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ORIGINAL ARTICLE

Etiology and outcomes of pleural effusion in children admitted in national institute of child health.

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ABSTRACT… Objective: To determine the etiology and outcomes of pleural effusions in children. **Study Design:** Cross-sectional study. **Setting:** Department of Pediatric Medicine, National Institute of Child Health, Karachi, Pakistan. **Period:** June 2022 to October 2023. **Methods:** A total of 60 admitted children of either gender, aged 1-12 years, and having pleural effusion were analyzed. Relevant laboratory and radiological studies including complete blood count, complete urinalysis, ultrasonography, chest X-ray, sputum for acid fast bacilli (AFB) smear, and gene x-pert were performed. Pleural tap was done and fluid was sent to institutional laboratory for biochemical analysis, microbiological testing, and cytology testing to rule out infections. **Results:** In a total of 60 children, 34 (56.7%) were male. The mean age was 5.4±3.5 years. Cough and fever were the most reported symptoms among the patients, with 18 (30.0%) having a cough, and 17 (28.3%) having fever. The sputum test was positive in 7 (11.7%) of children. The cause of pleural effusion in 44 (73.3%) of patients was pneumonia, 12 (20.0%) tuberculosis, and 4 (5.7%) had congestive heart failure (CHF). **Conclusion:** The cause of pleural effusion in the pediatric age group is commonly infection. Taking preventive measures, diagnosing and managing pleural effusion promptly as a multidisciplinary approach can decrease the morbidity and mortality rate.

Key words: Cough, Dyspnea, Fever, Pleural Effusion, Pneumonia.

INTRODUCTION

Pleural effusion is common in adults and children, and infectious and non-infectious diseases usually cause it. In children, pleural effusion commonly occurs due to secondary cause or complication of infections.[1,2] Pleural effusion can either be exudative and transudate[3], and both types have different characteristics. Exudative effusion usually results from an inflammatory process, whereas transudate results from changes in hydrostatic and oncotic pressure.[2] Most of the children with small effusions do not require investigations and need treatment with antibiotics alone. Pleural effusion due to systemic disease may resolve with the treatment of the primary disease.[3]

In the recent decades, a rising trend has been documented in the pleural effusion incidence due to underlying causes or infections around the world. In US, the incidence of pleural effusion was reported as 3.3 per 100,000 children, 8.5 per 100,000 children in Spain, and 13 per 100,000 in France.[4] It is also described that, in 50-68% of cases, pleural effusion occurs due to complications of pneumonia.[5] A local study from Peshawar revealed pneumonia as a common (60.9%) cause of pleural effusion, whereas malignancies (8.5%), and tuberculosis (4.8%) were other most common causes.[6] A study regarding causative agents conducted in Hyderabad showed Staphlococcus aureus as the most common organism, and tuberculosis was a frequent underlying cause of pleural effusion.[7] Another study reported the presence of tuberculosis in 58.9% cases of pleural effusion.[8] It has also been shown that common organisms causing pleural effusions in children are Streptococcus pneumonia, Staphylococcus aureus, and Hemophilus influenzae.[9] This study was aimed to determine the etiology and

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outcomes of pleural effusion in children.

METHODS

This cross-sectional study was conducted at the department of pediatric medicine, National Institute of Child Health, Karachi, Pakistan from June 2022 to October 2023 after obtaining approval from the Institutional Ethical Review Board (IERB No: 6/2021, dated 5-8-2021). Considering the anticipated frequency of tuberculosis as the cause of pleural effusion as 4.8%[6] with 95% confidence level and 5.5% margin of error, the minimum sample size was turned out to be 59 using OpenEpi software.

For this study, we analyzed 60 admitted children of either gender, aged 1-12 years, and having pleural effusion. Children who had undergone prior pleural procedures or interventions were excluded. Children who left against medical advice were also not included. Pleural effusion was labeled on the basis of clinical and radiological examinations of the chest. Informed and written consents were acquired from parents or guardians, ensuring them the privacy of the data. Relevant laboratory and radiological studies including complete blood count, complete urinalysis, ultrasonography, chest X-ray, sputum for acid fast bacilli (AFB) smear, and gene x-pert. Pleural tap was done and fluid was sent to institutional laboratory for biochemical analysis, microbiological testing, and cytology testing to rule out infections.

The "Statistical Package for Social Sciences" (SPSS) version 26.0 software was used for data analysis, summarizing quantitative data in mean and standard deviation and qualitative data in percentages or proportions. The chi-square test compared outcome variables with gender, causes, and effusion types, with a p-value <0.05.

RESULTS

In a total of 60 children, 34 (56.7%) were male. The mean age was 5.4±3.5 years. Cough and fever were the most reported symptoms among the patients, with 18 (30.0%) having a cough, and 17 (28.3%) having fever. The sputum test was positive in 7 (11.7%) of children. The cause of pleural effusion in 44 (73.3%) of patients was pneumonia, 12 (20.0%) tuberculosis, and 4 (5.7%) had congestive heart failure (CHF). Table-I is showing clinical and diagnostic characteristics of children with pleural effusion.

Variables	Frequency	Percentage
Gender		
Male	34	56.7
Female	26	43.3
Symptoms		
Cough	18	30.0
Fever	17	28.3
Dyspnea	14	23.3
Chills	11	18.3
Sputum		
Positive	7	11.7
Negative	51	85.0
Not done	2	3.3
Cause of disease		
Tuberculosis	12	20.0
Pneumonia	44	73.3
Congestive Heart Failure	4	6.7
Organism		
Streptococcus pneumonia	15	25.0
Staphylococcus auras	6	10.0
Klebsiela pneumonia	4	6.7
MRSA	1	1.7
Other	33	55.0
Outcome		
Diagnostic Tap	9	15.0
Therapeutic Tap	47	78.3
Death	2	3.3
Thoracostomy	2	3.3

Table-I. Clinical and diagnostic characteristics of children (n=60)

Symptoms indicated no statistically significant association with the causes of pleural effusion ($p=0.427$). A significant association was observed between the cause of pleural effusion and sputum AFB positivity ($p<0.001$). The cause of pleural effusion showed a significant association with the detection of genetic material using Gene Expert ($p<0.001$). No statistically significant association was found between the causes of pleural effusion and specific types of organisms causing the effusion ($p=0.830$). A highly significant association was observed between the cause of pleural effusion and the type of effusion ($p<0.001$).

	Tuberculosis (n=12)	Pneumonia (n=44)	Congestive Heart Failure (n=4)	P-Value
Symptoms				
Cough	3 (25.0%)	14 (31.8%)	1 (25.0%)	0.427
Fever	6 (50.0%)	10 (22.7%)	1 (25.0%)	
Chills	2 (16.7%)	9 (20.5%)	-	
Dyspnea	1 (8.3%)	11 (25.0%)	2 (50.0%)	
Sputum Acid Fast Bacilli				
Positive	7 (58.3%)	-	-	<0.001
Negative	5 (41.7%)	42 (95.5%)	4 (100%)	
Not done	-	2 (4.5%)	-	
Gene Expert				
Detected	9 (75.0%)	-	1 (25.0%)	<0.001
Not detected	3 (25.0%)	44 (100%)	3 (75.0%)	
Organisms				
Streptococcus pneumonia	2 (16.7%)	12 (27.9%)	1 (25.0%)	0.830
Staphylococcus aureus	1 (8.3%)	5 (11.6%)	-	
Klebsiella pneumoniae	-	4 (9.3%)	-	
MRSA	-	1 (2.3%)	-	
Others	9 (75.0%)	21 (48.8%)	3 (75.0%)	
Type of Effusion				
Exudate	12 (100%)	42 (95.5%)	1 (25.0%)	<0.001
Transudate	-	2 (4.5%)	3 (75.0%)	
Outcome				
Diagnostic Aspiration	-	7 (15.9%)	2 (50.0%)	0.196
Therapeutic aspiration	10 (83.3%)	35 (79.5%)	2 (50.0%)	
Thoracostomy	1(8.3%)	1 (2.3%)	-	
Death	1 (8.3%)	1 (2.3%)	-	

Table-II. Association of causes of pleural effusion with clinical, diagnostic characteristics and outcome (N=60)

Outcomes indicated no statistically significant association with the causes of pleural effusion (p=0.196). Association between cause of pleural effusion and other important clinical, diagnostic and outcome are shown in Table-II.

DISCUSSION

Pleural effusion is a prevalent clinical manifestation observed in both emerging and developed nations in adults and children.[1,2] In untreated cases of pleural effusion, major consequences from empyema are usually anticipated.

In this study, the prevalence of pleural effusion was relatively higher in males (56.7%) than in females (43.3%), which correlated with a study by Abubakar et al.[10] The function of the X chromosome in the creation of immunoglobulin, which is important for combating infections, is a possible explanation for the male prevalence of pleural effusion.[11] Since TB and pneumonia are the two main causes of pleural effusions, males are more susceptible to pleural effusions than females because they have one X chromosome, but females have two X chromosomes, which provides more protection against infections.[6,12,13] Age duration in this study accounted for cases between 4 and 9, with a median age of presentation of 5 years, consistent with prior studies.[6]

In high-income countries, the cause of pleural effusion is mostly malignancy, while infection is the leading cause in low- and middle-income countries.[11] Among infections, pneumonia is the leading cause of pleural effusion in the pediatric age group, accounting for 50-70% of the cases in previous literature and these findings are consistent with what we noted as 73.3% of pleural effusion cases were apparently due pneumonia.[10,11] Pleural effusion caused

by pulmonary tuberculosis is common among children and was reported as 4.9%[6] in another study compared to us where we had 20% cases of pleural effusion due to tuberculosis. High proportion of tb cases in pleural effusion could be credited to the fact that Pakistan already has a higher prevalence rate of tuberculosis. Consistent with earlier studies, the most frequent clinical symptoms included cough, dyspnea, fever, respiratory distress, desaturation, stony dull percussion tone, and tachycardia.[6,10,12,13] According to earlier research, the majority of cases had right-sided pleural effusion. This could be because the right bronchus is more vertically oriented, has a larger diameter, and is shorter than the left bronchus.[13] As a result, aspirated particles and microorganisms are more likely to enter it or its branches. In contrast, the findings of Nabila et al revealed that left-sided pleural effusions were more prevalent.[11]

The majority of patients (78.3%) received therapeutic aspiration of pleural fluid in combination with anti-tuberculous therapy (20.0%), heart failure medication (6.7%), and antibiotics (33.3%) as a type of therapy. The most frequent presentations in all cases needing the therapeutic aspiration required to be performed were late presentation and significant pleural effusion impairing respiratory function and requiring immediate symptom alleviation. These findings emphasize that therapeutic aspiration is a major cornerstone of therapy for pediatric pleural effusion.[14,15] This outcome aligns with previous researches since thoracocentesis, pleurodesis, and chemotherapy were used to treat the tiny percentage (6.1%) of malignant causes of pleural effusion, while 1.6% needed chest tube placement for continuous drainage. On the other hand, antibiotic therapy alone was the most common kind of therapeutic intervention.[11,13] Two patients died during management; one was diagnosed with tuberculosis and the other with pneumonia.

Relatively small sample size and single center study setting reduce the generalizability of this study. We were unable to record details about the antimicrobial treatment options. Further studies should be planned to record the impact of causes of pleural effusion and related long-term outcomes.

CONCLUSION

The etiology of pediatric pleural effusion is diverse, with pulmonary infections playing a major role in developing the condition. Preventing the condition, detecting it early, diagnosing it promptly, and managing it as part of an interdisciplinary team will lower the morbidity and mortality rate.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	Mashal Khan	Concept and design, Critical revisions, Proof reading.