

**Research Article**

Clinical Profile of Admitted Children with Pleural Effusion: A Tertiary Care Center Experience

Authors

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Abstract

Background: Pleural effusion is a problem commonly encountered by chest physicians. Management of pleural effusions depends on their origin whether exudates or transudates, simple or complicated. This study was carried out to find out types of effusion and their etiology.

Methods: A Prospective study of 60 patients were analyzed for clinical and laboratory profile, origin and type of fluid, etiology of pleural effusion in pediatric patients.

Results: Majority of the patients were in 1-4 years age group (42%). Fever, cough and respiratory distress were most common clinical symptoms in all type of effusion. Empyema was most common type of effusion followed by tuberculosis and para-pneumonic effusion cases. All of the exudative cases satisfied Lights criteria.

Conclusion: Pleural effusions are mostly exudative in origin in pediatric age. Pneumococci (30%) was more frequent among causative micro-organisms in recent time.

Keyword: pleural effusion, empyema, tuberculosis, para pneumonic effusion.

Introduction

Pleural effusion is a problem commonly encountered by chest physicians, accounting for approximately 4% of all attendances to the chest

clinic¹. Pleural effusion primarily occurs because of imbalance in hydrostatic and oncotic pressure, increased capillary permeability and impaired lymphatic drainage². Pleural fluid accumulates

when too much fluid either enters or too little fluid exits, out of pleural space². Though Pleural effusion occurs less frequently than adults they also differ significantly in etiology from adults².

It is important to classify pleural fluids into exudates and transudates because this is indicative of underlying pathophysiological process involved, such a distinction allows appropriate investigations to be instigated enabling better patient management³. Light et al has established criteria for demonstrating high degree of diagnostic accuracy for differentiating transudates and exudates⁴.

Pediatric pleural effusions present a changing profile over time, both in terms of etiological subgroups and causative microorganisms in parapneumonic effusions². The changing spectrum of causative agents in pediatric parapneumonic effusions is among the current topics on the subject^{2,5}. The causative agent may be difficult to estimate empirically because of changes in frequency of microbial agents over years, incomplete sensitivity and specificity of different methods in detecting the agents and increasing incidence of sterile empyemas as a result of wide utility of broad spectrum anti-microbial agents^{2,5,6,7,8,9}. Reviews of causative agents over long periods of time help reveal this changing profile of causative microorganisms and would be clinically useful.

Most common cause of Pleural effusion in children is bacterial pneumonia, other causes are tuberculosis, dengue, heart failure, nephrotic syndrome, diaphragmatic abscess, rheumatic and rheumatoid diseases, uremia and pancreatitis¹⁰.

In various study it has been reported that, incidence of parapneumonic effusion ranges from 20% to 91% with an increase in morbidity and mortality¹¹. Incidence of childhood empyema increased in UK in the mid to late 1990¹².

Parapneumonic effusion is more common in boys than girls and more frequently encountered in infants and young children¹³. Non bacterial infectious agents such as virus and Mycoplasma

pneumoniae are the common causes of pleural effusion in children throughout the world¹⁴.

It is justified to know the clinical presentation in order to avoid delays in diagnosis that may influence treatment and outcome. The current study was conducted to provide a general descriptive information on pediatric pleural effusion cases admitted at department of paediatric respiratory medicine (pulmonology) in Dhaka Shishu (Children) Hospital to find out the frequencies of effusion subtypes and etiologies.

Materials and methods

A prospective cross sectional study was carried out on patients diagnosed provisionally as pleural effusion and admitted in the department of pediatric respiratory medicine (pulmonology) from January 2019 to December 2019. A total number of sixty (60) admitted patients with pleural effusion were included in this study. These included patients in whom pleural effusions were the reason for referral as well as those with a clinical finding after admission for other presenting symptoms. Patients with low amounts of pleural fluid collections for whom diagnostic or therapeutic sampling was not required were excluded from the study. The patients were diagnosed by detailed history taking, physical examination and confirmed by chest radiography, ultrasonography (USG) of chest, CT scan of chest and aspiration of pleural fluid of one(1) year to seventeen (17) years age of either sex were selected purposively. Aspirated Pleural fluid was examined for physical appearance, and was sent to institutional laboratory for microscopic examination gram staining, AFB staining, Gene X-pert, immunochromatography and biochemical examination like protein and sugar. Some important biochemical analysis such as serum and pleural fluid LDH, pleural fluid ADA analysis were performed from outside center. The parents were explained about the purpose of the study. Both the written & verbal consents were taken from the parents. When parents did not give consent for any particular case next case was

selected. The exclusion criteria were very sick children, age below six months and above seventeen years, previously treated pleural effusion cases, cases having any other chronic illness or co-morbid situation, parents don't give consent for the study. All information's were recorded in pre-tested semi-structured questionnaire. Ethical clearance was taken from institutional ethical committee.

Results

Age distribution of cases, 25 (42%) were within 4 years, 22 (36%) were between 4 to 8 years,

13(22%) were between 9 to 17 years of age. (Table 1)

Table 1: Distribution of study population according to age

Age (years)	Number	Percentage
1-4	25	42
5-9	22	36
10-17	13	22
Total	60	100

Among admitted patients proportion was found to be higher in male children, 80% (48) and 20% (12) of children were female.

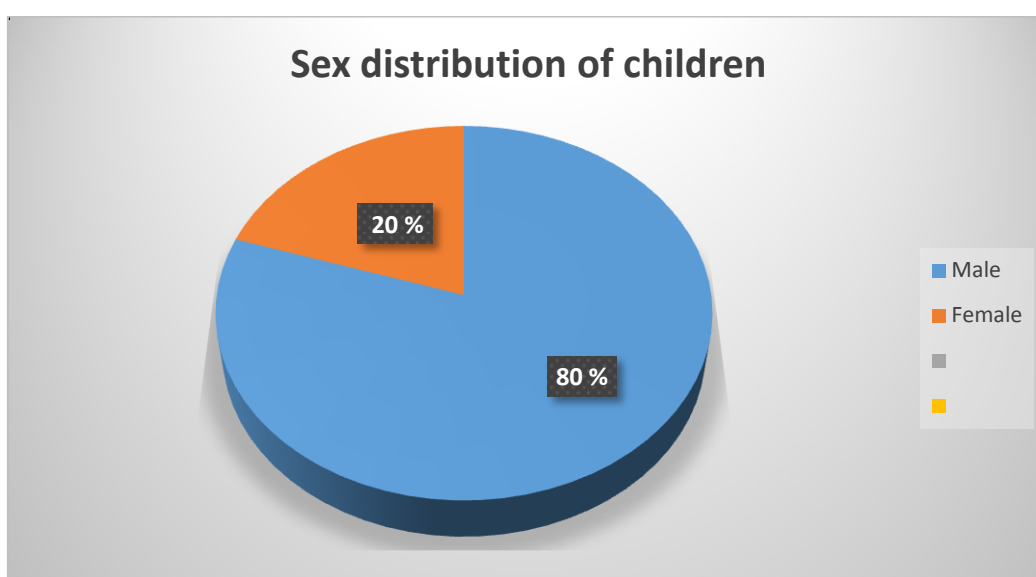


Figure 1: Sex distribution of children (n= 60)

Completely immunized were 37(55%), partially immunized 15(25%), and 8(12%) were not given immunization. (Figure 2)

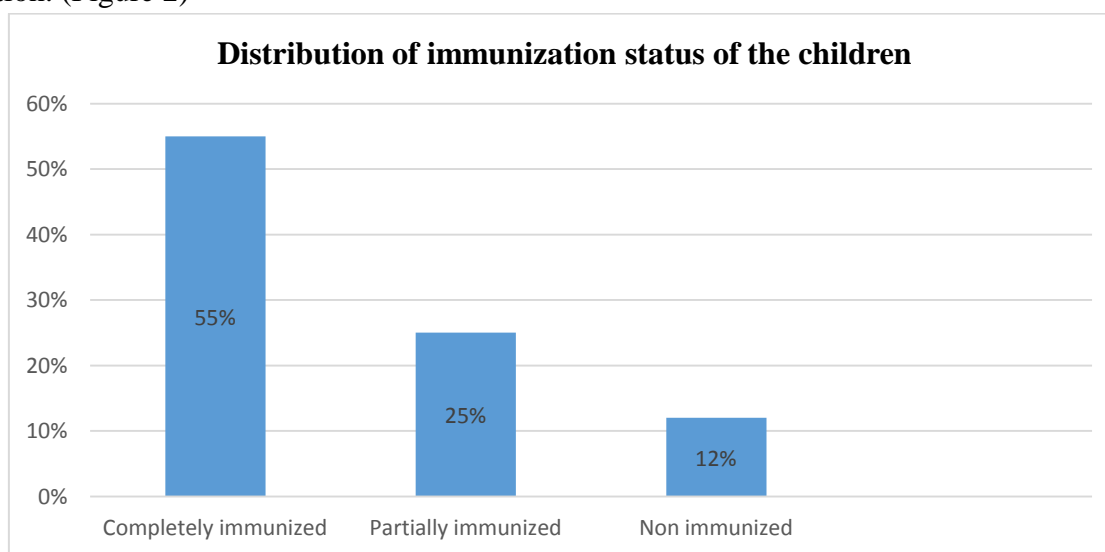


Figure 2: Distribution of immunization status of the study population (n=60)

Nutritional status (according to WHO classification), 33(55%) cases were severely malnourished, 19(32%) were moderately and 8(12%) were mildly malnourished (Figure 3).

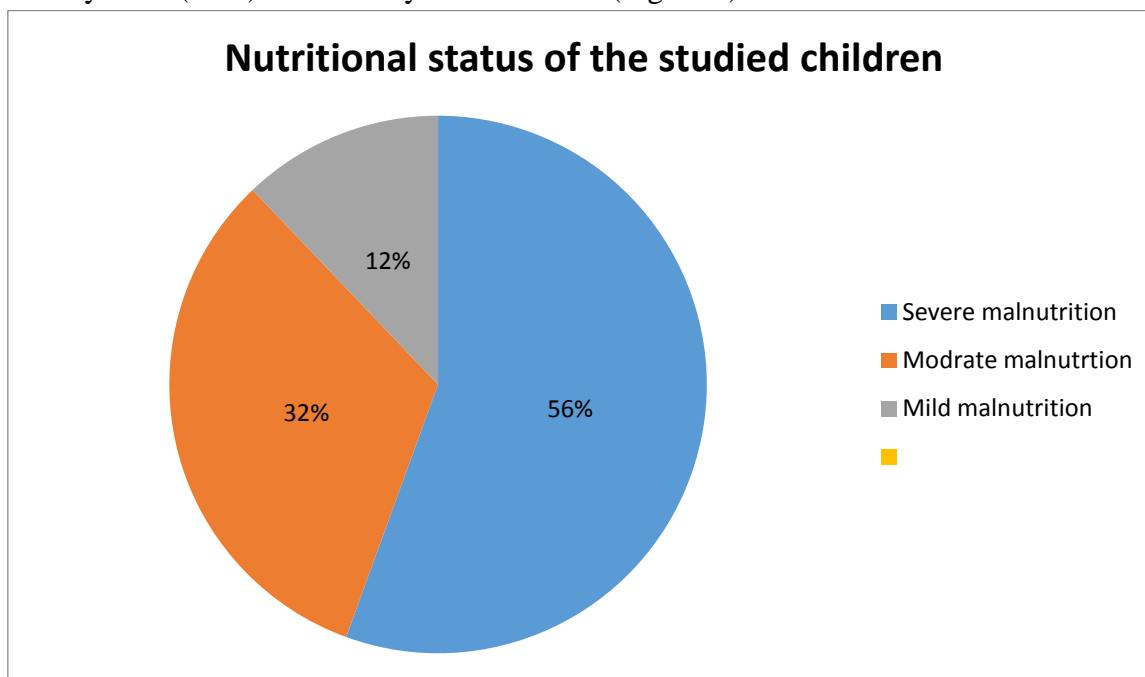


Figure 3: Nutritional status among the studied children (n=60)

Clinical presentation, all of the studied children (100%) had history of fever and cough was present in 55 (91.6%), cough in 27 (90%), followed by respiratory distress in 53 (88.3%), chest pain in 23 (38.3%), history of weight loss in 18 (30%) and contact with TB patient in last 1 year 09 (15%) cases (Table 2).

Table 2: Clinical presentation of studied children

Presenting features	Case	Percentage
Fever	60	100
Cough	55	91.6
Respiratory distress	53	88.3
Chest pain	23	38.3
History of weight loss	18	30
Contact with TB patient in last 1 year	09	15

Regarding physical signs, all 60 (100%) children had both dullness on percussion diminished breath sound with or without reduced vocal resonance, followed by 50 (83.3%) children with chest recession, 49 (81.66%) children with mediastinal shifting and diminished chest movement on 45 (75%) children (Table 3).

Table 3: Physical signs of studied children (n=60)

Clinical signs	Number	Percentage
Diminished chest movement	45	75
Chest recession	50	83.3
Mediastinal shifting	49	81.6
Dullness on percussion	60	100
Diminished breath sound ± vocal resonance	60	100

Among the study population, 31 (51.7%) had left sided pleural effusion followed by right sided pleural effusion in 25 (41.7%) and 4 (6.6%) children had bi-lateral pleural effusion (Table 4).

Table 4: Site of pleural effusion among study population (n=60)

Involvement	Case	Percentage
Left	31	51.7
Right	25	41.7
Bi-lateral	04	6.6

Out of 60 patients of pleural effusion, empyema 24 (40%), tubercular 18 (30%), para-pneumonic 16 (26.7%) and malignancy 2(3.3%) (Figure 4).

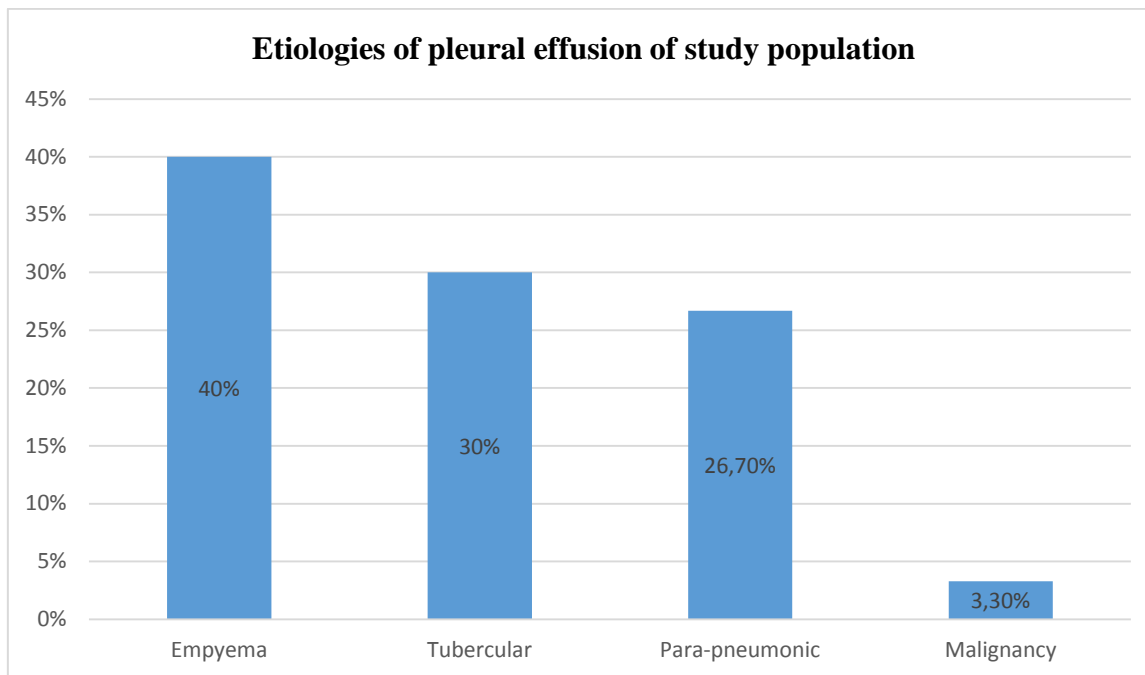


Figure 4: Etiologies of pleural effusion of the study population (n=60)

Pleural fluid was exudative in origin in 58 (96.7%) and transudative in 2 (3.3%) patients.

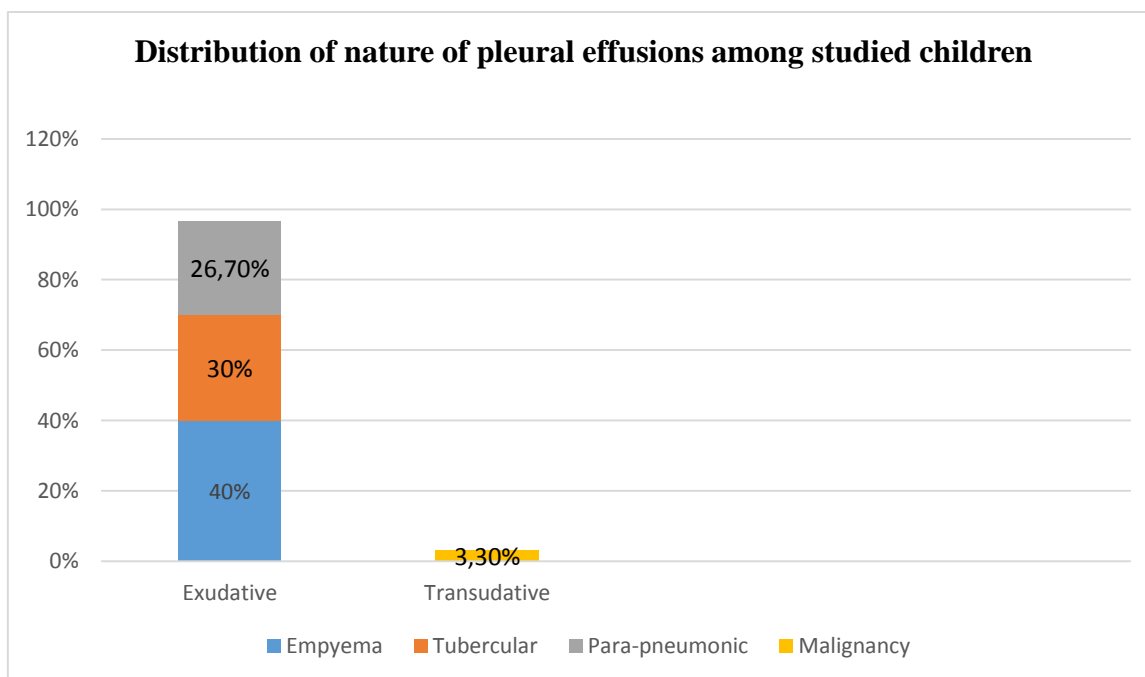


Figure 5: Distribution of nature of pleural effusions among studied children (n=60)

Table 5: Comparison of biochemical parameters in different types of pleural effusions

Diagnosis	Pleural fluid protein/ Serum protein		Pleural fluid LDH/ Serum LDH		Pleural fluid ADA (IU/L)	
	<0.5	>0.5	<0.6	>0.6	<50	>50
Empyema		24		24	18	06
Tubercular		18		18		18
Para-pneumonic		16		16	12	04
Malignancy	2		2		2	

Exudates were observed in majority of cases (96.7%), it was (100%) in empyema, tubercular and parapneumonic effusion. Pleural fluid protein / serum protein ratio was >0.5 in 96.7% of all patients, it was 100% in empyema, tubercular effusion and parapneumonic effusion whereas, it was <0.5 in 3.3% of malignancy patients.

Pleural fluid LDH /Serum LDH ratio was >0.6 in 96.7% of patients and 100% in empyema, tubercular effusion and para-pneumonic effusion. Thus, in all of the patients Lights criteria for exudates were satisfied. Both the sensitivity and specificity of pleural fluid/serum protein ratio and pleural fluid / serum LDH were 100% as shown in Table 5.

In 46.67% of patients pleural fluid ADA was >50 I.U. majority of patients in this category was of tuberculosis (64.2%). The sensitivity, specificity, positive predictive value and negative predictive value of ADA (>50 I.U.) in tuberculosis were 100%, 76.19%, 64.29% and 100% respectively (Table 5)

A total of 18 patients of tubercular pleural effusion, gastric lavage for AFB was positive in 4 patients. Montoux test was positive ($>10\text{mm}$) in 9 patients of tubercular effusion. B.C.G. was not administered in 8 patients of tubercular effusion. Pleural fluid culture was positive in none of the 60 patients. The only organism isolated was Pneumococcus, performed via immunochromatography in 18 (30%) patients.

Discussion

Pediatric pleural effusion is most commonly seen in males and younger children¹⁵. Male patients were more than females and most common age group in this study was also 1 to 4 years (32%) followed by 5 to 9 years (22%) whereas in Maulik study 32% patients were in 6 to 10 years and in Hasan et al 50% of patients were within 4 years^{10,16}. In this study male cases were more, probably due to greater attention to the male children. Males were (80%) and females (20%). Male predominance was also seen in Hasan et al, Maulik and Memon et al study^{10,16,17}.

On comparing different types of pleural effusion in this study empyema (40%) was more common than tubercular pleural effusion (30%) and parapneumonic effusion (26.7%). But Maulik study found parapneumonic effusion to more common 38.23% was more common than tubercular pleural effusion (23.50%), a similar finding as in Maher et al study^{10,16,18}. Yilmaz et al and Hasan et al showed that the malnutrition was a common association with effusion in children^{16,19}. In our study 56% of the cases were found to be severely malnourished whereas Hasan et al found 40% of the cases severely malnourished¹⁶. In this study fever, cough and respiratory distress were predominant presenting features. Restricted chest movement, subcostal recession, dullness on percussion and diminished breath sound were common physical findings. Presenting features were similar to findings in Hasan et al and to another study done in Ethiopia^{16,20}.

Barnes study found that 96% of the cases were diagnosed by ultrasonography though in this study, X-ray chest and thoracentesis were the main diagnostic tools for the diagnosis²¹. We also did CT scan of chest in some cases with diagnostic dilemma.

All of the patients satisfied Lights criteria for transudate and exudates in this study. Family history of tuberculosis was positive in 50% of patients of tubercular effusion as in Merino et al study (25.7%), whereas it was 55.5% in Boloursaz et al, 46% in Chiu study, 25% in Maulik study and 68% of patients in Siddiqui et al^{10,22-24}.

Sensitivity and specificity of various parameters (ratios) were tested to differentiate between transudate and exudates it was found that ratios of Pleural fluid and serum protein, and pleural fluid and serum LDH were all 100% sensitive and 100% specific. Gastric lavage for AFB was positive in 22.2%. Pleural fluid yield for bacterial culture was 100% negative growth whereas in Maulik study it was 11.76% and Narayanaapa et al found it to be 40%^{10,25}. But organism isolated via immunochromatography was Pneumococcus

30% of the cases. None of the studies used the method of pleural fluid immunochromatography.

Conclusion

Pleural effusion was most common in younger age. Empyema was most common cause among all types of effusion. Fever, cough, respiratory distress and chest pain were the common presentations. Physical findings of effusion were present in all cases. Left sided pleural effusion was more than the right sided. Majority of effusion were exudative in origin than transudates and all of them satisfied light's criteria. Causative microorganism were identified in 30% overall, with *S. pneumoniae*. A changing profile of the causative agents showed the relative frequency of *S. aureus* and *H. influenza* to be decreased, whereas pneumococci were more frequent in recent time.

Declarations

Ethical consideration

This study was approved by the ethical committee of the DSH. Moreover, the researchers were duly concerned about the ethical issues and the ethical issues were maintained in according to the current Declaration of Helsinki.

Consent of Publication: Not applicable

Availability of data and material: Data and materials supporting study findings in the manuscript will not be shared. It was not in accordance with participants' written informed consent. However, it can be shared with the reviewer team on request.

Conflict of Interests: The authors declare that there is no conflict of interests regarding the publication of this paper.

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Supplementary Materials: Available on request.

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