A STUDY OF CLINICAL PROFILE, AETIOLOGY AND OUTCOME OF PATIENTS PRESENTING WITH PLEURAL EFFUSION

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ABSTRACT

BACKGROUND

Pleural effusion is excess fluid that accumulates in the pleural space which is always abnormal and indicates the presence of an underlying disease. Excessive amounts of such fluid can impair breathing by limiting the expansion of the lungs during respiration. Our study is an etiological study of pleural effusion by conventional methods, such as clinical presentation along with radiological, biochemical and cytological correlation in J.J.M. Medical College attached Hospitals. The purpose of article is to study the etiological profile, clinical profile and outcome of patients admitted with pleural effusion.

MATERIALS AND METHODS

This was a prospective observational study of consecutively admitted patients with pleural effusion in Department of Pulmonary Medicine, J.J.M Medical College, Davangere. The study was carried out on 50 patients with pleural effusions. Detailed history, physical examination was done along with correlation of radiological, biochemical and cytological investigation. Sample size taken for convenience.

RESULTS

In this prospective observational study of 50 patients with pleural effusion, the mean age was 45.4 ± 17.67 years and two thirds were men. The three most common causes of pleural effusion in this study were tuberculosis (60%) followed by empyema (12%), transudative (10%) and parapneumonic effusion (10%) respectively. Among the transudative pleural effusion, congestive heart failure was most common cause. The patients with TB were young. The most common symptoms encountered by them were cough (83.33%), followed by fever (56.67%) and chest pain (36.67%). Empyema was the 2nd most common cause of pleural effusion in the study, cough was the predominant symptom (83.33%), followed by chest pain (50%) and breathlessness (50%) in the study population. Right sided effusion was most common with male to female ratio of 1.94:1. Pleural fluid ADA proved to be a good diagnostic indicator in TB effusion. ADA more than 70 IU/L was associated with nearly half of Tubercular effusions. Empyema was most commonly associated with high total cell counts, with predominant neutrophils, pleural fluid glucose <40 mg%, Pleural LDH to serum LDH ratio >2.

CONCLUSION

In pleural effusion, TB effusion remained to be the most common cause, which was diagnosed symptomatically, diagnostically with the aid of Lymphocyte: Neutrophil ratio, colour of pleural fluid and ADA levels, LDH, pleural fluid glucose. Total count helped in diagnosis of empyema and parapneumonic effusions. Congestive heart failure remained to be most common cause of transudative effusion, managed conservatively. Early diagnosis, early initiation of antitubercular drugs in TB effusion, early intervention and treatment like ICD procedures in cases of empyema and parapneumonic effusion showed improvement and signs of recovery in pleural effusion patients.

KEY WORDS

ADA- Adenosine Deaminase, LDH- Lactate Dehydrogenase, TB – Tuberculosis, PE- Pleural Effusion, PPE- Parapneumonic Effusion, EMP- Empyema, MAL- Malignancy, TRANS- Transudative Effusion

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BACKGROUND

The pleural space is bounded by two membranes, the visceral pleura covering the lung and the parietal pleura covering the chest wall and diaphragm.

Into this space, normal liquid and protein enter from the systemic circulation and are removed by the parietal pleural lymphatics. Pleural pressure is sub atmospheric and ensures inflation of the lung. Because the mesothelial boundaries are leaky, excess liquid can move across into this lower-pressure, high-capacitance space and accumulate as a pleural effusion.¹

Pleural effusion is the abnormal accumulation of fluid in the pleural space. A pleural effusion is always abnormal and

indicates the presence of an underlying disease.² Patients most commonly present with exertional breathlessness, dry cough & pleuritic chest pain. Patients with pleural effusion have higher morbidity and mortality than patients without pleural effusion.³

Pleural effusions are common finding and of highly diverse aetiologies, with higher incidence of effusions secondary to non-infective pathology in the western studies compared to infective pathology in India.⁴ Most of the patients are admitted to the hospital for conditions other than pleural disease, the pleura is often secondarily affected by pulmonary parenchymal disorders and other organ system dysfunction.⁵

Depending on the protein and lactate dehydrogenase (LDH) concentrations of the pleural fluid, these effusions can be categorized as exudates or transudates. Exudative pleural effusions meet at least two of the following criteria, whereas transudative effusions meet none (Light's criteria: pleural fluid protein-to-serum protein ratio of more than 0.5, pleural fluid LDH-serum LDH ratio of more than 0.6, and pleural fluid LDH more than two thirds of the upper normal limit for serum).¹

The etiological distribution of PE depends on the geographic region, patients age & advances in the diagnosis and treatment of underlying cause. Determining the etiological & clinical profile of PE helps in adoption of regionally optimized diagnosis & therapeutic approach.⁶

Tuberculosis is the most common cause of pleural effusion in India when compared to the Western countries where malignancy and parapneumonic effusions are more common.⁷

The diagnostic evaluation of pleural effusion includes chemical and microbiological studies as well as cytological analysis, which can provide further information about the aetiology of the disease process. Transudative effusions are usually managed by treating the underlying medical disorder. However, a large, refractory pleural effusion, whether a transudate or exudate, must be drained to provide symptomatic relief. Management of exudative effusion depends on the underlying aetiology of the effusion. Malignant effusions are usually drained to palliate symptoms and may require pleurodesis to prevent recurrence.⁸

Hence an attempt to study the aetiology, clinical profile and outcome of patients presenting with PE in the hospital is taken up which may help in adoption of regionally optimized diagnosis & therapeutic approach.

Objectives of the Study

To study the aetiological profile, clinical profile and outcome of pleural effusion

MATERIALS AND METHODS

Methodology

Inpatients of Department of Pulmonary Medicine, attached to JJM Medical College, with pleural effusion, fulfilling the inclusion & exclusion criteria were included in the study after obtaining written informed consent. Demographic data, history, clinical examination and details of investigations like routine blood investigations, sputum examination, chest X-rays and pleural fluid analysis. The pleural fluid will be analysed for cell count, cell type, protein, glucose, ADA, PH, LDH, Cholesterol levels and ultrasound thorax, CT thorax will

be done case per case basis). Sample size taken for convenience.

Source of Data

The study was conducted in JJM medical college, Davangere, Karnataka on patients with pleural effusions admitted in the medical wards.

Method of Collecting Data

Study Design

A prospective observational study.

Place of Study

JJM Medical College, Davangere.

Duration of Study

2014 - 2016

Sampling Technique

Convenient sampling.

Sample Size

50 patients.

Inclusion Criteria

- Both male and female patients with age more than 18 years presenting with clinical features of pleural effusion.
- More than 24 hours stay in hospital.

Exclusion Criteria

Patients who haven't given consent.

Statistical Method

Appropriate statistical method was followed. (Measures of central tendency and dispersion, Graphical representation of data was done using IBM SPSS Statistics v20.0).

RESULTS

1. Demographic Data

In this observational study, fifty consecutive patients with pleural effusions were studied in which 33 were males and 17 were females. The mean age was 45.4±17.67 years. The male to female ratio was 1.94:1 and nearly two thirds were men.

2. Aetiology

In this study patients with pleural effusion were classified as transudative (5 out of 50) and exudative pleural effusion (45 out of 50) based on Lights criteria. These were further classified (Graph-1) based on aetiology, clinical profile and outcome as-

- **Exudative pleural effusions-90%:**

The majority were tubercular in origin (60.0%), followed by empyema (12%), parapneumonic effusion (10%) respectively, malignant effusion (6%), others (which includes pancreatic pleural effusion) (2%).

- **Transudative pleural effusions-10%:**

Among five transudative pleural effusion majority were due to CCF (3 out of 5), followed by one effusion due to hypoproteinaemia and hepatic hydrothorax.

3. Age and Aetiology

Around 66.6% Patients with tubercular effusion were of age between 21 to 40 years than those with other causes of effusion, especially malignant effusion where 66.66% of patients were of age > 60 years. So, the patients with TB were younger than the patients with malignancy.

4. Presenting Symptoms

Patients with tubercular effusion presented predominantly with cough (83.33%), followed by fever (56.67%) and chest pain (36.67%). In empyema patients, cough was the predominant symptom (83.33%), followed by chest pain (50%) and breathlessness (50%).

Parapneumonic effusion cough (100%) followed by fever (80%) and in transudative effusion cough (100%) followed by breathlessness (60%) were major symptoms respectively.

Symptoms	Aetiology						Total
	TB	MAL	PPE	EMP	TRANS	OTHER	
Cough	25 (83.33%)	3 (100%)	5 (100%)	5 (83.33%)	5 (100%)	0	43
Sputum	12 (48%)	1 (33.33%)	2 (40%)	3 (60%)	4 (80%)	0	22
Dry	3 (52%)	2 (66.67%)	3 (60%)	2 (40%)	1 (20%)	0	21
Fever	17 (56.67%)	0	4 (80%)	2 (33.33%)	1 (20%)	0	24
Chest Pain	11 (36.67%)	1 (33.33%)	4 (80%)	3 (50%)	1 (20%)	1 (100%)	21
Breathlessness	18 (60%)	1 (33.33%)	1 (20%)	3 (50%)	4 (80%)	1 (100%)	27
Haemoptysis	1 (3.33%)	0	0	1 (16.67%)	0	0	2

Table 1. Frequency of Symptoms with Different Aetiology

5. Size of Effusion

Large effusions (Defined as pleural effusion occupying greater than 2/3rd of hemithorax on chest X-ray) were seen in malignant effusion. In rest of the aetiologies, small to moderate effusion classified as 'not large effusions / small effusions' were seen.

Loculated pleural effusion which were seen in 3 (6%) patients were included in 'not large effusion / small effusions. Among these 3 patients, 1 (33.33%) was loculated tubercular effusion and 2 (66.67%) were loculated empyema.

Aetiology	X-Ray Findings		
	Not Large/Small	Large	Combined
Tuberculosis	28 (93.33%)	2 (6.67%)	30
Malignancy	0	3 (100%)	3
Parapneumonic Effusion	4 (80%)	1 (20%)	5
Empyema	6 (100%)	0	6
Transudative Effusion	4 (80%)	1 (20%)	5
Others	1 (100%)	0	1
Total	43 (86%)	07 (14%)	50 (100%)

Table 2. Size of The Effusion and Aetiology

6. Pleural Fluid Appearance

Majority of the effusions were straw coloured especially tubercular (80%) and parapneumonic effusion (60%). Haemorrhagic effusions were seen most commonly in malignant pleural effusions (100%). Empyema was associated with pus (100%).

7. Total Cell Counts

Most effusions had a total cell count between 1000 to 5000 cells /mm³. Counts greater than 5,000/mm³ were seen predominantly in empyema (83.33%) and parapneumonic effusion (60%).

Graph 2: Association of Total Counts with Aetiology

8. Lymphocyte to Neutrophil Ratio

20 effusions out of 30 effusions (66.67%) were lymphocyte predominant in confirmed tubercular effusion. Majority of neutrophil predominant effusion were Parapneumonic effusion (80%) and empyema (83.33%).

LN Ratio & Aetiology	Aetiology						Total (n=50)
	TB (n=30)	MAL (n=3)	PPE (n=5)	EMP (n=6)	TRANS (n=5)	OTHER (n=1)	
<75%	10 (33.33%)	0	4 (80%)	5 (83.33%)	2 (40%)	1 (100%)	22
>75%	20 (66.67%)	3 (100%)	1 (20%)	1 (16.67%)	3 (60%)	0	28

Table 3. Lymphocyte Predominant Effusion with Aetiology

9. Pleural LDH to Serum LDH Ratio and Aetiology

The ratio of pleural fluid LDH to serum LDH was more than 2 in 100% and 40% of patients with empyema and parapneumonic effusion respectively. Patients with tubercular effusion had a ratio greater than 2 in 23.33% of patients. Pleural LDH to serum LDH ratio was lesser than 0.6 in all of transudative effusions (100%).

Pleural LDH/ Serum LDH Ratio	Aetiology						Total
	TB	MAL	PPE	EMP	TRANS	OTHER	
<0.6	4 (13.33%)	1 (33.33%)	0	0	5 (100%)	0	10
0.6 – 1.0	11 (36.67%)	1 (33.33%)	1 (20%)	0	0	1 (100%)	14
1.0 – 2.0	8 (26.67%)	1 (33.33%)	2 (40%)	0	0	0	11
>2.0	7 (23.33%)	0	2 (40%)	6 (100%)	0	0	15
Total	30 (100%)	3 (100%)	5 (100%)	6 (100%)	5 (100%)	1 (100%)	50

Table 4. Pleural LDH / Serum LDH Ratio and Aetiology

10. Pleural Fluid Glucose Level

The majority of pleural fluid glucose levels were between 40-100 mg/dl in tubercular effusions. All of the empyema's had pleural fluid glucose level less than 40 mg/dl (100%). Around 20% of parapneumonic effusion, 6.67% of Tubercular effusion had pleural fluid glucose levels less than 40 mg/dl.

11. Pleural Fluid Adenosine Deaminase (ADA)

In our study 14 patients (46.67%) with tubercular effusion had a ADA level more than 70I U/L, 15 patients (50%) with ADA level between 30-70 IU/L and 1 patient (3.33%) % showed a level of less than 30 IU/L.

ADA (IU/L)	Aetiology					
	TB	MAL	PPE	EMP	TRANS	Other
<30	1 (3.33%)	2 (66.67%)	2 (40%)	3 (50%)	4 (80%)	1 (100%)
30 – 70	15 (50.00%)	1 (33.33%)	3 (60%)	2 (33.33%)	1 (20%)	0
>70	14 (46.67%)	0	0	1 (16.67%)	0	0
Total	30	3	5	6	5	1

Table 5. ADA with Aetiology

11. Outcome

Patients admitted with TB effusion (30 patients) empyema (6 patients) parapneumonic effusions (5 patients), transudative effusion (5 patients) showed improvement after clinical, radiological diagnosis and treatment. All the patients were followed and managed accordingly.

DISCUSSION

In this study of 50 patients with pleural effusion, the mean age was 45.4 ± 17.67 years and nearly two thirds were men. Tubercular effusion affects most commonly young and the mean age was 38.33 years, consistent with Luis Valdes et al⁹ (34 years) and S.K. Sharma et al¹⁰ (33 years). Earlier studies done in United States by Epstein et al¹¹ and Aho K et al.¹² Showed a mean age of 54 and 28 years respectively. TB effusion is associated with cough and fever as the most common presenting symptom, in comparison with the studies done earlier by Moudgil et al¹³ and Berger H.W¹⁴ et al in which most common symptom was fever (82.06%) followed by cough (72.46%) and chest pain (31.8%).

Malignant effusions were seen in older age group around 60 years (mean 58 years) compared to study by Sharma et al (mean age 47 years). It is how ever well known that Indian patients with malignancy are 15 years younger as compared to the West as seen by Pathak et al.¹⁵ Patients with malignant effusion had cough (100%) followed by dyspnoea (33.33%) as common symptoms similar to a study by Chernov B et al, where cough (62%) was the predominant symptom. Massive effusion with haemorrhagic pleural fluid is in 100% of malignant effusion 100% of malignant effusions as compared to a study done by Maher et al¹⁶ (55%).

66.67% of TB effusions and 100% of malignant effusions had lymphocyte predominance. Our result was similar to the study done by Valdes L et al¹⁷ where they have encountered neutrophil predominant tuberculous effusion in only 6.7% of patients. In tubercular effusion pleural fluid glucose were between 40-100 mg/dl consistent with the earlier observation by Light.¹⁸

Although a pleural fluid ADA above 70 IU/L is definitive of tuberculosis, diagnosis should be considered if the pleural fluid ADA is between 40 IU/L and 70 IU/L. In tubercular, pleural effusion pleural fluid Adenosine de-aminase level (ADA) has got a good diagnostic index after excluding other causes of raised ADA levels. But different authors have used different cut off levels for pleural fluid ADA ranging between 33 IU/L to 50 IU/L.

In this study 96.67% of tubercular effusion had ADA of >30 IU/L and ADA more than 70 IU/L was associated with nearly half of Tubercular effusions. Studies done in the West demonstrate pleural fluid ADA more than 70 IU/L, by Valdes et al¹⁹ and Burgess et al²⁰ which is consistent with our study which showed a mean of 83.6 IU/L. The mean ADA were high in the two Indian studies done by Rajendra Prasad et al²¹, and Gilhotra et al²² with the mean ADA level ranging between 76.8 ± 23.8 IU/L - 95.8 ± 57.5 IU/L.

In 2 out 3 patients pleural fluid were positive for malignant cytology in consistent with the studies showing the malignant cytology ranging from 40% to 87% by Bueno CE et al.²³ Though it is consistent with observed literature, the numbers are too small to draw a definite conclusion. In carcinoma lung patient where pleural fluid malignant cytology was negative it was further investigated for sputum malignant cytology (Which was negative in that patient) and further subjected to BAL fluid / endobronchial biopsy and found to be positive for

malignant cells. Thus, signifying the importance of role of BAL fluid / endobronchial biopsy in patients with negative malignant cytology.

In terms of outcome, patients with TB pleural effusion (30 patients) who were treated with Antitubercular treatment improved, substantiated by clinical and radiological evidences.²⁴ Whereas empyema's (6 patients) and parapneumonic effusions (5 patients) improved with interventions like Intercostal drainage tube insertion, streptokinase infusion to break adhesions and loculation, along with appropriate antibiotic treatment.²⁵ Transudative effusions (5 patients) showed improvement with conservative line of management especially Congestive heart failure.²⁶ In malignant effusions, thoracentesis and Pleurodesis were done for symptomatic betterment and were followed up for further treatment and management.²⁷ Also a incidental case of pancreatic pleural effusion (Pleural effusion due to pseudocyst pancreas) was diagnosed and was treated accordingly.²⁸

Study Highlights

Total Patients		50
Male		33 (66%)
Female		17 (34%)
Mean Age		45.4+-17.6
M.C. Complaint		Cough
	Transudative	Exudative
Total Cases	10% (5 out of 50)	90% (45 out of 50)
M.C. Cause	CCF	Tubercular
LDH >0.6	0%	88.89%
ADA >40	0%	62.2%
L/N RATIO > 0.75	60%	55.56%
Improved Outcome	100%	90%

CONCLUSION

- In our study, exudative effusion remained the most common cause of pleural effusion. Tubercular effusion proved to be the commonest aetiology of all exudative effusions whereas congestive cardiac failure remains commonest cause among transudative effusions.
- Massive effusion with haemorrhagic pleural fluid was commonly associated with malignant effusion while small to moderate effusions with straw colour pleural fluid is associated Tubercular effusion and empyema cases presented with pus.
- Effusion was most common in males compared to females, with mean age of 45.4 years and right side was more compared to left.
- Empyema was most commonly associated with high total counts. Tubercular effusion was associated with lymphocytic predominant effusion whereas neutrophilic dominant effusion included empyema and parapneumonic effusion.
- Pleural fluid, with low glucose (<40 mg/dl) was seen predominantly in empyema and followed by parapneumonic effusions.

- Pleural LDH to serum LDH ratio >2 was seen in empyema and parapneumonic effusions indicating poor prognosis.
- A pleural fluid ADA more than 70 IU/L was associated with nearly half of Tubercular effusions, whereas others with ADA levels between 30 to 70 IU/L along with clinico-radiological findings increased the chances of a tubercular effusion, thus proving diagnostic importance of ADA in TB effusions.
- Early initiation Antitubercular drugs in TB pleural effusion, early intervention and treatment in cases of empyema and parapneumonic effusion showed improvement and signs of recovery.

Limitations of study

1. Adequate samples couldn't be sent for cytological examination in a suspected case of malignant effusion.
2. Pleural biopsy was not used in diagnosis.
3. There were inadequate number of cases to comment on the role of malignant cytology in diagnosing malignant effusion.

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