

Evaluation of predisposing factors, etiology, and clinical manifestations of childhood empyema thoracis at a tertiary care center of Odisha

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ABSTRACT

Background: Empyema thoracis (ET) is a life-threatening disease often encountered in pediatric patients. In spite of all modern sophistication of medical sciences, this disease is chargeable for a high proportion of hospital admission and continues to require an important tool against them. **Objective:** The objective of this study is to evaluate the age-sex profile, predisposing factors, etiology, seasonal variation, and clinical manifestations of ET in children. **Methods:** A cross-sectional study was conducted in the department of pediatrics in Western Odisha. A total of 80 children, aged 0–14 years and diagnosed as ET, were enrolled in the study. After inclusion, a detailed history including demographical data, clinical examinations, and thorough investigations (hematological, biochemical, and radiological) was done as per pro forma prepared for the study. Pleural fluid was collected by thoracocentesis and examined for cultural sensitivity. **Results:** Most of the cases belonged to the age group of 0–5 years (60%), and male-female ratio was 3:2. Of 80, 50 (72.5%) patients were malnourished. The most common symptoms in all patients were fever (100%) and cough (90%). Intercostal tenderness (100%) was the most common clinical sign. *Staphylococcus aureus* (60%) was the predominant causative organism. **Conclusions:** The prognosis of childhood empyema depends on the age, nutritional status of the child, and bacterial agent causing empyema. Earlier diagnosis and adequate treatment of potential predisposing factors favor the good prognosis.

Key words: *Empyema, Pleural effusion, Pneumonia, Pyopneumothorax, Subdiaphragmatic infections*

Empyema thoracis (ET) is defined as the collection of pus in the pleural cavity [1]. It is a life-threatening disease frequently encountered in pediatric patients. Over 2000 years ago, Hippocrates was the first to diagnose this disease by drainage of the pleural cavity [2]. It is most commonly caused due to staphylococci and less commonly due to *Haemophilus influenzae*. It may occasionally develop as a result of trauma, rupture of lung abscess, or a complication of primary tuberculosis (TB).

ET in children is usually caused secondary to bacterial pneumonia. The peak incidence of pneumonia in childhood is in those under 5 years of age, and a rise in pneumonia is responsible for a major proportion of hospital admission in children [3]. About 0.6% of pneumonia leads to the development of empyema thoracis [4,5]. In the recent antimicrobial era, the incidence of this disease is still increasing in both developed and developing countries and is a real burden to the society. Day by day, the high morbidity and mortality rate among children are increasing due to empyema. The cause of this may be due to poverty, negligence, malnutrition, or multidrug resistance [6-8]. Hence, the present study was carried out to evaluate the age-sex profile, etiology, clinical features, and predisposing factors of ET in a tertiary care center of Western Odisha.

MATERIALS AND METHODS

A cross-sectional study was conducted in the department of pediatrics of a tertiary care center in Western Odisha region from January 2017 to December 2017. The study was approved by the Institutional Ethical Committee. Informed written consent was obtained from parents of all subjects before enrolment in the study. A convenient sample size of 80 was taken. Children aged 0–14 years, diagnosed as ET, and admitted in the pediatrics department during the study period were included. Patients having a history of congenital pulmonary or cardiac diseases, post-surgical, and post-traumatic cases of empyema were excluded from the study.

After inclusion, a detailed history including demographical data, clinical examinations, and thorough investigations (hematological, biochemical, and radiological) was done as per pro forma prepared for the study. Pleural fluid was collected by thoracocentesis and examined for cultural sensitivity.

Data were analyzed using the SPSS software version 24.0 (Statistical Package for the Social Sciences, IBM Inc., New York). Results were expressed in terms of mean, standard deviations, and percentage.

RESULTS

In the present study, we found that most of the cases were below the age of 5 years (48) and a majority of them were males (60%) child as shown in Table 1. We also observed that various grades of malnutrition were found in most of the patients, i.e., 27.5% (22) Grade-I, 40% (32) Grade-II, 2.5% (2) Grade-III, 2.5% (2) Grade-IV, and 27.5% (22) patients were normal.

Various signs and symptoms of the disease present in children were fever, cough, breathlessness, and chest pain as shown in Table 2. Fever (100%) followed by a cough (90%) and breathlessness (60%) were the most common symptoms present in children, whereas intercostal tenderness (100%) followed by tachypnea (87.5%) and diminished chest movement (82.5%) were the most common signs.

In this study, the radiological findings reported were pyopneumothorax (65%, n=56), loculated empyema (17.5%, n=10), consolidation (10%, n=8), and pleural thickening (7.5%, n=6). We also observed that right-sided pleura was involved in 55% (n=44) of cases, left-sided pleura was involved in 42.5% (n=34) of cases, and 2.5% (n=2) cases showed bilateral pleural involvement. Fig. 1 shows the X-ray findings of right lower lobe involvement. These findings were again confirmed by doing ultrasonography and computed tomography (CT) of the chest, and pleural thickening was assessed.

While doing microbiological analysis, the culture sensitivity pattern of pleural pus showed that 60% of subjects were affected by *Staphylococcus aureus*, 27.5% by Streptococcus, 7.5% by *Klebsiella pneumoniae*, 2.5% by *H. influenza*, and 2.5% by *Mycobacterium tuberculosis* as shown in Table 3. In this study,

S. aureus was the predominant organism responsible for ET. Most of the cases (46%) appeared in the second quarter (April–June) of the year 2017.

DISCUSSION

The name “Empyema” comes from the Greek word empyein meaning pus producing (suppurate). In pediatrics population, ET most frequently occurs secondary to bacterial pneumonia and less commonly from pneumococci or *H. influenza*. It may occasionally develop as a result of trauma, rupture of lung abscess, or a complication of primary pulmonary TB. Other predisposing factors are poverty, immune deficiency which may be due to inadequate vaccination, poor oral hygiene, and aspiration syndrome.

In this study, most of the ET patients were below the age of 5 years. This result was in accordance with the study of Geha *et al.* [9]. A study done in 2016 by Dalavi *et al.* reported that 52.5% of empyema patients were below 5 years of age [10]. We also observed that majority of patients were males (48 male children of 80 cases). Another study conducted by Saleem *et al.* in 2014 also reported that males outnumbered the females in the development of this disease [11].

Another most important finding of this study was that the maximum number of patients was suffering from malnutrition. In a study by Goyal *et al.*, similar findings were observed, but they also found anemia along with malnutrition in all cases [12]. Magnet *et al.* reported that the majority of cases suffering from this disease belonged to low socioeconomic status [13]. Since malnutrition and socioeconomic status have got definite a relation to pulmonary infection, more number of children suffering from this disease were either malnourished or of low socioeconomic status as proved in these studies.

The most common clinical symptoms found in our study were fever (100%), cough (90%), and intercostal tenderness (100%) as a most common sign. A similar result of the presence of fever, cough, and breathlessness in all patients was reported in a previous study by Dalavi *et al.* [10]. We found right-sided chest involvement in 55% of cases. A study was done by Stephen and Kilman also reported similar results [14]. These studies proved that lung infections are common in the right side than the left side.

While doing a microbiological analysis of pleural pus, we observed that *S. aureus* was the most common causative organism; the second most common was streptococcus. Worldwide, several studies have been reported stating the association of these two organisms in the development of ET in children [5,15,16]. A previous study conducted by Dalavi *et al.* also observed similar results in their study [10].

In this study, an attempt was made to document some important predisposing factors and clinical features of empyema in children. However, we had not considered the treatment modalities and outcome of this disease which would be of utility. Moreover, the sample size was small, so further studies on larger sample size is essential for better results.

Table 1: Age and sex distribution of the study participants (n=80)

Age (years)	Sex (%)	
	Males	Females
0–5	32.5 (n=26)	27 (n=22)
5–10	17.5 (n=14)	12.5 (n=10)
10–14	10 (n=8)	0

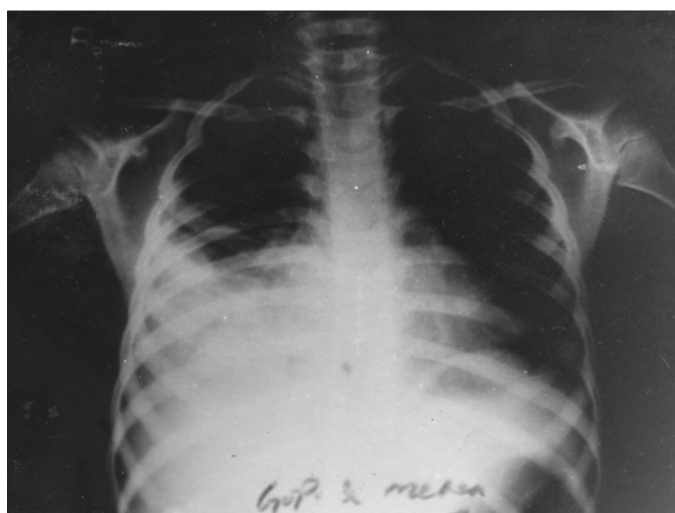


Figure 1: X-ray of right lower lobe of the lung in empyema

Table 2: Clinical symptoms and signs of empyema

Symptoms	n (%)	Signs	n (%)
Fever	80 (100)	Intercostal tenderness	80 (100)
Cough	72 (90)	Tachypnea	70 (87.5)
Breathlessness	52 (65)	Diminished chest movement	66 (82.5)
Chest pain	32 (40)	Mediastinal shift	60 (75)
Pain abdomen	12 (15)	Cyanosis	4 (5)
Abdominal distension	2 (2.5)		
Vomiting	2 (2.5)		
Excessive crying	2 (2.5)		
Loss of appetite	2 (2.5)		
Swelling of leg and face	2 (2.5)		
Pain in limbs	2 (2.5)		

Table 3: Culture and sensitivity pattern of pleural pus in empyema patients

Causative organisms	(n) %
<i>S. aureus</i>	(n=48) 60
Streptococcus	(n=22) 27.5
<i>K. pneumoniae</i>	(n=6) 7.5
<i>H. influenzae</i>	(n=2) 2.5
M. TB	(n=2) 2.5

S. aureus: Staphylococcus aureus, K. pneumoniae: Klebsiella pneumoniae, H. influenzae: Haemophilus influenzae, TB: Tuberculosis

CONCLUSION

On the basis of the results of this study, it can be concluded that empyema in children depends on the age, nutritional status, and causative bacteriological agents. Any child presenting with the respiratory problem should be examined thoroughly for the presence of empyema, especially in cases of pneumonia. Prevention of potential predisposing factors and early diagnosis favors good prognosis for empyema.

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