A Study of Serum to Pleural Fluid Albumin Gradient in Differentiation of Exudative and Transudative Pleural Effusion in Comparison to Light's Criteria

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Abstract	Original Research Article

Pleural effusion is the accumulation of fluid between the parietal and visceral pleura called the pleural cavity. It can occur by itself or can be the result of surrounding parenchymal diseases like infection, malignancy or inflammatory conditions. Pleural effusion is one of the major causes of pulmonary mortality and morbidity. Both the visceral and the parietal pleura play an important role in fluid homeostasis in the pleural space. Pleural effusions develop when there is excess hydrostatic pressure in the pulmonary capillaries, when fluid removal is impaired by compromised lymphatic drainage or when protein and cell rich fluid enters the pleural space through leaky capillary and pleural membranes. Pleural fluid is classified as a transudate or exudate based on modified Light's criteria, proposed by Light *et al*., in 1972 which has been the standard differentiation method.
It is considered an exudative effusion if at least one of the criteria is met:
➢ Pleural fluid protein/serum protein ratio of more than 0.5
➢ Pleural fluid lactate dehydrogenase (LDH)/serum LDH ratio of more than 0.6
➢ Pleural fluid LDH is more than two-thirds of the upper limits of normal laboratory value for serum LDH.
Commonly performed tests on the pleural fluid to determine etiology are a measurement of fluid pH, fluid protein, albumin and LDH, fluid glucose, fluid triglyceride, fluid cell count differential, fluid gram stain and culture and fluid cytology.
Keywords: Effusion, SEAG, Lights Criteria, LDH, Transudate, Exudate.

SUMMARY

The present study was conducted in the department of Pulmonary Medicine, Bhaskar Medical College, Hyderabad from January 2022- June 2023.

In this cross sectional study, 50 patients with pleural effusion were analysed to distinguish between exudate or transudate using the SEAG and LIGHT'S criteria. The observations have been summarised below.
1. The mean age of the subjects was 41.38 ± 12.58 years, with range of 18 to 61 years.
2. Males predominated in the study at 70%.
3. The mean Serum Albumin was 2.994 ± 0.3113 g/dl and the range was 2.3 to 3.8 g/dl.
4. The Plasma Albumin range was 1.1 to 3.0 g/dl and the mean was 2.098 ± 0.4605 g/dl.
5. The range of SEAG ratio was 0.3 to 2.2 in the present study subjects and the mean ratio was 0.896 ± 0.5767.
6. According to the SEAG criteria the number of patients with exudates were 36 (72%) and those with transudate were 14 (28%).

7. According to the LIGHTS criteria 42 (84%) were having exudates and remaining 8 (16%) had transudates.
8. The pleural to serum protein ratio in the exudate and transudate is 0.91±0.2 IU/Land 0.797±1.26 IU/L respectively.
9. The mean Serum LDH among exudate is 934.36+231.6 IU/L, and the mean in transudate was 450.545±128.94 IU/L.
10. The mean Pleural LDH in exudate was 683.59±210.086 IU/L and the mean in transudate was 204.364±77.266 IU/L.
11. The pleural protein, serum LDH and pleural LDH means among effusions was strongly significant (p=0.01).
12. The mean of SEAG in the patients was, 0.896 + 0.5767. This was significant with student's t test. This indicates that SEAG is a good test to differentiate between exudate and transudate.
13. The Serum albumin mean in exudative effusion was 2.88±0.263 g/l, while in transudative effusion was 3.286±0.228 g/l. The mean pleural albumin in exudative effusion was 2.314±0.3025 g/l, while in transudative effusion was 1.543±0.3031 g/l. These differences in the means were strongly significant.

AIM: To determine the efficacy of serum to pleural fluid albumin gradient as a maker to differentiate EXUDATE from TRANSUDATE.

OBJECTIVES
1. To study the clinical profile of the patients with pleural effusion.
2. To compare the efficacy of serum to pleural fluid albumin gradient with Lights criteria to differentiate transudate vs exudate effusion.

METHODS
Informed and written consent was taken from all patients. The clinical history of the patients was taken and was examined carefully and thoroughly. Then the patients were counselled for diagnostic thoracocentesis, which is aspiration of the pleural fluid and the fluid was sent for further analysis.

Study Design: Descriptive Cross - sectional study.

Study Population: Patients with complains of pleural effusion attending the pulmonology department.

Sample Size: This study consists of 50 patients presenting to Bhaskar General Hospital.

INCLUSION CRITERIA:
1. Patients above the age of 14 years

2. Patients with clinical and radiological evidence of pleural effusion

EXCLUSION CRITERIA:
1. Pregnant females
2. Old diagnosed cases of pleural effusion
3. Traumatic hemothorax

Study Period: Over a period of 18 months i.e from January 2022 to June 2023.

ETHICAL IMPLICATION:
• The study subjects will be selected following inclusion and exclusion criteria.
• Written and informed consent will be taken.
• Every patient will be completely explained about the study and related procedures and their importance and complications in their own understandable language.

FINANCIAL IMPLICATIONS:
Funding none
Expenses if any will be incurred by me.

INVESTIGATIONS:
Chest-Xray
Diagnostic Thoracocentesis - Pleural fluid analysis
Blood Samples - For routine investigations and serum analysis.

STATISTICAL METHODS:
Data is entered into Microsoft excel data sheet and is analysed using SPSS version 22 software. Categorical data is presented in the form of frequencies and proportions. Continuous data is represented as mean and standard deviation. Independent t test is used as test of significance to identify the mean difference between two groups. Chi-square was used as test of significance. p value <0.05 considered as statistically significant.
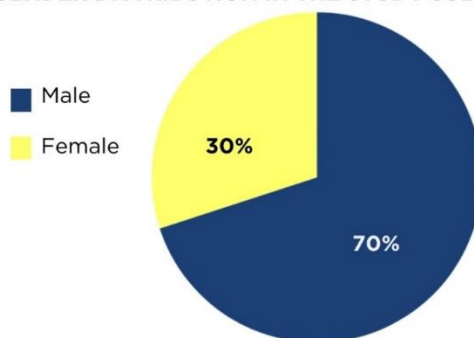
RESULTS

AGE DISTRIBUTION IN THE STUDY SUBJECTS
- 14 - 29 Years: 30%
- 30 - 49 Years: 50%
- >50 Years: 20%
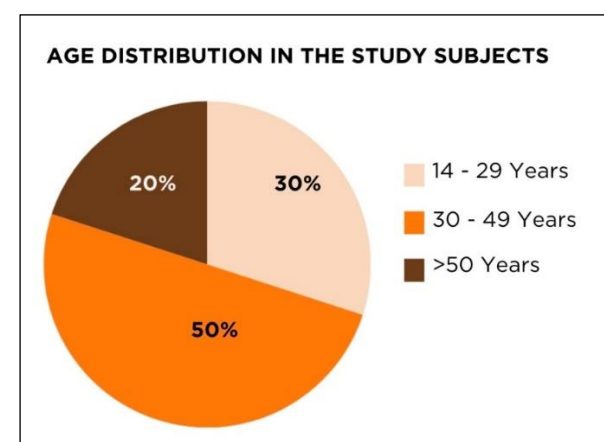
Frequency distribution of exudates and transudates in different age groups

| Age (Years)	Exudates	Transudates	Total	Percentage
14-29	9 (21.5%)	1 (12.5%)	10	20.0%
30-49	23 (54.7%)	2 (25%)	25	50.0%
≥50	10 (23.8%)	5 (62.5%)	15	30.0%
Total	42 (100.0%)	8 (100.0%)	50	100.0%

GENDER DISTRIBUTION IN THE STUDY SUBJECTS

Sex- wise distribution of exudative and transudative pleural effusion

Sex	Exudates	Transudates	Total
Male	27 (77.1%)	8 (29%)	35 (70%)
Female	15 (100%)	0	15 (30%)
Total	42 (84%)	8 (16%)	50 (100%)

BAR CHART OF CLINICAL DIAGNOSIS IN STUDY SUBJECTS

Diagnosis Versus Pleural Effusion with SEAG & Lights Criteria
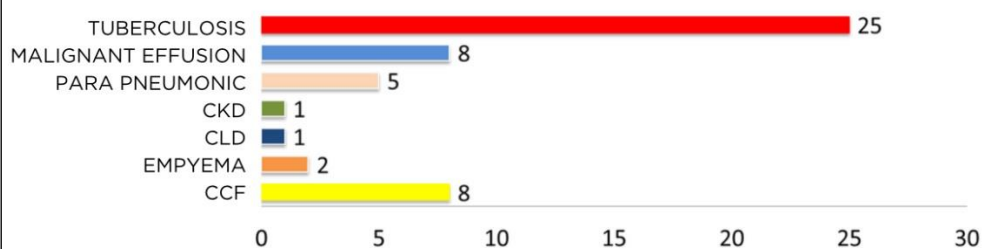
CLINICAL DIAGNOSIS	FREQUENCY	SEAG DIAGNOSIS		LIGHTS CRITERIA	
		EXUDATE	TRANSUDATE	EXUDATE	TRANSUDATE
CCF	8	0	8	3	5
CKD	2	0	2	1	1
CLD	1	0	1	0	1
EMPYEMA	1	1	0	1	0
MALIGNANCY	5	4	1	5	0
PARA PNEUMONIC	8	8	0	8	0
TUBERCULOSIS	25	23	2	24	1
TOTAL	50	50		50	

Comparison of Means by Student's t Test

Test Variables	Mean	Std. Deviation	Test Value	t	Significance
SEAG	0.896	0.5767	1.2	-3.727	**0.001**
Pleural/Serum Protein Ratio	0.88269	0.5995	0.5	4.514	**0.000**
LDH Ratio	0.664786	0.1506	0.6	3.041	**0.004**

Comparison of type of Effusion using SEAG vs Lights Ratio
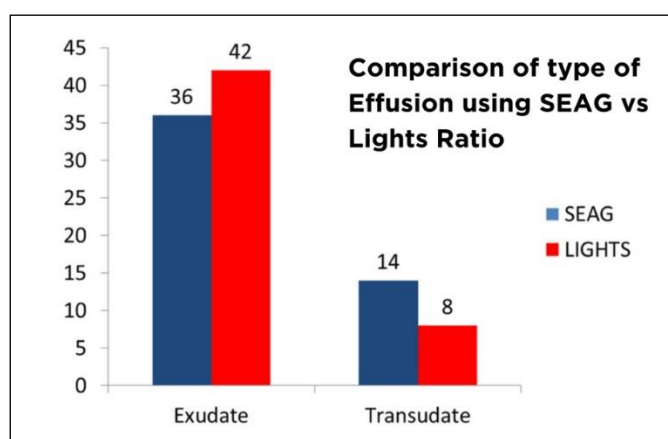
DISCUSSION

Pleural fluid accumulation occurs when the pathological processes cause an imbalance of hydrostatic pressure gradient, capillary membrane permeability and lymphatic capacity resulting in protein-poor transudates or inflammatory exudates.

The parameters we are analyzing for differentiation of transudates from exudates like albumin and protein are leaked into pleural fluid from serum but LDH comes from pleural fluid leukocytes within the pleural space itself.

In general, Light's criteria occasionally misidentifies a transudate effusion as an exudate effusion as in cardiac failure with diuretic therapy.

Clinically if a patient should have a transudate effusion, but meets Light's criteria for an exudate effusion, measure the serum-pleural fluid albumin gradient, or measure the serum-pleural protein gradient.

Serum-effusion albumin gradient of more than 1.2 g/dl and Serum-effusion protein gradient of more than 3.1g/dl is seen in transudates.

Therefore, in this study, SEAG is considered for discriminating exudates from transudates as it is based on the measurement of effusion and serum albumin concentration alone.

In a similar study done by Sujatha *et al.*, 100 patients with pleural effusion based on clinical and radiological basis were recruited.

The mean of serum protein, serum albumin and serum LDH were 5.74±1.149 g/dl, 2.96± g/dl and 283.29 U/L respectively. SEAG criteria classified 78 subjects under exudate effusion and 22 subjects under transudate effusion.

Light's criteria classified 83 patients under exudate effusions and 17 patients under transudate effusions. This study compared SEAG outcome with that of Light's criteria and the p-value was statistically significant.

This indicates that SEAG criteria is a good test for differentiation and helps in the proper diagnosis and treatment of pleural effusion.

CONCLUSION

- Analysis of pleural effusion as exudates and transudates gives an idea of the differential diagnosis and the need for further investigations.
- If the effusion is found to be exudative, invasive techniques such as cytopathology, pleural biopsy and thoracoscopy may be required so that a definitive diagnosis can be established and treatment is planned accordingly. Otherwise, if the effusion is transudative, further testing is not needed.
- Therefore, to avoid unnecessary mismanagement, SEAG has been adopted which is more accurate than the Light's as it is based on the calculation of gradient between serum and effusion rather than absolute values or ratios. Misclassifications have been avoided by using this criteria as demonstrated in this study.
- The sensitivity of the SEAG criteria was 100% and the specificity was 78.6%.
- The sensitivity of the LIGHTS criteria was 92.3% while the specificity was 100%.
- Also, only single parameter of pleural fluid is used in SEAG criteria which is easy to apply when compared to Light's criteria where three parameters are needed.

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