

DIFFERENTIATING TRANSUDATIVE AND EXUDATIVE PLEURAL EFFUSION BY PLEURAL FLUID CHOLESTEROL

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ABSTRACT

Background: Pleural effusion is one of the common condition encountered in day to day practise. Pleural effusions represent a very common diagnostic task to the physician. A correct diagnosis of the underlying disease is essential to rational management. Today there are a number of laboratory tests available to differentiate exudates and transudates which are considered cost effective to the patients, so this study was designed for the measurement of pleural fluid cholesterol to differentiate transudative and exudative pleural effusions (sensitivity-97.8%, specificity-100%) with the advantage that a contemporary blood sample is not required, thereby lowering cost of diagnostic procedure. **Objectives:** To study the diagnostic value of Pleural fluid Cholesterol in differentiating transudative and exudative pleural effusions. **Methodology:** This cross sectional descriptive study was conducted on patients of pleural effusion (n=60) age >18 years patients with definitive clinical diagnosis and evidenced by radiological diagnosis of pleural effusion were taken as inclusion criteria. **Results:** The results showed majority of the patients were males (63.3%) and females (36.7%). According to lights criteria 46 patients were exudates and 14 patients were transudates and according to Pleural fluid Cholesterol criteria 45 patients were exudates and 15 patients were transudates with sensitivity of 97.8% and specificity of 100% and accuracy of 98.3%. **Conclusion:** The pleural fluid cholesterol criteria were found to be the most efficient criteria. Since this parameter involves the measurement of only pleural fluid values of cholesterol, it has following advantages-Economically it reduces number of biochemical tests and Simpler as there is no need to take simultaneous blood sample at the time of thoracentesis.

Keywords: Pleural Effusion; Transudates; Exudates; Cholesterol.

INTRODUCTION

Pleural effusions represent a very common diagnostic task to the physician. A correct diagnosis of the underlying disease is essential to the rational management [1].

Normally the pleural space contains only a few millimetres of fluid. Accumulation of excessive amount of fluid is a frequent manifestation of many diseases of both thoracic and extra thoracic. Indeed pleural effusion must be regarded as a trivial event but as a sign of major disorder or disease [2].

The first diagnostic step is the identification of pleural effusions as either a transudate or exudates. This is useful because it indicates the pathophysiological mechanisms involved. Exudates are secondary to alteration of capillary permeability or lymphatic drainage. Transudates are due to either alterations of hydrostatic and / or osmotic pressure in pleural capillaries or to a fluid passing from the peritoneal cavity via diaphragmatic defects.

If an exudate is present further diagnostic procedures and tests are imperative for definitive diagnosis and specific therapy. On the other hand if the fluid is clearly

a transudate one need not worry about manoeuvres directed at the pleura and need to treat only the congestive cardiac failure, nephrosis, cirrhosis or hypoproteinemia [3].

Over the years many criteria have been developed by various workers for separation of exudates and transudates.

Objective: To study the diagnostic value of Pleural fluid Cholesterol in differentiating transudative and exudative pleural effusions.

MATERIALS AND METHODS

Study design: Cross sectional descriptive study

Ethics approval: Study was approved by the institutional ethics committee

Place of research: BLDEU'S Shri B. M. Patil medical college hospital and research centre, Vijayapura.

Study period: Period of study is from November 2016 to July 2018.

Inclusion Criteria: Data is collected from patients who are attending Medicine OPD and IPD. Age >18years, patients with definite clinical diagnosis and Pleural effusion evidenced by radiological imaging.

Exclusion criteria: Patients without definitive clinical diagnosis, and previously diagnosed or already on treatment.



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Sample size: Using expected incidence of exudates cases among pleural effusion as 69.4%, expected sensitivity as 88%, expected specificity as 100% and desired precision as +/-10%. The minimum sample is 60. This sample size will give the precision of 10% for both sensitivity and specificity.

Formula used: $N = z^2 (1-p)/d^2$

Z-value of z statistic at 5% level of significance, d-margin of error, p-expected incidence rate
Methodology: Complete history of the patient and clinical signs and symptoms at presentation is collected and determined the side of effusion. Pleural fluid is aspirated and investigations like pleural fluid analysis which includes pleural protein, pleural sugar, cell count, malignancy and pleural cholesterol is estimated. Pleural fluid cholesterol criteria is applied to differentiate transudate and exudates (pleural cholesterol <45mg/dl transudate and >45mg/dl exudates) and compared with the standard Lights criteria (pleural fluid protein: serum protein >0.6)

Statistical Analysis: Data will be analysed using mean +/-SD Chi square test for association, comparison of means using test, ANOVA for comparison between and within groups and diagrammatic presentation.

RESULTS

The present study was undertaken in 60 cases of Pleural Effusion over a period of 2 and half years from November 2016 to July 2018, the results of which are given below.

Table 1. Age and sex distribution

AGE (years)	Male	Female	p value
	N (%)	N	
18-20	1 (2.6)	0(0)	0.641
21-30	5(13.2)	4(18.2)	
31-40	8(21.1)	7(31.8)	
41-50	12(31.6)	3(13.6)	
51-60	8(21.1)	5(22.7)	
>60	4(10.5)	3(13.6)	
Total	38	22	

Table 2. Distribution of symptoms in pleural effusion at presentation

Presenting symptoms	Number of patients (%)
Cough	50 (83.3)
Fever	22(36.7)
Chest pain	34(56.7)
Dyspnoea	47(78.3)
Swelling of limbs	10(16.7)
Distension of abdomen	10(16.7)
Facial puffiness	6(10)
Loss of appetite	60 (100)
Loss of weight	40(66.7)

Table 3. Distribution of signs in pleural effusion at presentation

Clinical signs	N (%)
Stony dullness	60 (100)
Absent breath sound	50 (83.3)
Decreased vf/vr	52 (86.7)
Mediastinal shift	50 (83.3)
Pleural rub	4 (6.6)
Crepitations	5 (8.3)

Table 4. Pleural effusion right and left side distribution

Side of effusion	Number (%)
Right	36 (60)
Left	19 (31.7)
Bilateral	5(8.3)

Out of 60 patients, 36 had right sided effusion, 19 had left sided effusion, 5 patients had bilateral pleural effusion.

Table 5. Appearance of pleural effusion

Colour	Total		p value
	N	%	
Amber	36	60.0	0.864
Clear	18	30.0	
Haemorrhagic	4	6.7	
Straw	2	3.3	
Total	60	100.0	

Colour of pleural effusion – 36 patients had amber colour, 18 patients had clear, 4 patients had haemorrhagic and straw colour in 2 patients.

Table 6. Cytology of pleural effusion

Cytology	Total		p value
	N		
Lymphocytes + Mesothelial cells	3 (5)	0.476	
Predominantly lymphocytes	42 (70)		
Predominantly neutrophils	15 (25)		
Total	60		

Out of 60 patients, 3 patients had lymphocytes plus mesothelial cells, 42 patients had predominantly lymphocytes and 15 patients had predominantly neutrophils.

Table 7. Distribution of pleural protein

Pleural protein (gram/dl)	Number (n=60)
1-2	6
2-4	16
4-6	34
>6	4
Total	60

The above table shows the values of pleural protein. 6 patients had pleural protein values ranging from 1-2 gram/dl, 16 patients of pleural protein ranging from 2-4 gram/dl, 34 patients ranging from 4-6 gram/dl and 4 patients had protein levels above 6 gram/dl.

Table 8. Distribution of pleural cholesterol

Pleural cholesterol	N
<45 mg/dl	15
>45 mg/dl	45
Total	60

15 patients had pleural cholesterol levels less than 45 mg/dl and 45 patients had cholesterol level above 45 mg/dl.

Table 9. Biochemical analysis of pleural effusion

Parameters (g/dl)	Exudates	Transudate	P VALUE
	Mean ± SD	Mean±SD	
Lights criteria (transudate=14 exudate=46)			
Serum protein(g/dl)	5.7±1	6.1±1.1	0.215
Pleural protein(g/dl)	4.7±1	2.4±0.9	<0.001*
Pleural sugar(mg/dl)	68.2±40.1	126.7±76	<0.001*
Pleural fluid protein:Serum protein	0.8±0.2	0.3±0.1	<0.001*
Pleural cholesterol criteria(transudate=15 exudate=45)			
Pleural cholesterol (mg/dl)	78.2±23.7	21.9±9.2	<0.001*

Note: * significant at 5% level of significance (p<0.05). The p value of serum protein is 0.215,

According to Lights Criteria, the mean serum protein is 5.7±1.0 in exudates and 6.1±1.1 has p value of 0.215. The mean pleural protein is 4.7±1.0 in exudates and 2.4±0.9 has p value of 0.001. The mean pleural sugar is 68.2±40.1 in exudates and 126.7±75.9 has p value of 0.001. The mean pleural protein: serum protein is

0.8±0.2 in exudates and 0.3± 0.1 has p value of 0.001. According to pleural cholesterol criteria, the mean pleural cholesterol is 78.2±23.7 in exudates and 21.9±9.2 and has p value of 0.001 which is statistically significant.

pleural protein is <0.001, pleural sugar is <0.001, pleural cholesterol is <0.001, pleural fluid protein: serum protein is <0.001. P value of <0.001 is statistically significant.

Table 10. Distribution of exudates and transudate according to lights criteria and pleural fluid cholesterol criteria³

Based on lights criteria	N	%
Exudate	46	76.7
Transudate	14	23.3
Based on cholesterol criteria		
Exudate	45	75
Transudate	15	25

Based on Lights criteria, out of 60 patients 46 were exudates (76.7%) and 14 were transudates (23.3%).Based on pleural cholesterol level criteria, out of 60 patients 45 (75%) were exudates and 15(25%) were transudates.

Table 11. Result of sputum AFB

Sputum AFB	TOTAL		P VALUE
	N	%	
Negative	28	46.7	0.232
Positive	32	53.3	
Total	60	100.0	

In the study group of 60 patients, sputum AFB was positive in 32 (53.3%) patients and 28 (53.3%) patients had sputum AFB was negative.

Table 12. USG abdomen examination in pleural effusion

USG	Total		p value
	N	%	
Cirrhosis with portal hypertension	7	11.7	0.182
Mild hepatomegaly	1	1.7	
Minimal ascites	1	1.7	
Normal	39	65.0	
Not done	12	20.0	
Total	60	100.0	

In the study group of 60 patients, cirrhosis was present in 7 patients, hepatomegaly in 1 patient, ascites in 1 patient, and normal in 39 patients.

Table 13. Comparison of exudative and transudative pleural effusion according to pleural fluid cholesterol criteria and lights criteria

	According to pleural fluid cholesterol criteria	According to lights criteria	P value
	N (%)	N(%)	
Exudate	45 (75)	46 (76.6)	<0.001*
Transudate	15(25)	14 (23.3)	
Total	60	60	

Note: * significant at 5% level of significance (p<0.05)

Based on lights criteria 46 patients were exudate and 14 patients were transudative pleural effusion, based on cholesterol criteria 45 patients were exudative and 15 were transudative pleural effusion.

The p value is < 0.001 which is statistically significant.

Table 14. Sensitivity analysis of pleural cholesterol criteria

TP (true positive)	45
FN (false negative)	1
FP (false positive)	0
TN (true negative)	14
Sensitivity	97.8%
Specificity	100.0%
PPV(positive predictive value)	100.0%
NPV(negative predictive value)	93.3%
Accuracy	98.3%

DISCUSSION

A total of 60 patients were taken up for this study. Out of 60, 46 were exudates and 14 were transudates. Among 46 exudates, 40 were tubercular effusions, 5 patients were synpneumonic effusion and 1 patient with malignant effusion.

Among 14 transudative, 7 patients were congestive cardiac failure, 7 patients were cirrhosis.

Age and sex: The age of the patient in this study ranged from 18 years to 75 years. 1 patient was 18 years, 9 patients were between 21-30 years, 15 patients were between 31-40 years, 15 patients were between 41-50 years, 13 patients were between 51-60 years and 7 patients were above 60 years. Out of 60 patients, males were 38 and females were 22.

Hamm⁴ first used pleural cholesterol as a parameter. In his study of 150 patients he found excellent results (Sensitivity 93%, Specificity 100%, Accuracy 96%). Following Hamm's [4], Valdes [5] aimed to validate this parameter. In his study of 74 patients pleural cholesterol had good results as shown in the above table. Similar results were obtained from studies by Ram [6] in 100 patients and B N Mohaptra [7] in his study of 132 patients. The studies of Burgess [8] and Remero [9] of 124 patients, results were in favour of lights criteria but

they had less sensitivity, specificity and accuracy. As a result the present study of 60 patients which contains Pleural Cholesterol criteria has more sensitivity, specificity and accuracy when compared to other studies done by Burgess and Remero which contains Lights criteria.

The study shows that pleural fluid cholesterol criteria (cholesterol >45 mg/dl - exudate and cholesterol <45 mg/dl – transudate) constitute a useful tool for the separation of pleural effusions.

CONCLUSION

The pleural fluid cholesterol criteria were found to be the most efficient criteria. Since this parameter involves the measurement of only pleural fluid values of cholesterol, it has following advantages: Economically, it reduces number of biochemical tests, Simpler, as there is no need to take simultaneous blood sample at the time of thoracocentesis.

It is concluded that the determination of pleural fluid cholesterol criteria can be included in routine analysis of pleural fluid samples in place of presently used Lights Criteria.

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