



## Etiological, Radiological, Biochemical and Cytological Analysis of Pleural Effusion

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### Abstract

**Background:** Pleural effusion is the excessive or abnormal accumulation of fluid in the pleural space. Pleural effusion is routinely facing problem in practice by general physician and chest physician. For better management of cases to obtain knowledge of clinical history and clinical signs of pleural effusion along with radiological, biochemical and cytological evaluation of pleural fluid help in narrowing the diagnosis.

**Methods:** In this, prospective study of 60 patients with pleural effusion with respect to age, Sex, presenting complaint, clinical history with radiological biochemical and cytological examination of pleural fluid are considered.

**Results:** In this prospective study of 60 patients with pleural effusion, them can age 11 to 75 years and two third were men. The most common type of pleural effusion is exudative effusion. The most common cause of exudative effusion in this study were tuberculosis (36), followed by malignancy (9), Transudative (8), Syn-pneumonic (5) and 2 cases of empyema (2). Pleural effusion were commonly seen in male patient with maximum number of cases in age group – 31-50. Pleuritic chest pain, fever, cough and breathlessness were common presenting complaint. The commonest clinical sign was stony dullness to percussion. Right side effusions were more common. Majority had moderate amount of pleural effusions. Blood count and ESR were significantly elevated in exudatives. Pleural fluid cytology revealed elevated Lymphocytes in tubercular and polymorphs in acute infections. Cytology for malignant cells were diagnostic in 4 cases. ADA was significantly elevated in tubercular pleural effusion. Exudatives had decreased glucose but increased protein, LDH and cholesterol compared to transudatives.

**Conclusion:** Tubercular effusion remains the commonest etiology of all exudative effusions in our study. It involves the young and is associated with fever and cough as the most common presenting symptom. Malignant effusion were seen in older age group with cough and dyspnea as common symptoms. Massive effusion with haemorrhagic pleural fluid is commonly associated with malignant effusion

**Keywords:** Exudative, transudative, tubercular malignant, synpneumonic, empyema, pleural effusion.

### Introduction

Pleural effusions are a common diagnostic problem in clinical practice, as the list of cause's

is quite exhaustive<sup>1</sup>, although sometimes they can be inferred from the clinical picture. The etiological distribution of pleural effusions in

various series depends on the geographical area, patient's age, and advances in the diagnostic methods and treatment of the underlying causes. The difficulty in determining the cause of pleural effusion is shown by the fact that in many series "unknown etiology" constitutes nearly 15%<sup>2</sup> Exudative effusions require to be separated into infectious causes, non infectious causes and malignancy. The most common causes in most series are infections and malignancy. In the West the most common cause is parapneumonic effusions followed by malignancy<sup>1</sup>, while in India it is tubercular effusion followed by malignant effusion<sup>3</sup> and a very few due to parapneumonic effusion.

India has the highest prevalence of tuberculosis in the world with 2/3rds of all TB patients being in India<sup>4</sup>. Tuberculosis is the most common cause of effusion in India when compared to the West where malignancy and parapneumonic effusions are more common<sup>3</sup>. Pleural tuberculosis is second in frequency after TB lymphadenitis<sup>3</sup>. The clinical, biochemical and cytological parameters of tubercular effusion are shared by malignancy, both being exudates and predominantly lymphocytic effusions. This can pose a significant diagnostic dilemma. Adenosine deaminase enzyme activity, gamma interferon, polymerase chain reaction, lysozyme measurement pleural fluid tuberculous protein antibodies and various tumor markers like CA15-3, squamous cell carcinoma antigen, etc have been used to differentiate TB from non TB<sup>5</sup>. Other diagnostic tests including flow cytometry, chromosomal analysis of malignant cells, LDH isoenzymes assay, and tumor marker assays, immunohistochemical tests, and carcino embryonic antigen (CEA), are used to differentiate between benign and malignant effusions<sup>5</sup>. Despite the availability of all tests, it might be necessary to avail of more invasive diagnostic tools like pleural biopsy or thoracoscopy to establish a diagnosis. Adenosine deaminase although shown to be promising in the

West to differentiate tubercular from non tubercular effusion.

### **Background and Objectives**

For better management of cases to obtain knowledge of clinical history and clinical signs of pleural effusion along with radiological, biochemical and cytological evaluation of pleural fluid help in narrowing the diagnosis.

- 1) To determine the etiology of all pleural effusions by conventional methods
- 2) To determine the utility of cytological, biochemical parameters in the evaluation of pleural effusions
- 3) To determine the sensitivity of pleural fluid ADA in the diagnosis of tubercular pleural effusion
- 4) To evaluate cytological profile of pleural effusion
- 5) To evaluate the reliability and diagnostic efficacy of pleural glucose, total protein, lactate dehydrogenase Adenosine Deaminase and cholesterol in etiological diagnosis of pleural effusion

### **Methodology**

#### **Source of data**

The present study was conducted in the Katuri Medical College and Hospital, chinakondrupadu, Guntur district on the patients with pleural effusions admitted during the period of November 2016 to October 2017.

Sample size: 60 cases

Sample procedure: Prospective study of pleural effusion

#### **Inclusion criteria**

- 1) Pleural effusion as per clinical findings
- 2) Chest X-ray showing evidence of pleural effusion
- 3) Age more than 10 years
- 4) Patient who have given informed consent

#### **Exclusion Criteria**

- 1) Patient who have undergone repeated pleurocentesis

- 2) Minimal effusion without clinical and X-Ray finding
- 3) Patient age less than 10 years
- 4) Patient who do not given their consent

#### Methods of collection Data

Along with routine blood and urine investigations, X ray chest PA view,ultrasound chest(and guided pleurocentesis), diagnostic pleurocentesis, pleural biopsy were also considered. A detailed clinical history and general physical examination was done on all the patients. A chest radiograph poster anterior view was done and the size of the effusion was estimated. If the size of the effusion was less than 2/3rd it was considered as not large and if it was more than 2/3rds the size was considered as large effusion respectively. The cases were recorded according to the proforma given later. Out of 60 cases of pleural effusion studied, 36 cases were tuberculous effusions and 24 cases were non tubercular effusions.

The 60 cases of pleural effusion were divided into 5 groups as under:

- 36 cases of Tuberculous pleural effusion
- 9 cases of Malignant pleural effusion
- 8 cases of Transudative pleural effusion
- 5 cases of Synpneumonic pleural effusion
- 2 cases of Empyema

#### Group – 1: Tuberculous Effusions

There were 36 cases of tuberculous pleural effusion (23 male and 13 female). The diagnosis was based on factors like clinical features, X-Ray evidence of parenchymal infiltrates, sputum AFB positivity and pleural fluid analysis, Response to BMATT.

#### Group – 2: Malignant Effusions

There were 9 cases of malignant effusion (7 males and 2 females). The diagnosis was based on clinical features, pleural fluid cytology for malignant cells and in cases with pleural effusion with a known malignancy at other sites, with histopathological confirmation, other causes of pleural effusion being ruled out.

#### Group – 3: Transudative Effusion

There were 8 cases of Transudative effusion (6 males and 2 females)

- Congestive cardiac Failure: The diagnosis was based on raised JVP, peripheral edema, tender hepatomegaly, bilateral basal crepitations, chest X-ray signs of lung congestion and cardiomegaly.
- Renal Failure : Was diagnosed when there was raised blood urea and creatinine in the presence fluid overload.
- Nephrotic syndrome: This was diagnosed when the patient had proteinurea of > 3.5 gm/24 hrs, hypoalbuminemia < 3.5 gms/l and edema. Out of the 8 cases of transudative effusions, There were 2 cases of congestive cardiac failure, 2 case of chronic renal failure, 2 case of nephritic syndrome and 2 cases of cirrhosis of liver.

#### Group – 4: Synpneumonic Effusion

There were 5 cases of synpneumonic pleural effusion (4 males and 1 female). The diagnosis was established based on clinical features like fever, expectorant cough, signs of consolidation, chest X-ray and response to antimicrobial therapy.

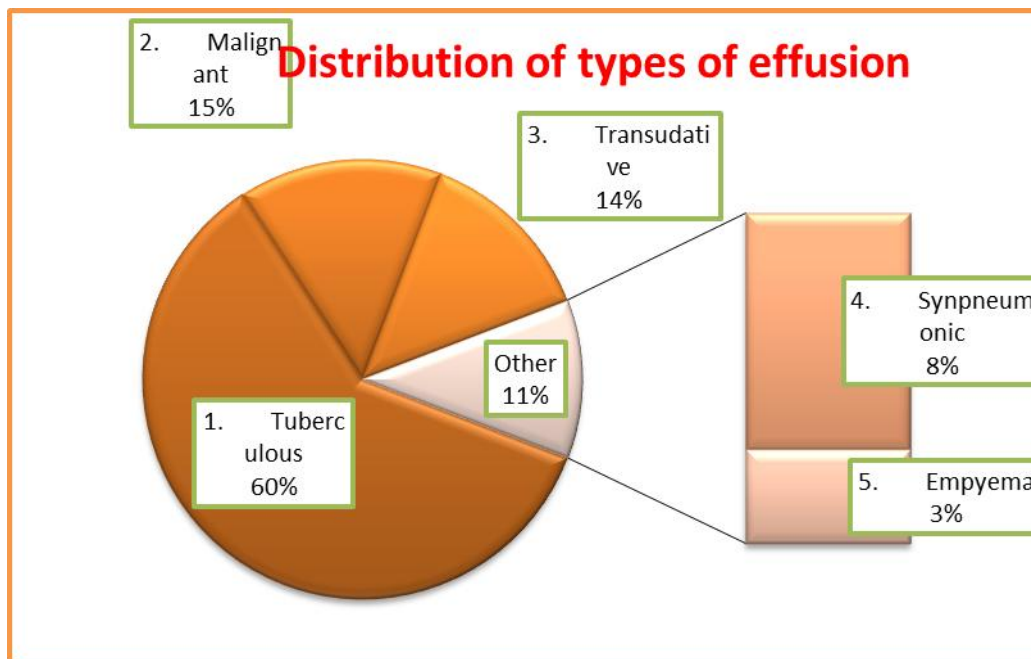
#### Group – 5 : Empyema

These were 2 cases of Empyema. The diagnosis was based on clinical feature, nature of pleural tapping, microbiological and cytological confirmation

#### Results

In this prospective study of 60 patients with pleural effusion, them can age 11 to 75 years and two third were men. The most common type of pleural effusion is exudative effusion. The most common cause of exudative effusion in this study were tuberculosis (36), followed by malignancy (9), Transudative (8), Syn-pneumonic (5) and 2 cases of empyema (2).

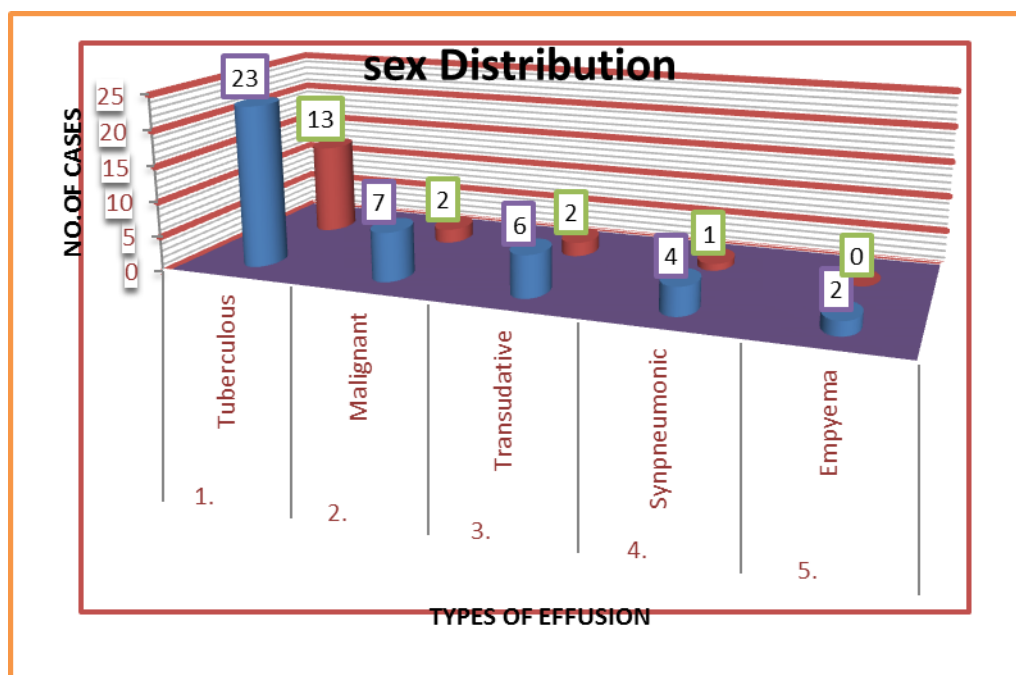
Sl. No.	Type of Effusion	No. of Cases	Percentage (%)
1.	Tuberculous	36	60.00
2.	Malignant	09	15.00
3.	Transudative	08	13.33
4.	Synpneumonic	05	8.3
5.	Empyema	02	3.33



**Sex distribution**

Among the 60 cases of pleural effusion there were 39 males and 17 females. The male: Female ratios in the various groups are as follows

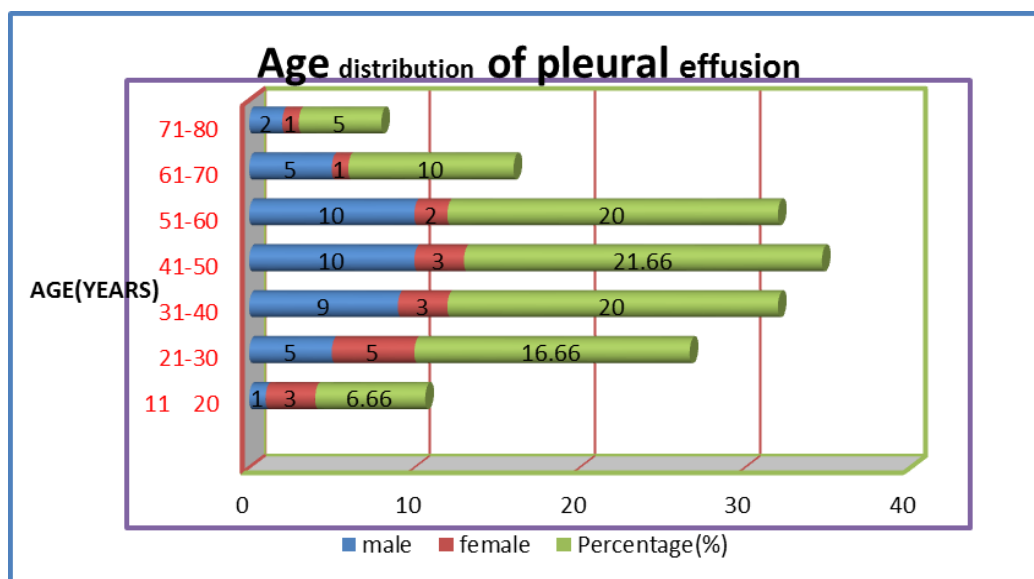
S. No.	Type of Effusion	No. of Cases	
		Male	Female
1.	Tuberculous	23	13
2.	Malignant	07	02
3.	Transudative	06	02
4.	Synpneumonic	04	01
5.	Empyema	02	00
	<b>Total</b>	<b>42</b>	<b>18</b>



Age distribution of pleural effusion

The age distribution among the cases are as follows.

Age (years)	No. of Cases		Total	Percentage(%)
	Male	Female		
11-20	01	03	04	6.66
21-30	05	05	10	16.66
31-40	09	03	12	20.00
<b>41-50</b>	10	03	13	<b>21.66</b>
51-60	10	02	12	20.00
61-70	05	01	06	10.00
71-80	02	01	03	5.00
<b>Total</b>	<b>42</b>	<b>18</b>	<b>60</b>	<b>100</b>

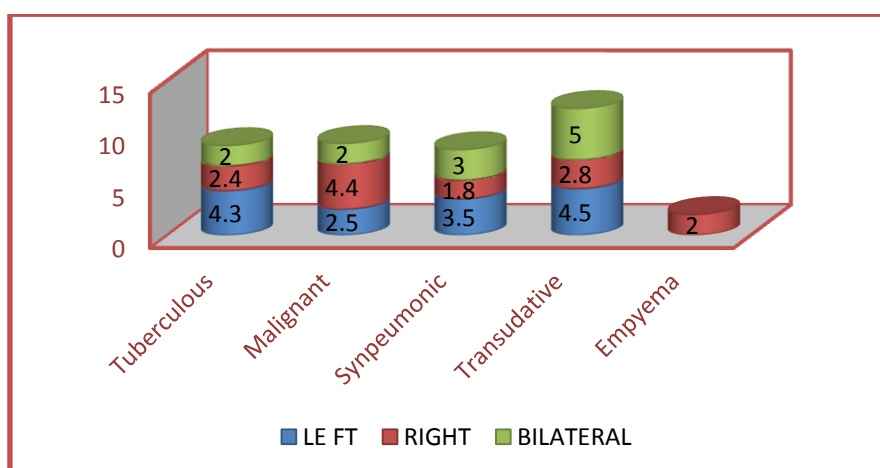


Site of Effusion

Out of the 60 cases of pleural effusion 32 cases were right sided and 21 cases were left sided, 5 patients had bilateral effusions and 2 cases of empyema were on Right side.

Table Distribution of site of effusion in pleural effusion

	Type of Pleural Effusion	Left	Right	Bilateral
1	Tuberculous	16	20	--
2	Malignant	04	02	03
3	Synpneumonic	01	04	--
4	Transudative	--	03	05
5	Empyema	--	02	--
	<b>Total</b>	<b>21</b>	<b>31</b>	<b>08</b>
	<b>Percentage</b>	<b>35.00</b>	<b>51.66</b>	<b>13.33</b>



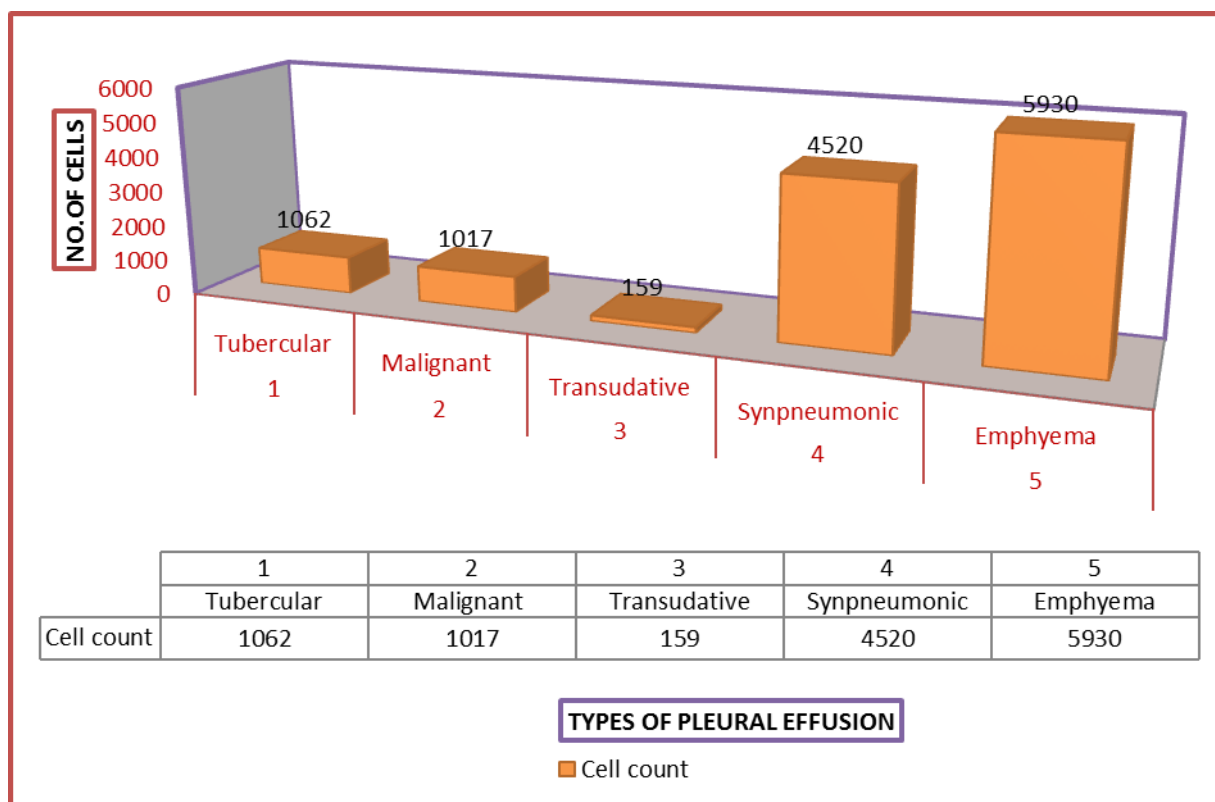
Majority had moderate amount of pleural effusions. Blood count and ESR were significantly elevated in exudatives.

Pleural fluid cytology revealed elevated Lymphocytes in tubercular and polymorphs in acute infections. Cytology for malignant cells were diagnostic in 4 cases.

**Pleural Fluid Cytology**

Table Showing the estimated mean ± SD of pleural fluid cell count and cell type

S. No.	Type of effusion	No. of Cases	Cell count	Celltype Predominant	Malignant cells
1	Tubercular	36	1062 ± 504	Lymphocytes	--
2	Malignant	09	1017±282	Lymphocytes	Positive in 5 cases
3	Transudative	08	159±62	Monocytes and lymphocytes	--
4	Synpneumonic	05	4520±1590	Polymorphocytes	--
5	Emphyema	02	5930±273	Polymorphocytes	--



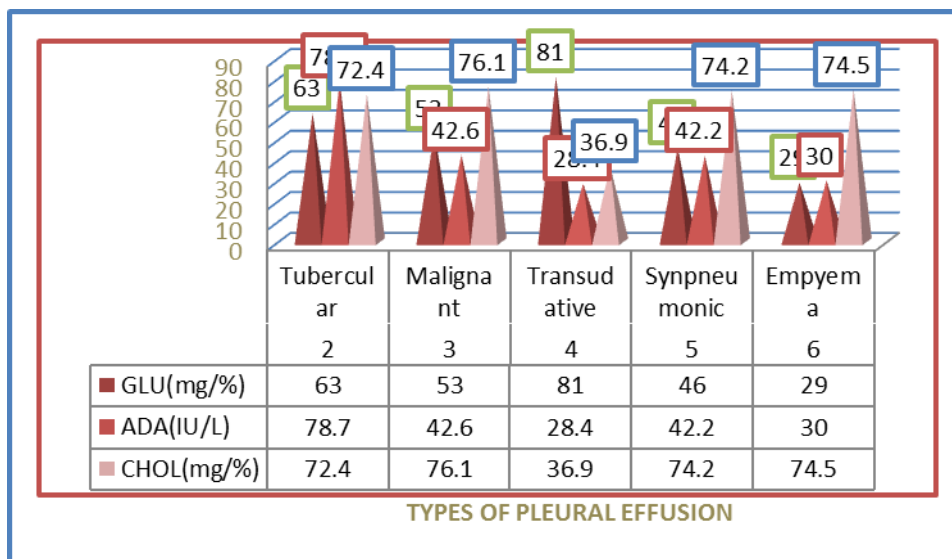
Showing the estimated mean ± SD of pleural fluid glucose, protein, LDH, ADA, cholesterol

Sl. No	Type of effusion	No. of Cases	Pleural Fluid				
			GLU (mg/%)	PROT (gm/%)	LDH(U/L)	ADA(IU/L)	CHOL (mg/%)
2	Tubercular	36	63±8.2	4.3±1.5	236.2±37	78.7±19.9	72.4±9.2
3	Malignant	09	53±3	4.6±0.4	340±46.5	42.6±9.3	76.1±10.2
4	Transudative	08	81±9	2±0.8	95±24.5	28.4±8.2	36.9±5.2
5	Synpneumonic	5	46±16	4.5±0.4	530±89	42.2±21.3	74.2±4.2
6	Emphyema	02	29±4	4.5±0.3	1225±247	30±6	74.5±4.5

ADA was significantly elevated in tubercular pleural effusion. Exudatives had decreased

glucose but increased protein, LDH and cholesterol compared to transudatives.





**Discussion**

60 patients with pleural effusion were studied of which 60.52% were cases of tuberculous effusion and 39.48% were cases of non tuberculous effusion. The present study is particularly relevant in our country, as it has a high prevalence of tuberculosis.

Out of the 60 cases of pleural effusion, which were studied, 36 cases were of tuberculous effusion. This was reflective of the high prevalence of tuberculosis in the area being studied. The remaining 24 cases were of malignant effusion (9 cases), Transudative effusion (8 cases), synpneumonic effusion (5 cases) and 2 cases of empyema. In comparison, the sex distributions in some of the previous studies are: Prabhu desai<sup>10</sup> tubercular effusion comprises 64% of infective cause and 8% were of empyema. In patients of age more than 40 years, malignant effusion was more common; A1 quatrain<sup>6</sup>- common diagnose was tubercular (37%) followed by neoplasm (8%), parapneumonic (14%) and congestive cardiac failure (14%); KZ mamum<sup>9</sup>- also showed tubercular and malignancy were the major causes of pleural effusion; Valdes<sup>8</sup> showed tubercular and transudative were commonest causes.

**Socioeconomic status**

Most of the patients in this study belonged to the lower socioeconomic class. This is consistent with

the fact that tuberculosis is a disease more commonly seen among people living in crowded, unhygienic conditions.

The following were the presenting complaints among the patients, on admission. The commonest symptoms were cough (78.32%) and breathlessness (74.76%), followed by fever 71.20%, weight loss 67.64%, chest pain 44.50%, loss of appetite 62.30% and hemoptysis 17.80%. A small percentage (32%) had various other symptoms like distension of abdomen, puffiness of face, swelling of feet, decreased urine output and myalgia. Most of the patients with synpneumonic effusion, had complaints of a short duration with an acute onset, whereas those the tuberculous effusion and malignancy had complaints of a longer duration. In comparison to other studies: Follader<sup>7</sup> main complaints were fever (41/44), chest pain (41/44) and weight loss (34/44).

Out of the 60 patients with pleural effusion 30 patients had a right sided effusion and 20 patients had a left sided effusion and 8 patients had bilateral effusion. 2 cases of empyema were on right side. In comparison to other studies: A1 Quarain<sup>6</sup> – pleural effusion was more common in right side (55%) than on the left (32%); In Follander<sup>7</sup>- both right and left side effusion were of equal distribution.

In this study, out of the 36 cases of tuberculous effusion, in 9 cases acid fast bacilli could be demonstrated in the sputum by Ziehl Nielson's staining (26.46%). The detection of AFB in the sputum in the tuberculous depends upon the associated lung parenchymal lesion. In comparison to other study: Subhakar. K<sup>11</sup> – 7 of the 62 patients with tuberculous pleural effusion showed sputum positivity for AFB (i.e.11%): Follander<sup>7</sup> – demonstrated predominance of lymphocytes and scarcity of mesothelial cells in tubercular effusion; Nance KV<sup>12</sup> – cytology for malignancy was diagnostic in 71%; Light RW<sup>13</sup> – large number of neutrophils indicate the presence of bacterial pneumonia. Lymphocytes predominant in tubercular pleural effusion.

Cytology for malignant cells was positive in 33-87%; Light<sup>14</sup> – demonstrated predominantly polymorphs in bacterial pneumonia.

All tubercular pleural effusion patients were put on treatment with antitubercular drugs along with steroids for rapid absorption of fluid and prevent fibrosis. Malignant pleural cases had pleurodesis and Synpneumonic effusion responded to appropriate antibiotics given for 2 weeks. Empyema patients required intercostals drainage and antibiotics were given for 3 weeks. All patients received other supportive measures. Check x-ray were done when and where necessary.

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