

Exploring the Etiology and Clinical Impact of Pleural Effusion in Pediatric Patients: A Cross-Sectional Analysis

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A B S T R A C T

Background: The accumulation of unusual fluids within the pleural cavity is known as a pleural effusion. Pleural effusions can be classified as either transudative or exudative.

Objective: The aim of the study was to explore the Etiology and Clinical Impact of Pleural Effusion in Pediatric Patients.

Methodology: This cross-sectional study was carried out at the Department of Pulmonology and Paediatric Medicine, Qazi Hussain Ahmad Medical complex, Nowshera from February 2019 to January 2020 after taking approval from the ethical committee of the institute. A total of 80 children aged less than 15 years old were included. All children underwent testing to determine the reasons of their pleural effusion. All the data was analyzed statistically.

Results: A total of 80 children with pleural effusion were enrolled in this study. Out of them 50 (62.5%) were male and 30 (37.5%) were female. Cough was the most frequent symptom observed in these children. Heart failure was the most frequent reason for transudative pleural effusion. Out 47 children had done tube thoracotomies out of 49 cases of parapneumonic effusion, and in 35 of those cases, streptokinase was given. Of all 35 cases, 23 had satisfied response in regards to lung expansion and pleural fluid drainage, while 11 still had non-expanding lungs and a localized pleural effusion; as a result, the patients were sent to a thoracic surgeon underwent decortications.

Conclusion: The most frequent reason for pleural effusion among children is parapneumonic effusion. Children responded well to intrapleural SK, which prevents many patients from undergoing surgery.

Keywords: Etiology; Pleural Effusion; Outcomes

Introduction

The accumulation of unusual fluids within the pleural cavity is known as a pleural effusion. Pleural effusions can be classified as either transudative or exudative. Exudative pleural effusion is caused by pleural inflammatory processes, whereas transudative pleural effusion is triggered by an imbalance between vascular hydrostatic and oncotic pressure.^{1, 2} Pleural effusion in paediatrics is an abnormality that often results from the accumulation of fluids in the pleural space, which can be the primary cause of the fluid buildup or secondary to a number of illnesses, including infections. This collected fluid may have resulted from inadequate absorption or from over-filtration. Mild effusions often have no symptoms, but they can have serious side effects such as septicemia, pneumothorax, pleural thickening, broncho-pleural fistula, and respiratory failure from excessive fluid buildup.

The incidence of inflammatory pleural effusion in children is 8.5 per 100,000.³ According to epidemiological research, the yearly incidence of pleural effusion ranges from around 30 to 115 per 100,000 persons, and longitudinal studies show that the annual incidence of pleural effusion increases over time. Around 300,000 fatalities are attributed to pleural effusion, making it one of the leading causes of cardiovascular disease-related mortality. PE mortality has declined recently due to advancements in pleural effusion therapy, including systemic thrombolysis and anticoagulation, although diagnosis and treatment still pose difficulties.⁴⁻⁷

Streptococcus pneumoniae is the most frequent bacteria that causes parapneumonic effusion, subsequently followed by *staph aureus* and *H. influenzae*.⁸ the characteristics of underlying illnesses and the carefully planned treatment strategy directly affect the prognosis of pleural effusion in infants. In this sense, many viral and mycoplasmal pleural effusions disappear spontaneously, although infection-based effusions may be effectively treated with the right anti-infection drugs. Severe consequences of empyema are typically anticipated in unmanaged cases of pleural effusion, particularly in young children. However, mortality as well as morbidity could be significantly decreased by draining the fluid as soon as possible. Furthermore, different treatment regimens have been shown to have different effects on children's prognoses for pleural effusion. For example, studies have shown that children administered antibiotics and chest tubes had a greater mortality rate compared to children handled with fibrinolytic therapy and video-assisted thoracoscopic surgery. Since underlying lung diseases in children are uncommon, treatment outcomes are invariably favorable. Although the frequency of pleural effusion in children is high, the death rate is low.⁹⁻¹² treatment depends upon the underlying cause. In case of

significant pleural infection, chest tube is inserted in the pleural cavity and repeated taps (thoracentesis) are not recommended. When treating patients with loculated parapneumonic effusion or empyema with pleural thickening, intrapleural fibrinolytic therapy has been recommended. The success rate varies between 80–90 %¹³⁻¹⁶ with a reduction in hospital stays and death rates.¹⁷ Open decortication in more complex situations and video aided thoracoscopic surgery (VATS) are further possibilities in cases that intra-pleural fibrinolytic treatment fails.¹⁸ The purpose of this study was to find out the Causes and outcome of pleural effusion in children.

Objective

The aim of the study was to explore the Etiology and Clinical Impact of Pleural Effusion in children.

Methodology

This cross-sectional study was carried out at the Department of Pediatrics Medicine, Qazi Hussain Ahmad Medical Complex, Nowshera from February 2019 to January 2020 after taking approval from the ethical committee of the institute. A total of 80 children aged less than 15 years old were included. Patients had pleural taps, and the pleural fluid was submitted for biochemical analysis to see if it was transudative or exudative. Pleural fluid was also sent for microbiological and cytological examination where, tuberculosis, other infection or malignancy was suspected. Pleural biopsy was also taken when required, pleural biopsies were also performed. Urine D/R, urea, creatinine, and baseline hematology were evaluated. Additional investigations which were performed included CT scan of chest, echocardiography, renal ultrasound, sputum for acid fast bacilli (AFB) for TB, AFB culture for TB, sputum & pleural fluid culture and sensitivity, lymph node excisional biopsy and fine needle aspiration cytology (FNAC) and 24 hours urinary proteins. The sputum sample was collected in a sterile tube early in the morning. PSS version 20 was used for recording and analyzing the data. For variables like gender, symptoms, causes and outcomes were presented as frequency and percentage while mean and standard deviation was determined for age.

Results

A total of 80 children pleural admitted at the pulmonology ward were enrolled in this study. Out of them 50(62.5%) were male and 30 (37.5%) were female. Their ages were from two to fifteen years old. Figure 1 displays the distribution of ages. Cough (82.5%) was the commonest symptom observed in these children, subsequently

Table 1. Exudative and Transudative Pleural Effusion causes among study cases

Variables	Factors	N (%)
Exudative Pleural Effusion (n=66)	Pneumonia	49 (61.25%)
	Malignancy	7 (8.75%)
	Undiagnosed	6 (7.5%)
	Tuberculosis	4 (5%)
Transudative Pleural Effusion (n=14)	Congestive Cardiac Failure	12 (15%)
	Renal Disease	1 (1.25%)

followed by pyrexia (71.1%), dyspnea (62.5%), chest pain (52.2%), loss of appetite (25.5%), and weight loss (17.2%) as displayed in figure 2. Total cases of pleural effusion were 80 in which the percentage of female were higher (62.5%) as compared to male (37.5%). Out of the total participants the frequency of exudative pleural effusion was 66 (82.5%) and transudative was 14 (17.5%).

The most common cause of pleural effusion explored was Pneumonia 49 (61.25%) (Table 1). Among the 49 cases of parapneumonic effusion the 10 individuals were excluded due to the missing of pleural fluid. So a total of 39 samples of pleural fluid were sent for culture and sensitivity (C/S). Culture and sensitivity pattern is shown in Table 2. Based on outcomes, out of 49 cases of parapneumonic effusion, 47 children underwent tube thoracotomy and streptokinase (SK) was administered in 35 cases. Among these 35 cases, 23 showed good response in terms of pleural fluid drainage and lung expansion while in 11 cases there was still localized pleural effusion with pleural thickening and non-expanding lung; so they were referred to thoracic surgeon for decortications. Six cases turn out to be

malignant, in which 4 were referred to oncology department for further management and one patient with malignancy expired during hospital stay while one left the hospital against the medical advice. In transudative effusion, 12 cases were having cardiac problems and one was having renal diseases which was referred to the concerned specialties for further care. Intravenous antibiotic treatment was the most often used therapeutic approach. The antibiotic sensitivity pattern is given in table 2.

Discussion

For both adults and children, pleural effusion constitutes a frequent clinical manifestation in both developed and underdeveloped countries. A common disorder in pediatrics is pleural effusion, which is caused by fluid accumulation within the pleural space. Children's pleural effusion outcome is directly influenced by the characteristics of underlying diseases and the mode of therapy. In this sense, antimicrobial medicines can be

Table 2. Culture and Sensitivity Pattern of study cases (n=39)

Microorganism	N (%)
Growth not seen	31 (79.4)
Methicillin resistant S.aureus	5 (12.8)
S. pneumoniae	2 (5.1)
K. pneumoniae	1 (2.5)
Total	39

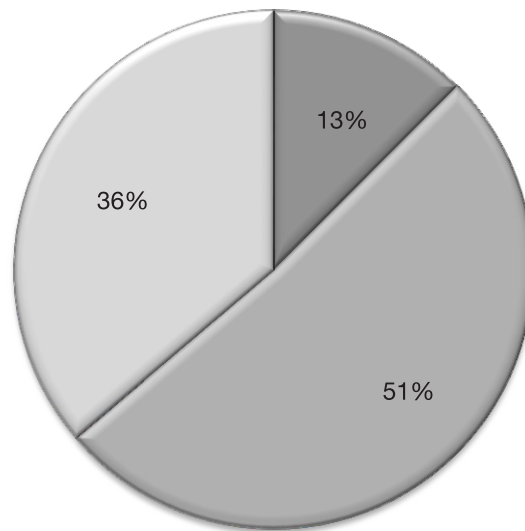


Figure 1. Age distribution of study cases

used to effectively treat infection-based effusion. The majority of viral effusions often go away on their own. In general, major problems from empyema will develop in situations involving pleural effusion that remain untreated. According to earlier research, cough, fever, and dyspnea were the most prevalent symptoms seen in our investigation.¹⁹ In advanced countries, the most prevalent reason of a pleural effusion is malignancy, but in poor or destitute countries the main cause is infection.^{20,21} The

current study evaluated that the main cause of pleural effusion is pneumonia (61.5%). But according to the data published it accounts for 50 to 70 percent.²² Pleural effusion is more common in male and in children as to female in our study. In accordance with our study, another study also reported male predominance.²³ This study confirmed that male children are more likely than girls to have pleural effusion. When culture sensitivity tests were performed about 79% Children with parapneumonic

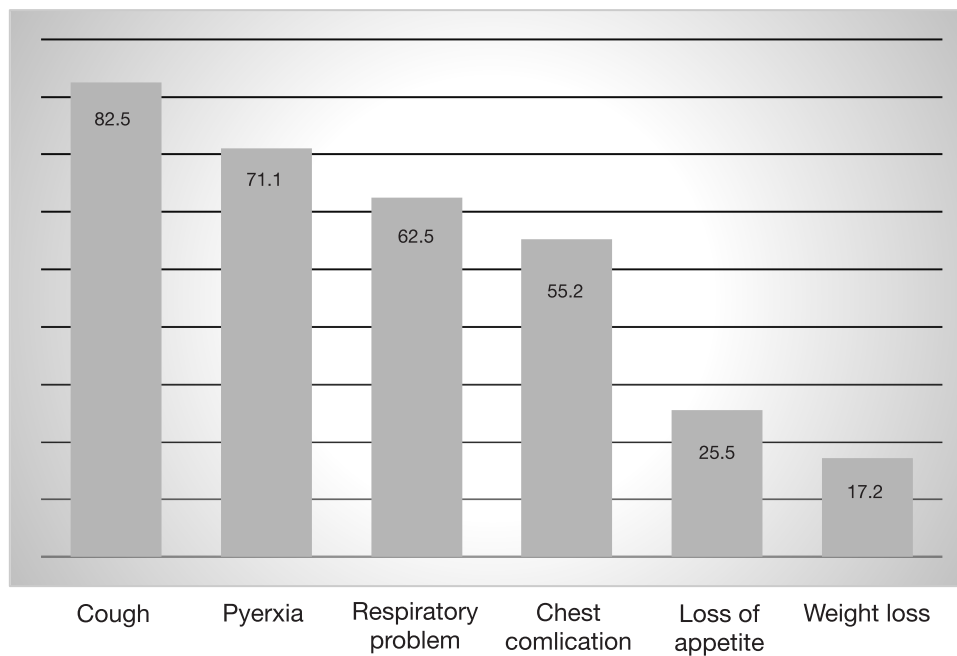


Figure 2. Symptoms of Pleural Effusion of the participants

effusion showed no growth. This may be due to the use of antibiotics. Tuberculous pleural effusion is common in adults, while pulmonary tuberculosis is the main manifestation of the disease in children.²⁴ The current study explored that incidence of tuberculous pleural effusion is about 5% in children these findings are similar with previous studies.²⁵ The most frequent therapeutic measure carried out in our study was intravenous antibiotic therapy. In our research, more children received tube thoracotomy (58%) than in the previous study carried out by Bose et al,²⁶ which involved just 50% of the children. The reason for this is that in our study, a greater number of children experienced complex and difficult parapneumonic effusions. Empyema thoraces if not treated properly it may progress to complication like thick pleural peel over the lung not allowing the lung to expand, broncho-pleural fistula, septicemia and dissection through the chest wall. Treatment options are chest tube insertion with or without fibrinolytics like instillation of intrapleural streptokinase, VATS and decortication. Options for treatment include the insertion of a chest tube with or without fibrinolytics, such as VATS, decortication, and intrapleural streptokinase. Intrapleural fibrinolytics not only shortens the length of hospital stay but also lessens the necessity for decortication and VATS, according to a meta-analysis of ten studies.²⁷ The effectiveness rate of intrapleural fibrinolytic treatment ranged from 72 to 96 percent, according to Eigen et al.²⁸ In the current study the success rate of intrapleural SK was 65%. This may be due to the advanced and late phase of empyema cases in our study in which the success rate decreases. No major complications were observed during tube thoracostomy or intrapleural SK administration. Two prospective randomized trials compared thoracoscopic decortication to the tube thoracostomy with fibrinolysis for empyema in children.^{29,30}

Conclusion

The most frequent reason for pleural effusion among children is parapneumonic effusion. Children responded well to intrapleural SK, which prevents many patients from undergoing surgery.

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