

## To study the clinical profile of children with pleural effusion at a Tertiary Care Center in North India: A prospective study

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### ABSTRACT

**Introduction:** Pleural effusion is the most common manifestation of pleural disorders and is mostly secondary to bacterial infections in children. **Aims and Objectives:** The primary objective was to study the clinical presentation of pleural effusion in hospitalized children. The secondary objective was to establish the etiology. **Methods:** A prospective observational study conducted from April 2014 to September 2015. Children >1 month and <14 years diagnosed to have pleural effusion on clinical and radiological examination were included in the study. Data regarding demographic profile, presenting complaints, immunization history, anthropometry, biochemical and radiological investigations, and the outcome of the patients were collected. **Results:** Seventy-five patients were included in this study. The mean age of the patients was 69.97±48.23 months. Regarding etiology of pleural effusion, it was parapneumonic in 35 (46.6%), empyema in 18 (24%), transudative in 12 (16%), tubercular in 9 (12%), and malignant (non-Hodgkin's lymphoma) in 1 (1.3%) case. The presenting complaints were fever (82.6%), cough (78.7%), respiratory distress (69.3%), chest pain (36%), and abdominal pain (9.3%). There was no sex predominance. About 16% patients were severely malnourished. Severe anemia was present in 5 (6.7%) patients. None of them required decortication surgery, and none of the patients expired during hospitalization. **Conclusion:** Pleural effusion is a major health problem with parapneumonic effusion still being the most common etiology. Our study also confirmed that fever, cough, and respiratory distress were the most common presenting complaints and most of the children were malnourished. A high index of suspicion is required to avoid delays in diagnosis that may influence treatment and outcome.

**Key words:** Children, Etiology, Pleural effusion, Symptoms

Pleural disease is an important cause of morbidity and mortality in adults as well as in children. The disease as a whole has not been studied well in the pediatric population [1-4]; although, studies on individual etiologies are available [5-17]. In developing countries, pleural effusion most frequently results as a complication of bacterial pneumonia [2]. Our work makes this attempt to study and to investigate children with pleural disease to understand all aspects of the disease, besides trying to establish the underlying possible etiology. Majority of the previous studies focus on only single aspect of disease such as management controversies or bacteriological profile in pleural disease [11,18-20]. Since clinical presentations, management, outcome, and prognosis of the individual etiologies differ, it is important to have a study, which elaborates the entire profile of each disease.

### MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Pediatrics of a Teaching Institute of North India from April 2014 to September 2015. Children >1 month

and <14 years diagnosed to have pleural effusion on clinical and radiological examination were included in the study. Children were diagnosed to have pleural effusion if on clinical examination there was presence of any of these findings such as pleural rub, dull percussion note, decreased chest wall movement, decrease or absent air entry, and decreased vocal fremitus and on X-ray had obliteration of costophrenic angle or chest ultrasonography (USG) detected pleural fluid. Children already taking antibiotics, having congenital malformation of the lung, cases with immunodeficiency, with pneumothorax were excluded from the study. The primary objective of the study was to study the clinical presentation of pleural effusion in hospitalized children. The secondary objective was to establish the etiology.

Demographic data of the patient were collected in the form of name, age, sex, and residence. Data such as presenting complaints, history of similar illness or any other significant illness, history of asthma/allergy, contact with a case of tuberculosis (TB), recurrent respiratory infections, aspiration, and prior hospitalization were duly noted. Birth, immunization, family and socioeconomic history were also recorded. Anthropometry and nutrition status were also recorded.

All children were subjected to investigations such as complete blood count, erythrocyte sedimentation rate (ESR), blood culture, Mantoux test, and sputum/gastric aspirate for acid-fast bacilli (AFB). Pleural fluid if any was collected and analyzed for cell type and count, pH, glucose, lactate dehydrogenase levels, gram and AFB stain, and culture and sensitivity for aerobic bacteria. Chest X-ray and ultrasound scan of chest were done in all patients and computerized tomography scan of the thorax was done wherever necessary. Investigations were done on day 1 and day 2 of admission depending on the time of admission. Investigations such as hemogram, blood culture, chest X-ray, and ultrasound were repeated wherever necessary. Appropriate history and examination were done including the anthropometry. After clinical history, examination, and investigation, diagnosis was made and patients were divided into following categories:

1. Parapneumonic effusion: Parapneumonic effusion was diagnosed if pleural effusion was associated with lung infection (i.e., pneumonia) [21]
2. Empyema: If the pleural tap showed pus cells under microscopy or on gross examination purulent exudates were present, case was labeled as empyema
3. Transudative pleural effusion: Pleural fluid was considered transudate on the basis of Light's criteria [22]
4. Tubercular pleural effusion: The diagnosis of pleural TB was based on medical history, clinical findings, chest X-ray, tuberculin skin test, microbiological tests (AFB in smear or mycobacterial culture), pleural effusion biochemical analysis, and response to anti-TB treatment [23-25]
5. Malignant pleural effusion: Presence of malignant cells in the pleural fluid.

Ethical clearance was taken from the Institutional Ethical Committee. Both the written and verbal consents were taken from the parents. Statistical methods such as frequencies, descriptive were used to analyze the data, employing the SPSS 11.0 package.

## RESULTS

Seventy-five patients were included in the study. The mean age of the patients was 69.97±48.23 months. Males (50.7%) and females (49.3%) were almost comparable in distribution. Severe anemia (hemoglobin <7 g/dl) was present in 5 (6.7%) patients. 24 (32%) patients had leukocytosis (total leukocyte counts [TLC] >11,000/mm<sup>3</sup>) at admission. Only 2 patients (2.7%) had leukopenia (TLC <4000/mm<sup>3</sup>), one had dengue fever, and the other had non-Hodgkin's lymphoma. Majority of cases (36%) (27 out of 75) were between 12 and 60 months of age, of which 13.3% had empyema, 12% has parapneumonic, 5.3% had transudative, and 5.3% had tubercular pleural effusion. Regarding etiology of pleural effusion, it was parapneumonic in 35 (46.6%), empyema in 18 (24%), transudative in 12 (16%), tubercular in 9 (12%), and malignant (non-Hodgkin's lymphoma) in 1 (1.3%) case. About 16% children were severely malnourished according to the WHO classification. ESR was raised in 26 (34.7%) cases, out of them

8 (10.66%) had empyema, 6 (8%) had parapneumonic, 3 (4%) had transudative, 8 (10.66%) had tubercular, and 1 (1.33%) had malignant pleural effusion.

At the time of admission, chest pain was present in 36%, cough in 78.7%, abdominal pain in 9.3%, fever in 82.6%, and respiratory distress in 69.3% of patients. The symptoms of the patients in different subgroups are described in Table 1. Crepts were present in 39 patients (52%). Lobar consolidation was present in 15 (20%) cases. Patchy infiltrates were present in 30 patients (40%), and air entry was decreased in 86.6% of patients.

On chest X-ray, pleural effusion was present in 17 (94.4%) patients with empyema, 29 (82.9%) patients with parapneumonic, 9 (75%) patients with transudative, and 5 (55.6%) patients with tubercular pleural effusion. All patients with tubercular pleural effusion had unilateral pleural effusion. Hilar lymphadenopathy was present in 2 patients with transudative and 4 patients with tubercular pleural effusion. Chest X-ray was normal in one patient with empyema and 2 patients with transudative pleural effusion. Patchy infiltrates were present in 20 patients (57.1%), lobar consolidation in 9 (25.7%) patients, and atelectasis in 5 (14.3%) patients with parapneumonic pleural effusion on chest X-ray.

On USG, among 18 cases of empyema, 5.55% had loculations, 5.55% had pleural thickening, and 100% had pleural effusion. All patients with parapneumonic pleural effusion had pleural effusion on USG. Out of 12 cases of transudative pleural effusion, 11 (91.66%) had pleural effusion in chest USG. Among tubercular pleural effusions, 22.2% (2 out of 9) had loculations, 11.1% (1 out of 9) had pleural thickening, and 6 (66.7%) had pleural effusion on chest USG.

Intercostal drainage was done in 18 patients. Pleural fluid was straw-colored in 20, clear in 36, purulent in 18, and hemorrhagic in one case. Straw-colored fluid was found in 2 (16.7%) patient with transudative, 9 (25.7%) patients with parapneumonic, and all patients with tubercular pleural effusion. All patients with empyema had purulent fluid. Pleural fluid was clear in 10 (83.3%) patients with transudative and 26 patients with parapneumonic pleural effusion.

Pleural fluid was neutrophilic in all patients with empyema, 29 (82.9%) patients with parapneumonic, and 4 (33.3%) patients with transudative pleural effusion. It was lymphocytic in all patients with tubercular pleural effusion, 6 (17.1%) patients with parapneumonic, and 4 (33.3%) patients with transudative pleural effusion. Only 1 case of malignant cytology with hemothorax was noted.

Mantoux test was reactive in 12% (9 out of 75) of cases. All of them had tubercular pleural effusion. Gastric aspirates for AFB positive were positive in 66.7% (6 out of 9) of cases with tubercular pleural effusion. Nearly 44.4% (8 out of 18) of empyema cases were positive for gram stain. Pleural fluid culture found to be positive only in 11.1% of cases of empyema. In one, *Staphylococcus aureus* was isolated, and in the other, *Pseudomonas aeruginosa* was isolated. None of them required decortication surgery and none of the patients expired during hospitalization.

Table 1: Symptoms of the patients at the time of admission symptoms at the time of admission

Symptoms at admission	Final diagnosis					
	Parapneumonic pleural effusion n=35 (%)	Empyema n=18 (%)	Transudative pleural effusion n=12 (%)	Tubercular pleural effusion n=9 (%)	Malignant pleural effusion n=1 (%)	Total n=75 (%)
Cough	30 (85.7)	14 (77.8)	5 (41.7)	9 (100)	1 (100)	59 (78.7)
Respiratory distress	26 (74.3)	15 (83.3)	6 (50)	4 (44.4)	1 (100)	52 (69.3)
Chest pain	12 (34.3)	9 (50)	4 (33.3)	1 (11.1)	1 (100)	27 (36)
Fever	29 (82.9)	18 (100)	5 (41.7)	9 (100)	1 (100)	62 (82.6)
Abdominal pain	2 (5.7)	3 (16.7)	2 (16.7)	0	0	7 (9.3)

## DISCUSSION

Pleural effusion is a common problem encountered in the pediatric population. Most of the studies available are from the West and most of the work in India has been done on empyema and TB only [6-8,10,11,13,23].

Our study found that the mean age was 69.97 months which was comparable to study in the North East England (67.2 months) [26]. In the present study of the 75 patients, there were 37 (49.33%) females and 38 (50.66%) males which is similar to study (2003) in Memphis, in which 45% were female and 55% were male [27], although one study by Hasan et al. showed male predominance [28].

In accordance with other studies, we also encountered parapneumonic pleural effusion 35 (46.66%) as most common followed by empyema in 18 (24%), transudative in 12 (16%), and tubercular pleural effusion in 9 (12%) and lastly one case of malignant pleural effusion (non-Hodgkin's lymphoma). In a study of 210 cases at Community Mental Health Center (1996), 143 (68.09%) were parapneumonic with 60 (28.57%) empyemas, 67 (31.9%) were non-parapneumonic, 23 (10.95%) congenital heart disease, 10 (4.76%) uremia/solid malignancy, and other miscellaneous causes [14]. Some referral bias is bound to occur as ours is a tertiary center with large catchment area. Non-inclusion bias was minimal to the best of our knowledge.

The most common symptoms of presentation were fever (82.6%), cough (78.7%), and respiratory distress (69.3%). In a study by Hasan et al. (2012), in thirty children, a history of respiratory distress and fever was present in 96.7% and cough in 90% of cases [28]. On comparing different etiologies of pleural effusion, no difference was found in the symptoms at the time of admission. Among patients with empyema, 83% had respiratory distress, 77.8% had cough, 50% had chest pain, 100% had fever, and 16.7% had abdominal pain. Similar results were found in a study in Mysore by Narayanappa and Rashmi, out of 50 children with empyema, all children had fever and cough, 35 (70%) had hurried respiration, 4 (8%) had abdominal pain, 4 (8%) had chest pain, and 2 (4%) of them had ear discharge [11]. In a study by Grisaru-Soen et al., a retrospective case-control study on children aged 2 months-18 years, children with empyema most commonly presented with prolonged fever, dyspnea (51%), and chest pain (17%) [29].

All patients with tubercular pleural effusion had fever and cough. Similar results were found by Shrestha et al. with fever (75.6%),

cough (63.4%) being the most common symptoms [10]. Similarly, in a study by Wang et al. in China, 112 pediatric patients with tubercular pleural effusion were retrospectively reviewed and found that 85.7% had fever, 72.4% had dyspnea, and 56.3% had cough at admission [30]. Our study confirmed that cough (85.7%), fever (82.9%), and respiratory distress (74.3%) were the most common symptoms in patients with parapneumonic pleural effusion as found by Devota et al., in which fever (90.28%), cough (69.44%), and dyspnea (66.67%) were the most common clinical presentations in 72 patients with parapneumonic pleural effusion [31].

On chest X-ray, in patients with parapneumonic pleural effusion, 82.9% had pleural effusion, 57.1% had patchy infiltrates, 25.7% had lobar consolidation, and 14.3% had atelectasis. In a similar study by Devota et al., out of 72 patients, pleural effusion was present in all patients with concomitant finding of pneumonia in 18%, septation in 8.33%, and atelectasis in 5.56% [31]. Among tubercular pleural effusion, 55.6% had pleural effusion and 44.4% had hilar lymphadenopathy in chest X-ray and all tubercular effusions were unilateral. In a study by Chiu et al., chest radiograph review showed unilateral pleural effusion in 12 patients (92%) with tubercular pleural effusion [25]. In a study conducted in Spain, it was found that in 175 children with primary pulmonary TB, chest radiograph disclosed 39 cases of tubercular pleural effusion and all cases were unilateral [32].

Pleural fluid was straw-colored in 26.7%, clear in 48%, purulent in 24%, and hemorrhagic in 1.3% of cases. However, in a study by Hasan, pleural fluid was straw-colored in 56.7%, clear in 30%, and blood stained in 13.3% [28]. Gastric aspirates for AFB was positive in 66.6% of patients and ESR was raised in 88.9% of patients with tubercular pleural effusion. In a study by Wang et al., 5.4% were AFB smear positive, 36.6% were culture positive, and ESR was raised in 84.1% [30]. Our study found that gram stain was positive in 44.4% cases with empyema. Pleural fluid culture was positive in only 2 cases. In one case, *S. aureus* was isolated, and in the other, *P. aeruginosa* was isolated. In a retrospective study of 48 children by Hilliard, organisms were identified in 31% of children, the most common organism was *Streptococcus pneumoniae*, but 20% of organisms were *S. aureus* [20]. Various studies have also shown streptococcus and staphylococcus as the most common organism in pus culture in patients with empyema [6,27,33].

Limitations of our study include conventional methods were used for diagnosis, and newer diagnostic tools such as gene expert, mycobacteria growth indicator tube culture, pleural biopsy, and

polymerase chain reaction techniques were not used because of which there may be under diagnosis of some etiologies. Sample size was not calculated statistically in this study. Data regarding the medical treatment given, duration of medical treatment, duration of stay, and course of illness were not collected.

## CONCLUSION

Our study showed the current status of pleural effusion in children with parapneumonic effusion still being the most common etiology. Hence, early suspicion and investigations, especially early diagnostic thoracentesis, are vital for the good clinical outcome.

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