easier, and cost-effective method to differentiate exudates from transudates. This study also shows that in situations of pleural effusion, pleural fluid cholesterol should be measured routinely.

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