COMPARISON OF LIGHT'S CRITERIA AND PLEURAL FLUID CHOLESTEROL TO DISTINGUISH EXUDATIVE AND TRANSUDATIVE PLEURAL FLUID

Kali Gandhi[1], Uday Raj Singh[2], P. C. Kol[3], Ashutosh Garg[4], Krati Gandhi[5], S. K. Sutrakar[6], Hemlata Bamoriya[7]

[1]Junior Resident, Department of Pathology, S. S. Medical College, Rewa, Madhya Pradesh.
[2]Professor and HOD, Department of Pathology, S. S. Medical College, Rewa, Madhya Pradesh.
[3]Associate Professor, Department of Pathology, S. S. Medical College, Rewa, Madhya Pradesh.
[4]Demonstrator, Department of Microbiology, S. S. Medical College, Rewa, Madhya Pradesh.
[5]Junior Resident, Department of OBG, Pt. B. D. Sharma PGIMS, Rohtak, Haryana.
[6]Associate Professor, Department of Pathology, S. S. Medical College, Rewa, Madhya Pradesh.
[7]Junior Resident, Department of Pathology, S. S. Medical College, Rewa, Madhya Pradesh.

ABSTRACT

BACKGROUND

Light's criteria is the gold standard to differentiate transudative pleural effusion from exudative pleural effusion, but it requires four biochemical estimations which in developing countries such as India, may not be feasible in every patient due to economic constraints.

MATERIALS AND METHODS

In this prospective study, 60 patients with pleural effusion were included. Pleural fluid total protein, LDH and cholesterol as well as serum total protein and LDH levels along with other investigations were studied. Clinical classification of transudate or exudate was done based on aetiology.

RESULTS

Based on clinical signs and symptoms, chest radiograph and other investigations, 52 of these effusions were classified as exudates and 8 as transudates. Using the pleural fluid cholesterol cut-off point >45 mg/dL to differentiate exudates and transudates, the sensitivity, specificity, positive predictive value (PPV) and the negative predictive value (NPV) were found to be 100%. Using Light's criteria to differentiate exudates and transudates, the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were found to be 98%, 87.5%, 98% and 87.5% respectively. The differences resulted from misclassification of 1 expected exudate as transudate out of 52 and 1 expected transudate as exudate out of 8 by Light's criteria.

CONCLUSION

Pleural fluid cholesterol is a simple, cost effective and useful parameter in differentiating pleural exudates from transudates, with the advantage of requiring only one laboratory determination and no simultaneous blood sample, as compared to the use of Light's criteria.

KEYWORDS

Light's Criteria, Pleural Fluid Cholesterol, Exudates and Transudates.

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BACKGROUND

Pleural effusion is a manifestation of several diseases, both pulmonary and extrapulmonary.[1] Based on underlying pathological abnormality and mechanism of formation, effusion can be either "transudates" or "exudates".[2] In 1972, Light et al[3] compared various criteria for differentiating between transudative and exudative pleural effusion and found none of them to be specific. They advocated the use of a combination of following criteria to differentiate between transudative and exudative pleural effusion with nearly 100% sensitivity and specificity: Pleural fluid protein to serum protein ratio >0.5, Pleural fluid LDH >200 IU/L, Pleural fluid LDH to serum LDH ratio >0.6. However, several prospective studies[4-7] were unable to reproduce the results obtained by Light et al.[3] In most of these studies, Light's criteria had a >95% sensitivity for exudates but specificity was <78%. Various cause may be responsible for the presence of cholesterol in the pleural effusion.[8-10] Light's criteria is the gold standard to differentiate transudative pleural effusion from exudative pleural effusion, but it requires four biochemical estimations which in developing countries such as India, may not be feasible in every patient due to economic constraints. The purpose of present study is comparison of Light's criteria and pleural fluid cholesterol to distinguish exudative and transudative pleural fluid.

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Corresponding Author:
Dr. Kali Gandhi,
Junior Resident,
Department of Pathology,
S. S. Medical College,
Rewa-486001, Madhya Pradesh.
E-mail: kali05sept@gmail.com
DOI: 10.14260/jemds/2017/659

MATERIALS AND METHODS

This prospective study was conducted in Department of Pathology, Shyam Shah Medical College and Sanjay Gandhi Memorial Hospital, Rewa (M. P.), a tertiary care hospital, from duration April 2015 to March 2016. The study comprised of

60 patients who were admitted to SGMH with signs or symptoms of pleural effusion by adhering strictly to certain inclusion and exclusion criteria.

Inclusion Criteria

(1) Age of patient >15 years, (2) Clinically and radiologically demonstrable moderate to large pleural effusion, (3) Willingness of patient to participate in the study, (4) Patients of pleural effusion who have not received any therapy for his/her present disease, (5) Indoor patients.

Exclusion Criteria

(1) Age of patient <15 years, (2) Patients with contradictions to perform thoracocentesis like bleeding diathesis, local infection, thrombocytopenia, renal insufficiency, etc. (3) Patient's refusal, (4) Outdoor patients, (5) Patients with history of pleural effusion due to trauma.

All the patients underwent a detailed history of fever, productive or dry cough, night sweats, haemoptysis, chest pain, weight loss, lower extremity oedema, orthopnoea, paroxysmal nocturnal dyspnoea, decreased urine output, and other relevant symptoms. Clinical assessment including general survey and systemic examination were done. Blood investigations (complete haemogram, total protein, cholesterol and LDH), urine examination, chest radiograph (Postero-anterior view), electrocardiography, echocardiography, renal function test, liver function test, sputum examination for acid-fast bacilli, ultrasonography, computed tomography chest (in selected patients) were done in all the patients. Pleural fluid analysis was done for total protein, cholesterol and LDH in all the patients. Pleural fluid and serum collected at same time. Present study material comprised of patients with following clinical diagnosis. (1) Tuberculosis (TB), (2) Pneumonia, (3) Malignancy, (4) Empyema, (5) Pericardial disease, (6) Pulmonary Embolism, (7) Congestive Heart Failure (CHF) and (8) Hepatic Cirrhosis.

The protein concentrations (g/dL) were measured by using biuret method, the cholesterol was measured by using enzymatic method CHOD-PAP and the LDH was estimated by Modified IFCC Method, with the help of colorimetric estimation. For laboratory classification of pleural fluids, protein and LDH are interpreted according to the criteria of Light et al and a cut-off point of 45 mg/dL was adopted for cholesterol.[11]

RESULTS

This study comprised of 60 patients. All of them were inpatients both male and female with signs or symptoms of pleural effusion admitted to wards of S.G.M.H., Rewa. Patients were divided into 2 groups: patients with clinically suspected exudative effusion and patients with clinically suspected transudative effusion. A total of 60 patients were taken for study which included 52 patients with exudative effusion and 8 patients with transudative effusion.

Table 1 and Figure 1 shows the distribution of study population by type of effusion, in this exudative effusion was seen in a majority of study population i.e. 86.7% (n=52) and transudative effusion was seen in 13.3% (n=8) of study population.

Table 2 and Figure 2 shows the distribution of study population by effusion type and gender. It was observed that both exudative and transudative effusions were more prominent in male patients i.e. 75% (n=39) were male and 25% (n=13) were female out of 52 exudative effusion. Similarly, 75% (n=6) were male and 25% (n=2) were female out of 8 transudative effusions.

Table 3 and Figure 3 shows the distribution of study population by effusion type and age group. In patients with exudative effusion, the majority (n=24 and 46.2%) of study population were in >65 years age group, followed by the 41-65 years (n=18 and 34.6%) and 15-40 years (n=10 and 19.2%) age groups. Similarly, in patients with transudative effusion, the majority i.e. 62.5% (n=5) of study population were in >65 years age group, followed by the 41-65 years (25% and n=2) and 15-45 years (12.5% and n=1) age groups.

Table 4 and Figure 4 shows the distribution of study population by effusion type and clinical diagnosis. As can be seen from data, among the patients with exudative effusion, tuberculosis was the most common cause, diagnosed in 23 patients (44.2%) followed by pneumonia (12 and 23%), malignancy (7 and 13.3%), empyema (5 and 9.6%), pericardial disease (3 and 5.7%) and pulmonary embolism (2 and 3.8%). However, among the patients with transudative effusion, congestive heart failure (6 and 75%) was the most prevalent condition, followed by hepatic cirrhosis (2 and 25%).

Table 5 and Figure 5 shows sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for differentiation of exudate and transudate while using pleural fluid cholesterol cut-off point >45 mg/dL. As from data it can be seen that sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were 100%, 100%, 100% and 100% respectively, when using pleural fluid cholesterol cut off point >45 mg/dL to differentiate exudate and transudate.

Type of Effusion	Frequency (n)	Percentage (%)
Exudate	52	86.7%
Transudate	8	13.3%
Total	**60**	**100%**

Table 1. Distribution of Study Population by type of Effusion

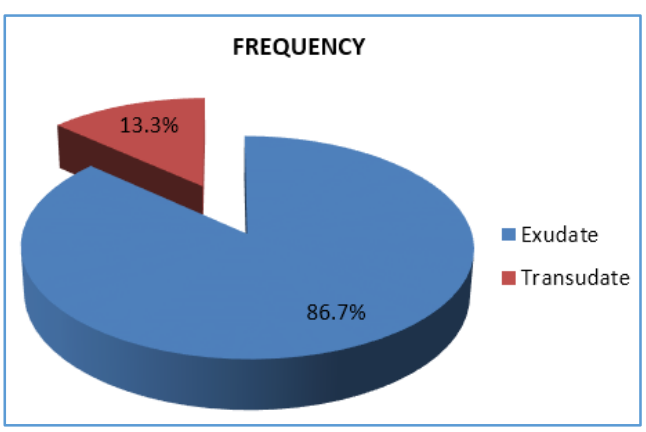

Figure 1. Distribution of Study Population by Type of Effusion

	Male		Female		Total	
Effusion Type	**n**	**%**	**n**	**%**	**n**	**%**
Exudate	39	75	13	25	52	86.7
Transudate	6	75	2	25	08	13.3
Total	**45**	**75**	**15**	**25**	**60**	**100**

Table 2. Distribution of Study Population by Effusion Type and Gender

	15-40 yrs.		41-65 yrs.		>65 yrs.		Total	
Effusion type	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Exudate	10	19.2%	18	34.6%	24	46.2%	52	86.7%
Transudate	1	12.5%	2	25%	5	62.5%	8	13.3%
Total	**11**	**18.3%**	**20**	**33.3%**	**29**	**48.4%**	**60**	**100%**

Table 3. Distribution of Study Population by Effusion Type and Age Group

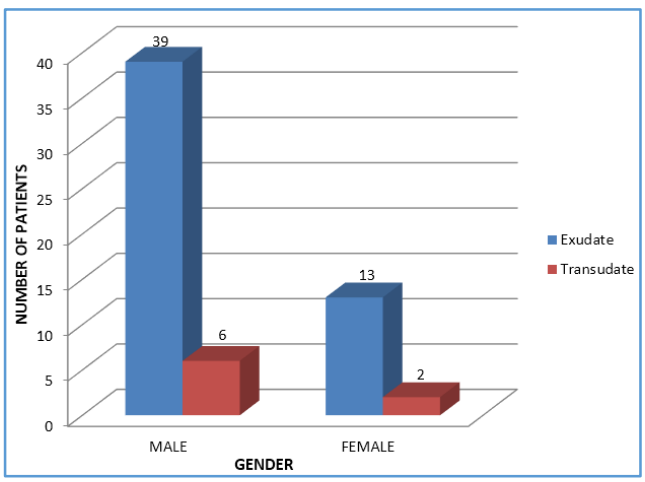

Figure 2. Distribution of Study Population by Effusion Type and Gender

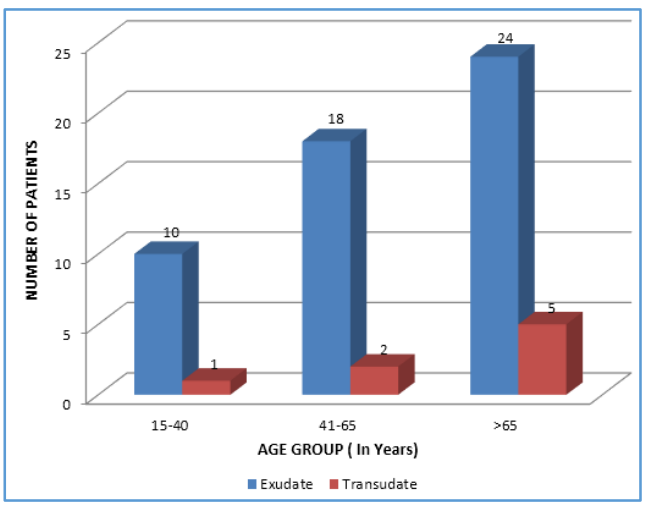

Figure 3. Distribution of Study Population by Effusion Type and Age Group

	T.B.	Pneumonia	Malignancy	Empyema	Pericardial DS.	Pulmonary Embolism	CHF	Hepatic Cirrhosis	Total
Effusion Type	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Exudate	23 44.2%	12 23%	7 13.5%	5 9.6%	3 5.7%	2 3.8%	0 0%	0 0%	52 86.7%
Transudate	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	6 75%	2 25%	8 13.3%
Total	**23 38.3%**	**12 20%**	**7 11.8%**	**5 8.3%**	**3 5%**	**2 3.3%**	**6 10%**	**2 3.3%**	**60 100%**

Table 4. Distribution of Study Population by Effusion Type and Clinical Diagnosis

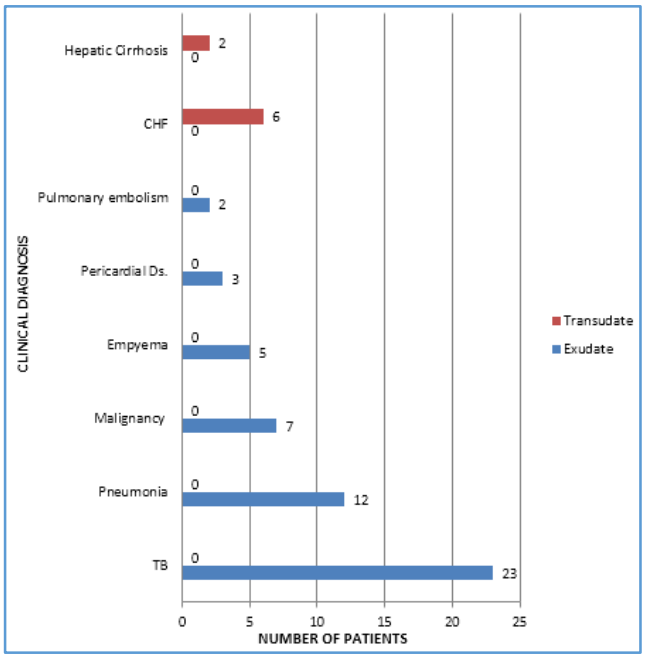

Figure 4. Distribution of Study Population by Effusion Type and Clinical Diagnosis

Parameters	**Pleural fluid Cholesterol Cut-off point >45 mg/dL**
Sensitivity	100%
Specificity	100%
PPV	100%
NPV	100%

Table 5. Sensitivity, Specificity, PPV, and NPV for Differentiation of Exudate and Transudate by using Pleural Fluid Cholesterol Cut-off point >45 mg/dL.

Test of significance Chi-square test. p value <0.0001.

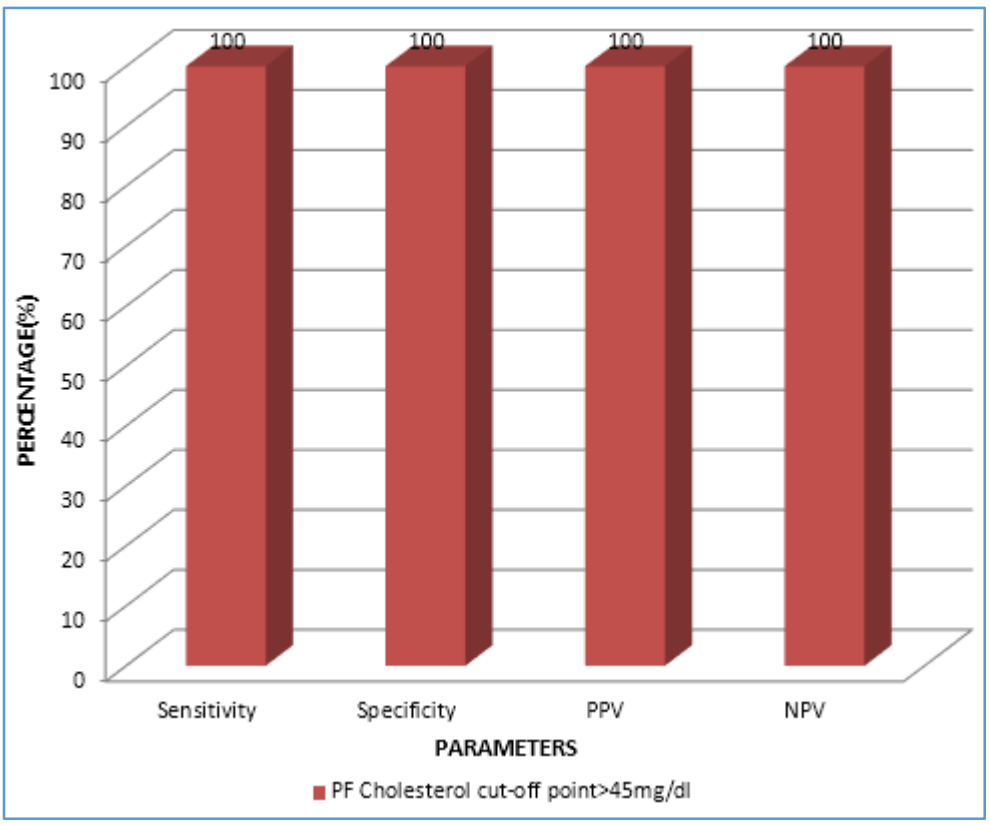

Figure 5. Sensitivity, Specificity, PPV, and NPV for Differentiation of Exudate and Transudate by using Pleural Fluid Cholesterol Cut-off Point >45 mg/dL

		Marina Costa MD et al[12]	**Rohit Rungta et al[13]**	**Anand K. Patel et al[14]**	**Present Study**
Light's Criteria	Sensitivity	98%	98%	98%	98%
	Specificity	82%	82%	100%	87.5%
	PPV	-	90%	100%	98%
	NPV	-	82.9%	92%	87.5%
Pleural fluid Cholesterol		**Cut-off point >45 mg/dL**	**Cut-off point >45 mg/dL**	**Cut-off point >60 mg/dL**	**Cut-off point >45 mg/dL**
	Sensitivity	90%	90%	98%	100%
	Specificity	100%	99%	100%	100%
	PPV	-	93%	100%	100%
	NPV	-	95%	92%	100%

Table 6. Comparison of Sensitivity, Specificity, Positive Predictive Value and Negative Predictive Value when using Light's Criteria to Differentiate Exudate and Transudate and when using Pleural Fluid Cholesterol to Differentiate Exudate and Transudate among Various Studies

DISCUSSION

This study was carried out on 60 patients divided into 2 groups; exudate and transudate. Exudate consists of 52 patients including patients with clinical diagnosis of tuberculosis, pneumonia, malignancy, empyema, pericardial disease, pulmonary embolism. Transudate consists of 8 patients with clinical diagnosis of congestive heart failure and hepatic cirrhosis. Out of 52 patients, 39 were male and 13 were female, with maximum number of patients falling in age group >65 years with mean age 57.11 years. Out of 8 patients, 6 were male and 2 were female with maximum number of patients falling in >65 years age group with mean age 58.62 years.

Present study demonstrates that the sensitivity, specificity, positive predictive value and negative predictive value were 98%, 87.5%, 98%, and 87.5% respectively when using Light's Criteria to differentiate exudate and transudate while the sensitivity, specificity, positive predictive value and negative predictive value were 100%, 100%, 100%, and 100% respectively when using pleural fluid cholesterol cut-off point >45 mg/dL to differentiate exudate and transudate. Present study shows that using pleural fluid cholesterol to differentiate exudate and transudate was more sensitive and specific than using Light's criteria because in our study 1 exudate out of 52 exudates was misclassified as transudate (Sensitivity 98%) and 1 out of 8 transudates was erroneously labelled as exudate (Specificity 87.5%) when using Light's criteria to differentiate exudate and transudate.

When using the pleural fluid cholesterol cut-off point >45 mg/dL, all the 52 exudates were correctly classified (sensitivity 100%) and all the 8 transudates were correctly labelled (specificity 100%).

Table 6 shows comparison of sensitivity, specificity, positive predictive value and negative predictive value when using Light's criteria to differentiate exudate and transudate and when using pleural fluid cholesterol to differentiate exudate and transudate among various studies.

CONCLUSION

The present study has been an attempt to determine the role of pleural fluid cholesterol and to suggest that the pleural fluid cholesterol is a better criterion than Light's criteria to differentiate exudative and transudative effusion. The sensitivity, specificity, positive predictive value and negative predictive value when using pleural fluid cholesterol to differentiate exudate and transudate is higher than the sensitivity, specificity, positive predictive value and negative predictive value when using Light's criteria to differentiate exudate and transudate. Thus, it is suggested that the measurement of pleural fluid cholesterol to differentiate exudate and transudate is better than the Light's criteria, with the advantage of no simultaneous collection of blood sample, especially in country like India where financial and technical constraints are immense.

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