

## Evaluation and Outcomes of Pediatric Pleural Effusions in Over 10 Years in Northwest, Iran

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### Abstract

#### **Background:**

Pleural effusion is the accumulation of excess fluid in the pleural cavity. Most information available about pleural effusion is obtained from studies on adults and little evidence is available in children. Therefore, it is necessary to identify the existing status and explain the disease process, signs, treatment, and prognosis.

#### **Materials and Methods:**

In this descriptive research, children with pleural effusion who were admitted and undergone thoracentesis in the children's university hospital during the last ten years were studied. The data obtained from *in vitro* experiments and the information questionnaire was analyzed using SPSS<sub>18</sub> through descriptive statistics of frequency, percent, and mean.

#### **Results:**

Ninety-four children with pleural effusion were admitted during 10 years. Pleural effusion was exudate in 56.38% and transudate in 43.61% of children. The most common symptoms were tachypnea, fever, and cough. Antibiotic administration was the most performed therapeutic action.

#### **Conclusion:**

The mode of addressing pleural effusion in this research was similar to other studies. Considering the results, better planning can be performed regarding preventing this disease or improving its prognosis.

**Key words:** Effusions, Northwest- Iran, Pediatrics, Pleural.

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## Introduction

Pleural effusion is the accumulation of excess fluid in the pleural cavity, which results in disturbance of the equilibrium between vascular hydrostatic and oncotic pressures (1,2). The underlying causes of pleural effusion include pleural inflammation or infection, congestive heart failure, lymphatic drainage blockage and malignancy (3,4). In fact, pleural effusion is associated with inflammatory process in lungs and manifests as alerting signs of pain, dyspnea, and the signs of respiratory failure due to compression of the lungs (5-7).

Other signs include tachypnea, decreased percussion, and decreased respiratory sounds. Pleural effusion arisen from a known pneumonia is called parapneumonic effusion (8-11). The most common cause of pleural effusion in children is parapneumonic effusion or purulent empyema (12-16). The incidence of parapneumonic effusion is 3.3 in hundred thousand children per year (17).

Although the prevalence of pleural effusion is high in children, its mortality rate is low (18-20). According to the studies performed in the United States, parapneumonic effusion is known as the most common underlying cause of pleural effusion in 50% to 70% of the cases (21). Congenital heart diseases include 5-15% of the causes and malignancies are the rare reasons of effusion (22).

In general, effusions may be transudate or exudate and examination of the pleural fluid is necessary to differentiate them (23). Exudate is confirmed by the presence of at least one of the following criteria; pleural effusion concentration higher than half of the serum protein level, pleural effusion protein level more than 3 g/dL, pleural effusion lactate dehydrogenase higher than 200 U, pH lower than 7.2, and glucose lower than 40 (24,25). Pleural effusion is treated according to the underlying causes. Small transudate

effusion are not usually discharged, however, drainage or surgical debridement are necessary for purulent cases and large effusions (26). Most small to medium parapneumonic effusions can be treated with intravenous antibiotics (27). In a 17-year study in Denmark, 50% of children were undergone drainage with chest tube (28). Some other studies treated effusion through intrapleural injection of fibrinolytic agents and according to research, the duration of hospitalization in intensive care unit and the duration of treatment with chest tube was lower in children receiving fibrinolytic agents (29).

However, many challenges exist regarding the therapeutic measures of pleural effusion. In addition, most information about pleural effusion is obtained from studies on adults and little evidence is available in children (30). On the other hand, since the disease is different in adults, its findings cannot be extended to children (31). Furthermore, most studies regarding pleural effusion were carried out in countries other than Iran, where studies about the disease and other related information are very limited. Therefore, it seems necessary to carry out a study to identify the existing status and to explain the disease's process, signs, treatment, and prognosis and to perform the required actions. Children with pleural effusion who were admitted to the children's university hospital during the last ten years were investigated.

## Materials and Methods

In this descriptive research, children with pleural effusion who were admitted and undergone thoracentesis in the Children's University Hospital in Tabriz-Iran, during (Jan 2004 to Jan 2014), were studied. Laboratory experiments performed on pleural fluid included pleural fluid culture, Gram staining, cytological examination, and protein and lactate dehydrogenase measurement and cell count, as well as

peripheral blood test. A questionnaire containing child's age, the presence of underlying disease, signs of pleural effusion, and the performed treatments was also filled. Data were analyzed using SPSS<sub>18</sub> through descriptive statistics of frequency, percent, and mean.

## Results

Ninety-four children with pleural effusion were admitted during 10 years. The mean age of the children was  $57.9 \pm 0.584$  months. Pleural fluid examination in terms of exudate and transudate (protein and lactate dehydrogenase measurement and cell count) showed that pleural effusion was exudate in 56.38% (53 persons), and transudate in 43.61% (41 persons) of the children. The results of pleural effusion revealed that 14.98% (14 cases) of the specimens were infected with bacteria and one case with fungus. Peripheral blood test showed a leukocytosis or leucopenia in 62% and an ESR higher than 30 in 58.69% of children. The most frequent underlying diseases in children with pleural effusion were cardiovascular diseases and malignancies. The clinical signs of the children and the performed treatment were depicted separately in (Tables 1,2), respectively. Five children (5.3%) expired due to pleural effusion.

**Table1:** Frequency of symptoms in children with pleural effusion in Tabriz Children Hospital

Symptoms	percentage%	Frequency
Tachypnea	60.63	57
Fever	53.19	50
Cough	40.42	38
Abdominal pain	19.14	18
Chest pain	19.14	18
Vomiting	18.08	17

**Table2:** Treatments were performed in children with pleural effusion in Tabriz Children Hospital

Treatments	Percentage%	Number
Treatment with antibiotics alone	39.36	37
Antibiotic treatment with chest tube placement	35.10	33
Surgical Treatment	25.53	24
Total	100	94

## Discussion

In this study, children with pleural effusion admitted to Children's University Hospital in Tabriz-Iran, during 10 years were evaluated in terms of the disease signs, the performed treatments, the presence of underlying disease, and prognosis. Ninety-four children with a diagnosis of pleural effusion were admitted during 10 years to the Children's Hospital as the sub-specialty referral center in the north-west of Iran. A research performed in the Children's Hospital of Hacettepe University in Ankara showed that 492 children with pleural effusion were hospitalized during 29 years; an average of 160 cases for every 10 years (32). This number indicates a higher rate of effusion in the hospital in Ankara in comparison to the results of our study. Although this difference can be attributed to the difference in the number of patients referred to these hospitals (32).

In Denmark, Puchwald *et al.* studied 100 children with parapneumonic effusion during 17 years (33). According to the results of this study, the number of exudative pleural effusion was higher than transudate. However, the rate of microorganisms in the cultures of pleural effusion was not high. In the study of the Children's Hospital of Hacettepe University in Ankara, the number of

exudative pleural effusion was also higher than transudate (32). The results of a research in Spain in 2008 on 63 children with pleural effusion showed that 33% of the children had exudative pleural effusion. These results are somehow consistent with the results of the present study, however, it should be noted that all children in this study had pneumonia as the underlying disease (34).

In our research, parapneumonic effusion was the most common cause of effusion and the highest underlying diseases of effusion were cardiovascular diseases and then malignancies; while in the study of Hacettepe Hospital, cardiovascular diseases and malignancies were not the most common underlying causes, and malignancies (3.9%) were higher than cardiovascular diseases (1.4%).

The most common symptoms in children were tachypnea, fever, and cough. A review article in 2012 studied the outcomes of the American Pediatric Surgical Association about diagnosis and control of pleural effusion (35). In that review, the results of the most common signs of pleural effusion in different studies were fever, tachypnea, and increased oxygen demand. In the study of Hacettepe Hospital, the most common signs of effusion were fever, cough, and dyspnea (32). The results of these studies are in agreement with ours.

According to the results, in terms of the performed therapeutic actions, antibiotic therapy was the most frequent measure carried out. Surgery accounted for a lower percent of the treatment compared to antibiotic therapy and drainage. In the study of Puchwald *et al.*, 50% of children were undergone drainage of pleural effusion (33); this is higher than the percent of drainage in our study. A research in Greece evaluated the evidence present in literature and reported the use of antibiotic therapy, drainage, and surgery in

different studies (36). They did not recommend surgery as the first action prior to antibiotic therapy and drainage.

### **Conclusion:**

This research demonstrated some how the status of pleural effusion and its incidence during the last 10 years, as well as the therapeutic action, in the only referral hospital of the North-west of Iran. According to the results of most studies, parapneumonic effusion is the most common cause of effusion in children. Therefore, focusing on the infectious causes of effusion is of great importance. Hence, evaluation of the microorganisms involved in perfusion can be considered as future etiologic studies.

In general, it can be concluded that the mode of addressing pleural effusion in this research was similar to evidence in scientific databases. According to this research, better planning can be performed regarding prevention or shortening of the disease course.

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