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Characteristics of Pleural Fluid in Exudative Pleural Effusion

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ABSTRACT

Introduction: *Since exudative pleural effusion is a manifestation of an underlying specific disease process, its morbidity and mortality are directly related to that particular disease along with its duration and extent at the time of presentation that have some reflection on the findings of pleural fluid study. The aim of the study was to find out the pleural fluid characteristics in exudative pleural effusion.* ***Methods:*** *This prospective analytical study was conducted for a period of one year in the Department of Medicine, Shaheed Ziaur Rahman Medical College Hospital, Bogura enrolling 50 subjects with pleural effusion. The cases with transudate pleural effusion were not included. Pleural fluid was aspirated and analyzed for detecting cause of effusion.* ***Results:*** *Among total 50 study subjects, 37 were male and rest 13 were female. Incidence of tuberculous and malignancy as the causes of pleural effusions were more common in males than those in females. Low-grade fever, cough, weight loss and dyspnoea were found as the most common symptoms of tuberculous effusion. Cough, Chest pain, weight loss and dyspnoea were the common symptoms of malignant pleural effusion. Majority of the subjects had straw 35 (70%) coloured effusion followed by haemorrhagic pleural effusion 11 (22%). Fluid analysis was 47.0% sensitive, 75% specific for diagnosis of tuberculosis and 54.6% sensitive, 92.3% specific for diagnosis of neoplastic diseases.* ***Conclusion:*** *From the present study it was seen that pleural fluid analysis was very effective, safe and cheap procedure in identification of cause (tubercular, malignant etc.) pleural effusion.*

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INTRODUCTION

The accumulation of fluid within the pleural space is one of the most common diagnostic problems encountered by the physicians. In general, pleural fluid accumulates as a result of either increased hydrostatic pressure or decreased colloidal osmotic pressure (transudative effusion) or from increased

microvascular permeability and /or decreased lymphatic drainage due to disease of pleural surface itself, or of adjacent tissues (exudative effusion).[1] When a patient is found to have a pleural effusion, an effort should be made to determine the cause. The first step is to determine whether the effusion is a transudate or an exudate and second step is definitive management.[2] The causes of transudate pleural effusion are congestive cardiac failure, chronic liver disease, nephrotic syndrome and other hypoproteinaemic states like malnutrition, mal-absoption etc. The leading causes of exudative pleural effusion are pneumonia, tuberculosis, malignant disease, connective tissue diseases like systemic lupus erythematosus and rheumatoid arthritis, pulmonary infarction, acute rheumatic fever etc.[1,2] Pleural space normally contains a very thin layer of fluid (5-15ml) which serves as a lubricant and its surface tension help maintaining negative intrapleural pressure during all phases of breathing.[3] Diseases affecting any structure of thorax like pleura itself, lungs, thoracic wall or mediastinal structure can lead to development of pleural effusion. Some extra thoracic sources like subphrenic abscess, liver abscess or acute pancreatitis and some systemic disease may also cause it. Pleural effusion is not a diagnosis but describes the underlying pathological process involving the pleura either primarily or secondarily.[4,5] Clinical presentation of pleural effusion varies from asymptomatic to life threatening symptoms depending upon the volume of effusion and underlying disease process. Pleural effusion affecting minimal lung functions is well tolerated, whereas similar effusion in patients with underlying severe lung disease may cause ventilator failures.[3-5] By taking proper history, performing physical examination and necessary investigations definitive aetiological diagnosis of pleural effusion could be made which would help and influence the effective management of pleural effusion.[6] However, in some cases, the exact cause and clinical significance of pleural effusion is not obvious. If carefully done, thoracocentesis is a relatively uncomplicated technique, well tolerated and quite safe. It is an appropriate procedure for the well-trained physician. In most circumstances diagnostic thoracocentesis may be done in an ambulatory setting.

A wide variety of potential testing options with pleural fluid including its physical appearance, chemical analysis, cytologic and bacteriologic evaluation are available. Thoracocentesis and pleural fluid study very often diagnostic and even if not, may give a clue to further invasive work up needed for diagnosis. Straw coloured pleural fluid may suggest tuberculosis while haemorhagic fluid raises the possibilities of tuberculosis, bronchial carcinoma, pulmonary infarct etc. A predominant lymphocytic count may suggest tuberculosis, malignancy or chronic rheumatoid disease while polymorphonuclear predominant effusion suggests parapneumonic effusion, empyema, oesophageal rupture, acute rheumatoid process or lupus pleuritis.[1,5-8] The presence of pleural fluid eosinophilia considerably reduces the possibility of malignancy.[4,8] Measurements of pleural fluid pH, lactate dehydrogenase (LDH) and adenosine deaminase (ADA) levels, though very informative, are not widely available. A very low glucose level of (<20 mg/dl) is highly suggestive of rheumatoid disease but low glucose level (<60 mg/dl) may be found in bacterial, tuberculous as well as in malignant effusion.[1,5,7,8] Pleural fluid amylase level higher than that of plasma usually signifies acute pancreatitis as the cause.[1] This current study was carried out to identify the aetiology of pleural effusion in an effective and economic way and can produce awareness among all level of medical practitioners, minimize diagnostic dilemma and enhance prompt diagnosis or at

least early referral and thereby reducing suffering and cost of expensive test of the poor population of this country.

METHODS

This prospective analytical study was conducted for a period of one year (January 2008 to December 2008) at Department of Medicine in Shaheed Ziaur Rahman Medical College Hospital, Bogura, enrolling 50 subjects with pleural effusion. All patients admitted in hospital those were found to have pleural effusion on the X- ray films and confirmed by ultrasonogram were selected as study population. The cases of pleural effusion diagnosed to be transudative from clinical and/or laboratory evidence, viz. due to congestive cardiac failure, nephrotic syndrome, chronic liver disease and other hypoproteinaemic states, were excluded from the study. After taking informed written consent, thorough physical examination was carried out giving emphasis to confirm the diagnosis of pleural effusion as well as aetiological aspect of pleural effusion. All the relevant information from history, clinical findings and investigation results were recorded in a predesigned questionnaire. Pleural fluid was aspirated under aseptic precaution from all of the selected cases for the aetiological diagnosis. After collecting the fluid, it was sent for biochemical, microbiological and cytological analysis to the specific department.

RESULTS

Among total 50 study subjects, 37 (74.0%) were male and rest 13 (26.0%) were female. Majority (10, 29.4%) of the tuberculous pleural effusion cases found among 21-30 years age group. Tuberculosis occurred between 21 to 40 years of age in majority of subjects. Malignant effusion was found between 41 to 70 years of age. No malignant effusion was found below 40 years of age (Table I).

Table I: Age distribution in different groups of pleural effusion patients (n=50)

Age in years	Tuberculous pleural effusion (n=34) No. (%)	Malignant pleural effusion (n=11) No. (%)	Others (n=5) No. (%)
11-20	6 (17.7)	0	1 (20.0)
21-30	10 (29.4)	0	2 (40.0)
31-40	5 (14.7)	0	1 (20.0)
41-50	6 (17.6)	4 (3)	1 (20.0)
51-60	4 (11.7)	5 (45.4)	0
61-70	2 (05.8)	2 (18.1)	0
Above 70	1 (02.9)	0	0
Total (n=50)	**34 (68.0)**	**11 (22.0)**	**5 (10.0)**

Incidence of tuberculsis and malignancy as the causes of pleural effusions was more common in males than that in females. In current study, out of 34 cases of tuberculous pleural effusion, 23 (68.0%) were males and 11 (32.0 %) were females and out of 11 cases of malignant effusion, 9 (81.8%) were males and 2 (8.2%) were females (Table II).

Table II: Gender distribution of different types of pleural effusion patients (n=50)

Type of Pleural effusion	No. Of patients	Male (%)	Female (%)
Tuberculous	34	23 (68.0)	11 (32.0)
Malignant	11	9 (81.8)	2 (18.2)
Others	5	4 (80.0)	1 (20.0)

Low-grade fever, cough, weight loss and dyspnoea were found as the most common symptoms of tuberculous effusion. Cough, Chest pain, weight loss and dyspnoea were the common symptoms of malignant pleural effusion. Hoarseness of voice was found in 6 (54.5%) cases of malignant pleural effusion (Table III), 35 (70.0%) subjects had straw coloured effusion, whereas 11 (22.0%) had haemorrhagic pleural effusion. Out of 34 tuberculous patients, 28 (80.0%) had straw colour in effusion and in malignant pleural effusion 7 (63.6%) had haemorrhagic type (Table IV).

Table III: Relative rates of symptoms present among different groups of pleural effusion (n=50)

Symptoms and signs	Tuberculous (n=34)	Malignant (n=11)	Others (n=05)
Cough	34 (100.0%)	09 (81.8%)	04 (80.0%)
Fever	34 (100.0%)	06 (54.5%)	05 (100.0%)
Dyspnoea	23 (67.6%)	07 (63.6%)	03 (60.0%)
Chest pain	16 (47.0%)	08 (72.7%)	04 (80.0%)
Haemoptysis	19 (55.8%)	09 (81.8%)	01 (20.0%)
Weight loss	30 (88.2%)	09 (81.8%)	03 (60%)
Sputum	23 (67.6%)	07 (63.6%)	04 (80%)
Hoarseness of voice	00 (0%)	06 (54.5%)	00 (0%)

Table IV: Appearance of pleural effusion in different groups (n=50)

Appearance	Pleural Effusion			Total (%)
	Tuberculous no. (%)	Malignant no. (%)	Others no. (%)	
Straw	28 (80.0)	4 (11.4)	3 (8.6)	35 (70.0)
Amber	2 (100.0)	0 (0.0)	0 (0.0)	2 (4.0)
Haemorrhagic	4 (36.4)	7 (63.6)	0 (0.0)	11 (22.0)
Turbid	0 (0.0)	0 (.0)	2 (100.0)	2 (4.0)
Total	**34 (68.0)**	**11 (22.0)**	**5 (10.0)**	**50 (100.0)**

Increased lymphocyte counts were found in most of the cases of tuberculous effusion, with or without leukocytosis (Table V). Parapneumonic effusion or empyema was associated with neutrophilic leukocytosis. Tuberculosis (34, 68.0%) was the most common cause of pleural effusion among study subjects. Sputum for AFB was found positive in 2 (5.9%) subjects. AFB was also found

in Z-N staining of pleural fluid in 2 cases. Pleural biopsy was positive in 25 (73.5%) subjects. Lymph node biopsy was done in 3 cases and positive result was found in 1case. Total 11 (22%) cases were confirmed to be of malignant origin. Nine cases were diagnosed by cytology of pleural fluid and pleural biopsy. One case was confirmed by lymph node biopsy and another by bronchoscopy biopsy with histopathology (Table VI). Fluid analysis was 47.0% sensitive, 75% specific for diagnosis of tuberculosis and 54.6% sensitive and 92.3% specific for diagnosis of neoplastic diseases (Figure 1).

Table V: Predominant cell type in different group of pleural effusion

Predominant Cell type	Final diagnosis					Total
	Tuberculous n (%)	Carcinoma n (%)	Empyema n (%)	Undiagnosed n (%)	Lymphoma n (%)	
Lymphocytes	22 (64.7%)	8 (23.5%)	1 (2.9%)	2 (5.9%)	1 (2.9%)	34
Polymorphs	3 (6%)	0 (0%)	2 (40%)	0 (0%)	0 (0%)	5
Mixed	7 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7
RBC	2 (50%)	2 50%)	0(0%)	0 (0%)	0 (0%)	4

Table VI: Methods of diagnosis of tuberculous pleural effusion (n= 34)

Methods	Number of Positive cases	Percentage (%)
Histopathology of pleura	25	73.5%
Culture of pleural tissue in L-J medium	04	11.8%
AFB stain &Culture of pleural fluid in L-J medium	02	5.9%
Sputum for AFB stain	02	5.9%
Lymph node biopsy	01	2.9%
Total	**34**	**100**

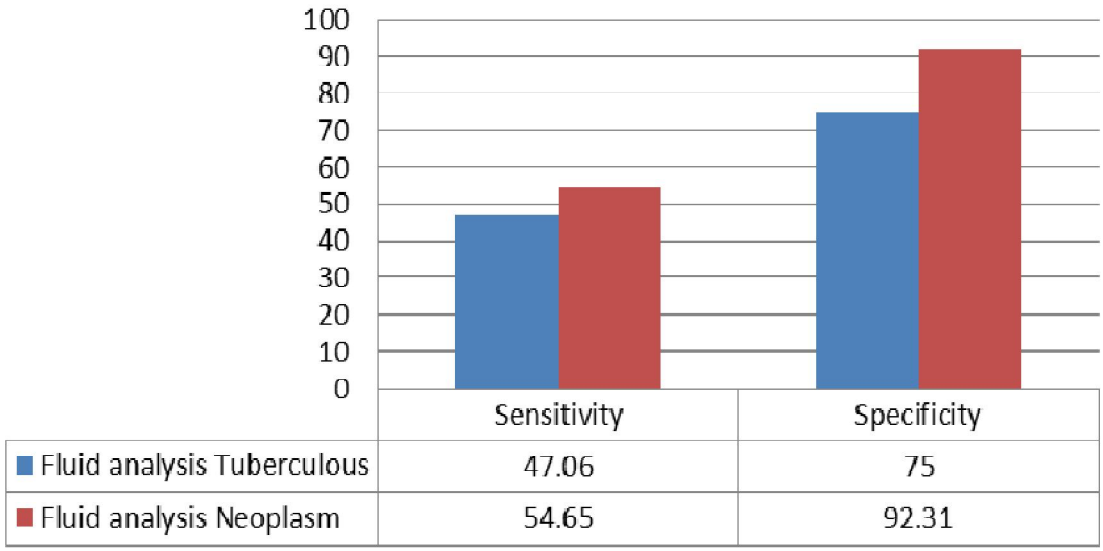

Figure 1: Analysis of sensitivity and specificity of different diseases diagnosed in pleural fluid

DISCUSSION

The aim of the study was to find out the pleural fluid characteristics in exudative pleural effusion. The mean age was 35.58 years. Age range varied between 11 to 70 years. In pleural effusion due to tuberculous origin, common age was in the third decade having 10 (29%) cases, as reactivation of tuberculosis occurs in this age group.[3] This has also correlated with the findings of another previous study.[8] The highest age incidence for malignant effusion patients was the 6th decade followed by fifth decade. This report is also consistent with the study[8] showing the percentage of male female as 83% and 17% respectively. Another researcher[9] showed in his study the percentage of male female as 56% and 44% respectively. Out of 50 patients 34 patients (68%) had tuberculosis, 10 (20%) patients had malignant effusion. Three patients had empyaema, 1 lymphoma and 2 cases were undiagnosed. This finding is not consistent with previous report[10] where 414 patients in Mayo clinic found 68% of their patients to be of malignant origin and only 13% to be of tuberculous origin. In our country tuberculosis is the most common etiology of pleural effusion.[9] In the current study, among the malignant causes, adenocarcinoma topped the list followed by squamous cell carcinoma. Some 07 cases (63.6%) had adenocarcinoma which is consistent with a previous study[4] which found 70% of their cases to be adenocarcinoma. In 2 (18.1%) cases, we did not find out the cause after repeated fluid study. Researchers found the unidentified cases number to be 19%.[2] One patient of this present study had lymphoma. So, it is seen that lymphoma is not an uncommon cause of pleural effusion. Thirty four cases of tuberculous pleural effusions were diagnosed. Eleven cases of malignant effusions were confirmed by different methods. In current study, pleural fluid analysis was 47.0 % sensitive, 75% specific for diagnosis of tuberculosis and 54.6 % sensitive, 92.3% specific for diagnosis of neoplastic diseases. Similar result was observed in previous study where it was seen that sensitivity, specificity value of pleural fluid analysis was 70%, 100% respectively in diagnosis malignancy.[11]

CONCLUSION

Tuberculosis and malignancy are two most common causes of exudative pleural effusion in our country. Majority of the subjects with pleural effusions were of tuberculous origin and rest one third from malignant causes. Acid fast staining of pleural fluid does not give much yield and mycobacterial culture of pleural fluid is a lengthy and difficult procedure and furthermore this procedure is not much yielding.

Conflict of interest: None

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