CONTRIBUTION OF VARIOUS BIOCHEMICAL PARAMETERS IN PLEURAL EFFUSION

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ABSTRACT

The study was a in a descriptive mode in hospital. The study was conducted over a period of one year on 150 samples. Total 150 samples were enrolled in the study. Both serum and pleural fluid samples were collected and quantitatively analysed using semi-automated analyser. It was concluded that Biochemical parameters play important role in diagnosing Pleural effusions. These markers when used collectively their diagnostic efficacy is greatly increased. Patients with pleural effusion is to determine whether the effusion is a transudate or an exudate. An exudative effusion is diagnosed if the patient meets Light's criteria. The serum to pleural fluid protein or albumin gradients may help better categorize the occasional transudate misidentified as an exudate by these criteria. If the patient has a transudative effusion, therapy should be directed toward the underlying heart failure or cirrhosis. If the patient has an exudative effusion, attempts should be made to define the etiology. Pneumonia, cancer, tuberculosis, and pulmonary embolism account for most exudative effusions. Many pleural fluid tests are useful in the differential diagnosis of exudative effusions. The SEAG is superior to Light's criteria in identifying the transudative effusions. It is also observed that Light's criteria identified exudative effusions better than SEAG. The aim of present study was to analyse various biochemical parameters (LDH, pH, Glucose, Triglycerides, Cholesterol, Creatinine, Amylase and ADA) in pleural fluid and to correlate these Biochemical parameters with diagnosis of the patients.

Keywords: Pleura, Effusion, Transudate, Exudate, biochemical parameters

INTRODUCTION

A variety of disease states are associated with the development of pleural effusions (Table 1), and depending on the disease, the pleural effusion can either exhibit specific or nonspecific characterise-tics. All healthy humans have a small amount of pleural fluid that lubricates the space and facilitates normal lung movements during respiration. The pleural fluid normally provides lubrication between the parietal and visceral membranes and the organs contained within the space. 1 A pleural effusion, an excessive accumulation of fluid in the pleural space, indicates an imbalance between pleural fluid formation and removal. A diagnosis of pleural effusion may be sug- gested by characteristic symptoms (e.g., chest pain, dyspnea) and physical exam findings (e.g., dull lung bases on auscultation and percussion) but definitive diagnosis requires radiological imag- ing. In particular, X-rays taken with the patient in the decubitus position have high diagnostic sensi- tivity, and computerized tomography imaging can detect even small amounts of pleural effusion and thus play a significant role in the assessment of intrapulmonary and extra pulmonary lesions. Thoracic ultrasound examination is another effective method of confirming the presence of pleural fluid and determining appropriate access sites for thoracentesis. Because intrapulmonary lesions can go undetected when the pleural effusions are large, CT imaging should be repeated once the fluid has been drained. Further, special attention should be paid to the rate and volume of fluid aspiration during thoracentesis, as rapid or large volume drainage may result in re-expansion pul-monary edema. Pleural fluid is continually secreted by blood capillaries in the visceral and parietal pleural membranes, but most of this fluid is normally secreted from the parietal pleura. Typically, the amount of fluid produced is equal to the amount reabsorbed by the flow of lymph from the visceral pleura. Consequently, the fluid keeps the pleural surface moist and reduces friction between the pleural membranes during respiratory excursion without accumulating in the pleural cavity. This balance between fluid production and absorption. Accumulation of pleural fluid is not a specific disease, but rather a reflection of underlying pathology. Pleural effusions accompany a wide variety of disorders of the lung, pleura, and systemic disorders. Therefore, a patient with pleural effusion may present not only to a pulmonologist but to a general internist, rheumatologist, gastroenterologist, nephrologist, or surgeon. To treat pleural effusion appropriately, it is important to determine its cause. 2 For diagnosing and treatment plan, pleural effusions have to be classified into transudate and exudate. The characteristics of pleural fluid differ according to the underlying pathological condition but can be broadly classified into two categories, transudative and exudative, and then further into subcategories, such as purulent, bloody, and chylous, according to appearance and smell. Although the classic Rivalta reaction can also be of assistance, Light's diagnostic criteria (Table 2) are most commonly used to differentiate between transudative and exudative effusions. According to this method, an exudative effusion is diagnosed if one or more of three criteria are satisfied. When the pleural effusion is diagnosed as exu- date by this criterion in spite of clinically being considered as transudate, the difference of albu- min concentration between serum and

effusion is greater than 1.2 mg/dl, then the effusion is diag- nosed as transudate. The routine pleural fluid evaluation usually includes determination of protein, pH, lactate dehydrogenase, glucose, and albumin levels, with adenosine deaminase levels and cell count for differential and cytological examination. 3 If the diagnosis is no appropriate, it may result in severe complications. The most commonly used method for differentiating exudates from transudates was established by Light et al. 4 Fluid is considered exudative if it meets one or more of the following: (a) pleural/serum protein ratio greater than 0.5 (b) pleural/serum lactate dehydrogenase (LDH) ratio than two-thirds of the normal upper limit for serum. Another method used for differentiating exudates from transudates was Serum - pleural effusion albumin gradient (SEAG). Albumin gradient (serum albumin concentration - pleural effusion albumin concentration). The main purpose of this study was, to study the diagnostic role of biochemical parameters in pleural effusion. To treat pleural effusion appropriately, we have divided the pleural effusions into the transudative and exudative pleural effusions with help of various biochemical parameters with $p = < 0.0001$. Emic SEAG could only identify the 68 pleural effusion as exudative and Lights criteria identify 73 effusion as exudative. SEAG misclassify 4 tubercular effusions whereas light's criteria misclassify only 1 CHF effusion.

AIM AND OBJECTIVES

Following are the aims and objectives of the study:

1. To analyse different biochemical parameters in pleural fluid.

2. Correlate the biochemical parameters with diagnosis of the patients.

MATERIALS AND METHODS

The study was a hospital based descriptive study. The study was conducted over a period of one year on 150 samples. Total 150 samples were enrolled in the study. Both serum and pleural fluid samples were collected and quantitatively analysed using semi-automated analyser.

Table 1: Pleural Fluid Biochemical Parameters of Exudate and Transudate

Parameters	Type of pleural effusion	Number of cases	mean±SD	P value
pH	Transudate Exudate	43 77	9.69±0.8 7.67±0.63	0.5
Glucose (mg/dl)	Transudate Exudate	43 77	88.69±15.8 63.57±10.63	<0.0001
Total protein (g/dl)	Transudate Exudate	43 77	4.69±0.7 5.87±1.03	0.0001
Albumin (g/dl)	Transudate Exudate	43 77	3.09±0.67 3.57±0.73	<0.0001

					Mean±SD of
Cholesterol (mg/dl)	Transudate Exudate	43 77	56.9±12.8 77.37±11.63	<0.0001	
Triglycerides (mg/dl)	Transudate Exudate	43 77	78.9±13.8 81.67±15.7	<0.0001	
Creatinine (mg/dl)	Transudate Exudate	43 77	3.79±0.87 3.77±0.93	0.5	
Amylase (IU/L)	Transudate Exudate	43 77	73.07±10.5 73.57±14.33	0.9	
LDH (U/L)	Transudate Exudate	43 77	345.9±40.8 423.7±70.00	<0.0001	
ADA(U/L)	Transudate Exudate	43 77	49.69±14.17 57.67±16.83	<0.0001	
Serum biochemical parameter					
Albumin (g/dl)	Transudate Exudate	43 77	4.79±0.8 2.87±0.73	<0.0001	
LDH(U/L)	Transudate Exudate	43 77	567.9±70.08 463.7±53.63	<0.0001	

transudative and exudative pleural effusion according to SEAG criteria

Table 2: Sensitivity And Specificity of SEAG and Light's Criteria In Comparison to Clinical Diagnosis

	Type of effusion	SEAG	Light's criteria
Sensitivity	Transudate Exudate	97.53% 95.47	97.53% 100%
Specificity	Transudate Exudate	95.47% 97.53%	100% 97.53%

DISCUSSION

The present study show analysis of biochemical parameters (LDH, pH, Glucose, Triglycerides, Cholesterol, Creatinine, Amylase and ADA) in both pleural fluid and serum. According to present study Lights criteria's specificity for exudate was 97.53% and sensitivity was 100%. SEAG criteria had specificity 97.53% and sensitivity 95.47% for exudate. However, Lights criteria had specificity of 100% and sensitivity 97.53%. SEAG criteria have specificity 95.47% and sensitivity 97.53%. Levels of glucose, ADA and LDH in pleural fluid of exudate effusions were 63.57±10.63, 57.67±16.83, and 463.7±53.63 respectively, and these results was highly statistically significant with p= < 0.0001. Levels of glucose, ADA and LDH in pleural fluid of

transduate effusions were 88.69±15.8, 49.69±14.17, 567.9±70.08 and these results was highly statistically significant with p= < 0.0001.

RESULTS

1. Comparison of clinical diagnosis of exudative pleural effusions with SEAG diagnosis and Light's criteria diagnosis out of total 82 patients 47 were tubercular, 22 malignant and 13 patients are empty and these results was highly statistically significant with p= < 0.0001 and these results was highly statistically significant with p= < 0.0001. Emic SEAG could only identify the 58 pleural effusion as exudative and Lights criteria identify 83 effusion as exudative. SEAG misclassify 4 tubercular effusions whereas light's criteria misclassify only 1 CHF effusion.

2. Comparison of clinical diagnosis of transudative pleural effusions with SEAG diagnosis and Light's criteria diagnosis out of 35 patients 17 were congestive heart failure cases, 10 having liver cirrhosis and 05 patients have anaemia SEAG could identify 39 effusion as transudative and Lights criteria identifies 27 effusions as transudative. SEAG misclassify 7 tubercular effusion whereas Light's criteria misclassify 3 tubercular effusion.

CONCLUSION

The diagnosis of pleural effusion is very difficult, even though the patients often complain of typical symptoms indicating of pleural diseases. Pleural effusion is characterized by the pleural cavity filled with transudative or exudative pleural fluids, and it is developed by various etiologies. The presence of pleural effusion can be confirmed by radiological studies including simple chest radiography, ultrasonography, or computed tomography. Identifying the causes of pleural effusions by pleural fluid analysis is essential for proper treatments. This review article provides information on the diagnostic approaches of pleural effusions and further suggested ways to confirm their various etiologies, by using the most recent journals for references. Transudates are caused by increased hydrostatic pressures (e.g., heart failure), decreased oncotic forces (e.g., hypoproteinemia), increased negative intrapleural pressure (e.g., atelectasis), or movement of ascitic fluid through the diaphragm (e.g., hepatic hydrothorax). In contrast, exudates are due to the increased capillary permeability and/or impaired lymphatic drainage which results from the proliferative (e.g., malignancy) or inflammatory (e.g., parapneumonic effusions) processes It was concluded that Biochemical parameters play important role in diagnosing Pleural effusions. These markers when used collectively their diagnostic efficacy is greatly increased. The SEAG is superior to Light's criteria in identifying the transudative effusions. It is also observed that Light's criteria identified exudative effusions better than SEAG.

REFERENCES

Atalay F, Ernam D, Hassanoglu HC, Karalezli A, Kaplan O. Pleural adenosine deaminase in the separation of transudative and exudative pleural effusions. Clin Biochem 2005 Dec; 38(12): 1066-70.Epub 2005 Oct 13.

Basu A, Chakrabarti I, Ghosh N, Chakraborty S. A clinicopathological study of tuberculous pleural effusion in tertiary care hospital. Am Trop Med Public Health 2012; 5:168-72?

BLONK DI, SCHABERG A, WILLIGHAGEN RGJ: Enzyme cytochemistry of benign and malignant cells in pleural and peritoneal fluid. Acta Cytol (Baltimore) 11:460-465, 1967

Brims FJ, Davies HE, Lee YC. Respiratory chest pain: diagnosis and treatment. *Med Clin North Am.* 2010;94:217–232. [PubMed] [Google Scholar]

Broaddus VC, Light RW. What is the origin of pleural transudates and exudates? Chest 1992; 102:658-59

Broaddus VC, Staub NC. Pleural liquid and protein turnover in health and disease. Semin Respir Med 1987; 9:7-12

Broaddus VC, Wiener-KronishJP, Staub NC. Clearance of lung oedema into the pleural space of volume-loaded anaesthetized sheep. J Appl Physiol 1990; 68:2623-30

Broaddus VC, Wiener-KronishJP, Staub NC. Clearance of lung oedema into the pleural space of volume-loaded anaesthetized sheep. J Appl Physiol 1990; 68:2623-30

Burgess LJ, Maritz FJ, Taljaard JJ. Comparative analysis of the biochemical parameters used to distinguish between pleural transudates and exudates. Chest. 1995;107(6):1604–9.

Burgess LJ, Martiz FJ, Taljaard JJ. Comparative analysis of the biochemical parameters used to distinguish between pleural transudates and exudates. Chest. 1995; 107:1604-9.

Burgess LJ, Martiz FJ, Taljaard JJ. Comparative analysis of the biochemical parameters used to distinguish between pleural transudates and exudates. Chest. 1995; 107:1604-9.

Chandrasekhar AJ, Palatao A, Dubin A, et al. Pleural fluid lactic acid dehydrogenase activity and protein content. Arch Intern Med 1969; 123:48-50

Chandrasekhar AJ, Palatao A, Dubin A, et al. Pleural fluid lactic acid dehydrogenase activity and protein content. Arch Intern Med 1969; 123:48-50

Chetty KG (1985) Trabsudative pleural effusions. Clin chest Med.6:49-54. 5. Gorguner MI Cerci M, Gorguner L. Determination of adenosine deaminase activity and its isoenzymes for diagnosis of pleural effusions. Respirology 2000 Dec; 5(4):321-24.

Chetty KG (1985) Trabsudative pleural effusions. Clin chest Med.6:49-54. 5. Gorguner MI Cerci M, Gorguner L. Determination of adenosine deaminase activity and its isoenzymes for diagnosis of pleural effusions. Respirology 2000 Dec; 5(4):321-24.

Chubb SAP, Williams RA. Biochemical Analysis of Pleural Fluid and Ascites. Clin Biochem Rev. 2018;39(2):39–50.

Collins TR, Sahn SA. Thoracocentesis clinical value, complications, technical problems and patient experience. Chest. 1987;91(6):817–22.

Das AK, Krishna B. A study on significance of serum effusion albumin gradient in the differential diagnosis of pleural effusion. J Med Educ Res. 2009;11(3):123–6.

DETORREGROSA VM: Results of lactic dehydrogenase determinations in benign and malignant effusions. Am J Med Sci 238:552-556, 1959

Dhar MC, Chaudhary S, Basu K, Sau TJ, Pal D, Mitra K. Serum effusion albumin gradient in the differential diagnosis of pleural effusion. Indian J Tub. 2000;18:241–5.

Diaz-Guzman E, Budev MM. Accuracy of the physical examination in evaluating pleural effusion. *Cleve Clin J Med.* 2008;75:297–303. [PubMed] [Google Scholar]

ERICKSON JR: Lactic dehydrogenase activity of effusion fluids as an aid to differential diagnosis. JAMA 176:794-796, 1961

Froudarakis ME. Diagnostic work-up of pleural effusions. *Respiration.* 2008;75:4–13. [PubMed] [Google Scholar]

Gupta DK, Suri JC, Goel A.Efficacy of adenosine deaminase in the diagnosis of pleural effusions . Indian J Chest Dis Allied Sci.1990 Oct-Dec;32(4):205-8.

Gupta K B, Ghalaut V, Gupta PP, Arora P, Tandon S. Efficacy of pleural fluid alkaline phosphatase and its ratio to serum levels in distinguishing exudates from transudates. Lung India 2004;21:46-9.

Inma Ocana, jose M. Martinez – Vazquez, Rosa M. Segura, et. 1983, "Adenosine deaminase in pleural effusions", Chest, 84(1):51-53.

Jadhav AA, Bardapurkar JS, Jain A. Alkaline phosphatase: Distinguishing between Tuberculous and nontuberculous pleural effusion. Lung India 2009;26:77- 80

Jhamaria JP, Jenaw RK, Luhada SKI Mathur DK, Parihar HL, Sharma SK. Serum adenosine deaminase in differential diagnosis of pulmonary tuberculosis and common nontubercular respiratory diseases. Indian J Tubercul 1988;35:25-27.

KIRKEBY K, PRYDZ H: Lactic dehydrogenase activity in pleural and peritoneal effusions. Scand J Clin Lab Invest 11:185-189, 1959 19. MEYER P: Metastatic carcinoma of the pleura. Thorax 21: 437-443, 1966

Light RW, Mcgregor MI, Luchsinger PC, Ball WC. Pleural effusions the diagnostic separation of transudates and exudates. Ann Intern Med. 1972;77(4):507–13.

Light RW. Pleural effusions. *Med Clin North Am.* 2011;95:1055–1070. [PubMed] [Google Scholar]

Light RW. *Pleural diseases.* 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2013. [Google Scholar]

Pistolesi M, Miniati M, Guintini C. Pleural liquid and solute exchange. Am Rev Respir Dis 1989; 815-47

Porcel JM, Light RW. Pleural effusions. *Dis Mon.* 2013;59:29–57. [PubMed] [Google Scholar]

Porcel JM, Vives M. Etiology and pleural fluid characteristics of large and massive effusions. *Chest.* 2003;124:978–983. [PubMed] [Google Scholar]

Porcel JM. Pearls and myths in pleural fluid analysis. Respirology. 2011;16 (1):44–52.

Romero S, Candela A, Martin C, et al. Evaluation of different criteria for the separation of pleural transudates from exudates. Chest 1993; 2:399-404

Sandeesha V, Kiran CVR, Ushakiran P, Sulemani M, Lakshmanakumar N. A comparative study of serum effusion albumin gradient and Light's criteria to differentiate exudative and transudative pleural effusion. J Family Med Prim Care. 2020;9 (9):4847–52.