

EMPYEMA THORACIS IN CHILDREN: A CLINICAL STUDYNarendra Laishram¹, Daizy Ngangom²¹Assistant Professor, Department of Paediatrics, JN Institute of Medical Sciences.²Senior Resident, Department of Paediatrics, JN Institute of Medical Sciences.**ABSTRACT****BACKGROUND**

Empyema thoracis is a disease that despite centuries of study still causes significant morbidity and mortality.

AIMS

To study the age-sex profile, clinical presentation, etiologic agents, management and the overall treatment outcome of empyema thoracis in children.

METHODOLOGY

A total of 25 patients of both the sexes aged 0-12 years diagnosed to have empyema thoracis and who underwent tube thoracostomy from March 2013 to February 2014 were studied. Detailed clinical history, physical examination, relevant routine and specific investigation were done. The pleural fluid was studied for gram staining, microscopy, cytology, pleural fluid culture and antibiotic sensitive pattern. All the patients were treated with tube thoracostomy and antibiotic therapy depending on the culture and sensitivity pattern. Complications were recorded.

RESULTS

Majority of patients (0.64%) were seen in age group of 1-5 years. Fever (96%), breathlessness (92%), and cough (72%) were the commonest presenting features. Bacteriological examination revealed staphylococcus aureus as the commonest etiologic agent (20%) isolated from pleural fluid culture. Pyopneumothorax (16%) was the commonest complication seen in these patients. All patients (92%) were treated with antibiotics, and drainage of the empyema was effected by closed thoracostomy in (92%) of the cases. There was no mortality.

CONCLUSION

Empyema is not rare in our practice. Early diagnosis and proper treatment of pneumonia prevent the development of empyema. Antibiotics and tube thoracostomy is an effective method of treating pyogenic empyema thoracis in children in resource poor settings.

KEYWORDS

Tube Thoracostomy, Empyema Thoracis, Parapneumonic Effusion.

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INTRODUCTION

Hippocrates in 600 B.C. defined empyema thoracis as a collection of pus in the pleural cavity and advocated open drainage as its treatment.⁽¹⁾ Empyema thoracis, a common condition in childhood,^(2,3) and has significant morbidity and mortality. Empyema thoracis constitutes approximately 5-10% of cases seen by pediatrician in India.^(4,5)

Acute respiratory infections are the most common illness of childhood accounting 50% of all illness in under-fives and 30% in the 5-12 years age groups, largely involving the upper respiratory. However, about 5% involve the lower respiratory tract resulting in serious diseases, especially the bacterial pneumonia.⁽⁶⁾ Forty percent of bacterial pneumonia are said to be complicated by parapneumonic effusions, 10% of whom would evolve into empyema.⁽⁷⁾ Possible reason for this include delay in initiating treatment, prolonged oral treatment in the community with antibiotics inadequate drug level in the pleural space and delayed presentation, or unusual casual organism.⁽⁸⁾

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It is a significant cause of pediatric hospital admissions and morbidity especially in developing countries where hospital resources are scarce.^(9,10,11)

The proper management of empyema thoracis in children continues to be a source of debate. It continues to have a high mortality rate 10-16%.⁽¹²⁾ Pleural effusion and empyema are known complications of bacterial pneumonia. Effusion occur in at least 40% of bacterial pneumonia with up to 60% of effusions resulting in the formation of empyema in all age groups.^(13,14) The American Thoracic Society has described three stages of empyema namely exudative, fibrinopurulent and organized.⁽¹⁵⁾ It is postulated that most appropriate therapy depends on stage of disease at presentation.

Staphylococcus aureus is the most common cause of in the developing world, while streptococcus pneumonia in the developed world.^(16,17,18) The reported rates of identifying an infectious cause from pleural fluid vary from between 8% and 16% respectively. Pleural fluid is sterile due to widespread early use of antibiotics.^(19,20)

The aim of therapy is to ensure rapid recovery with a normal long-term pulmonary outcome. Medical therapy includes use of antibiotics and chest tube drainage. More recently, early intervention in the form of Video-Assisted Thoracoscopic Surgery (VATS) has been reported.

MATERIAL AND METHODS

This was a prospective observational study, conducted in the Department of Pediatrics, JNIMS, Imphal, from March 2013 to Feb 2014. The study was approved by the Institute’s Ethical Committee and written informed consent was obtained from all patients. All children in age group of 0 to 12 years diagnosed pyogenic empyema during the study period were included in the present study. Children with empyema secondary to post-surgical cause or post traumatic cause were excluded from the study.

The diagnostic criteria for empyema thoracis was presence of pleural effusion, clinical and radiological examination and aspiration of pus from the thoracic cavity. A detailed history was taken regarding complaints, predisposing factors, immunization and communications. Detailed general and systemic examination done. Routine and relevant specific examinations were done. These include hemoglobin estimation, total leukocyte count, ESR, HIV. All patients suspected of pleural effusion clinically were subjected to chest X-ray, USG and (If required) CT thorax. Other investigations includes pleural tap fluid was studied for gram staining, microscopy cytology biochemical analysis including protein estimation, pleural culture and antibiotic sensitivity pattern. A chest radiograph (PA or AP) and a lateral view if indicated were done after chest tube insertion. Intercostal drainage with tube thoracostomy was performed in all patients.

All patients received supportive treatment and were empirically administered ceftriaxone, cloxacillin and amikacin as first line antibiotics in appropriate doses. Subsequent management including choice and duration of antibiotics was determined by clinical progress of the patients and availability of pus culture and sensitivity results. Change of antibiotic was considered in case of clinical non-improvement after 5 days of initial antibiotic therapy and effective drainage and in the absence of a positive culture report, the second line antibiotic used were piperacillin-tazobactam and vancomycin. Clinical non-improvement was defined as persistence of sepsis indicated by fever spikes, poor oral intake and rising TLC. Antibiotics were given for 4 weeks or longer (If required): a minimum of 2 weeks of injectable antibiotics or till 1 week after disappearance of fever, whichever was later.

The patient requiring prolonged hospitalization and who did not respond to conventional antibiotics and tube thoracostomy or developing complications or those not showing radiological signs of lung expansion were referred to the pediatric surgeon for thoracoscopic decortications or VATS. All patients were studied for complications during hospital stay.

At each follow-up, patients were assessed clinically and subjected to chest radiography.

Age Group (Years)	Number of Cases	Percentage
0-1	3	0.12
1-5	16	0.64
6-12	6	0.24

Table 1: Age distribution of the 25 Empyema Cases

SEX DISTRIBUTION

Sex	Number of Cases	Percentage
Male	17	68
Female	8	32

UNDERLYING PREDISPOSING RISK FACTORS FOR EMPYEMA THORACIS

	Number of Cases	Percentage
1. Measles	2	8
2. Bronchopneumonia	5	20
3. Impetigo and other skin lesion	3	12
4. Tuberculosis	2	8
Total	12	48

Nutritional Status

Grade of Malnutrition	Number of Malnutrition	Percentage
1. No Malnutrition	5	20
2. PEM I	3	12
3. PEM II	10	40
4. PEM III	6	24
5. PEM IV	1	4
Total	25	100

Manifestations	Number of Cases	Percentage
1. Fever	24	96
2. Breathlessness	23	92
3. Cough	18	72
4. Chest Pain	8	32
5. Anorexia, Malaise, weight loss	12	48

Table 2: Presenting symptoms in patients with Empyema Thoracis

BACTERIOLOGICAL PROFILE/PUS CULTURE RESULTS

Organism	Number	Percentage
1. No growth	16	64
2. Staphylococcus aureus	5	20
3. Streptococcus pneumoniae	2	8
4. Klebsiella pneumoniae	1	4
5. Pseudomonas	1	4

Complications

Complications	Number	Percentage
1. Pyopneumothorax	4	16
2. Pneumothorax	2	8
3. Subcutaneous emphysema	1	4

Response to various modalities of treatment.

Procedure	No. of Cases	Percentage
Antibiotic + Tube thoracostomy	23	92
Decortications	1	4
VATS	1	4

Outcome of Emphysema Thoracis in study children (N=25)

Duration (d)	Number	Percentage (%)
Chest Tube		
<8 d	8	24
8-30 d	15	60
>30 d	1	4
Hospital Stay		
<14 d	17	68
14-30 d	6	24
>30 d	2	4

RESULTS

The general characteristic of these patients of empyema thoracis are shown in Table 1. A total of 25 patients were included in the study, male 17 (68%), female 8 (32%). Majority of cases of empyema occurred in the age group 1-5 years comprising (0.64%) of cases and male outnumbers female. Thus the male-to-female ratio was 2.1:1. Seven patients (28%) were residents of urban areas and 18 patients (72%) belonged to rural areas and most of them belonged to low socioeconomic strata. Certain predisposing factors are studied like measles, bronchopneumonia and skin lesions. Bronchopneumonia (20%) was found to be the commonest predisposing factor.

Nutritional status was assessed as per Indian Academy of Pediatrics (IAP) classification of malnutrition. Majority of patients were of grade II (40%), followed by grade III and grade IV i.e. 24% and 4% respectively. The results of study of empyema thoracis were shown in Table II. The commonest symptoms at presentation were fever (96%), breathlessness (92%), cough (72%) followed by chest pain (32%). In addition constitutional symptoms viz anorexia, malaise and weight loss were noted in 12 patients (48%).

Pleural fluid culture were positive in 9 (36%) patients. Five patients (20%) had gram positive cocci in clusters in gram stain, but a negative culture. The most frequently isolated micro-organism was staphylococcus aureus 5 (20%). Other micro-organisms were streptococcus pneumoniae (8%), pseudomonas (4%), Klebsiella pneumoniae (4%). Pleural fluid cultures were sterile in 64% of patients.

The commonest complication associated in these patients was pyopneumothorax (16%) as shown in Fig 2. The associated complications after start of treatment were improper position (12%), thickened pleura (4%), pyopneumothorax (4%). Eighteen (72%) patients received antibiotics (Oral plus parenteral) for 4 weeks and seven (28%) received for a period greater than 6 weeks. A chest X-ray was obtained after insertion of chest tube to confirm the position of the chest tube. The chest tube was removed when there was no drain or minimal drain <20mL/day for two consecutive days with a patent tube. Overall, of 25 patients 23 (92%) cases managed with tube thoracostomy. One case managed with decortication and another case with VATS (Video assisted thoracoscopic surgery). In outcome, all patients survived (100%).

DISCUSSION

Though the incidence of empyema thoracis has declined in the west due to effective use of broad spectrum antibiotics, but it still remains a significant health problem in developing countries due to low socioeconomic status, malnutrition and delay in diagnosis of pneumonia, delayed referral to higher centre.

Therapy for thoracic empyema requires appropriate antibiotics, prompt drainage of the infected pleural space and lung expansion. However there is no clear consensus on the best way to obtain these objectives. (21,22,23)

The age of presentation and male preponderance was consistent with similar other studies. (17,24,25) The higher prevalence in under-fives (0.64%) and the slight male preponderance (2.1:1) is in general agreement with the established pattern of acute lower respiratory infections in children. (6)

Out of many predisposing factors studied, bronchopneumonia found to be the most commonest as in other studies done. (26,27) In our study, 80% of the children were malnourished as per IAP classification. (28) Fever, breathlessness and cough were the most common (90%) manifestations found at admission similar to many other studies. (29,24,25) Other associated manifestations were anorexia, malaise and weight loss.

A higher incidence of empyema cases were seen more often in malnourished children as seen in this study, similar to other studies conducted in developing countries. (30,31,32,33) Predisposition of malnourished children to recurrent, severe and complicated infection is a known factor.

In our study, pleural fluid culture showed bacterial growth in 36% of patients and no growth in 64% of patients. (24) The present study culture reports were similar to other reports. Most common organism isolated was staphylococcus aureus which is comparable to previous studies from other developing countries. (29,24,25,34,35) Other causes are streptococcus pneumoniae, pseudomonas and Klebsiella pneumoniae. The sterile sample might be due to high rate of antibiotics pre-treatment or lack of better facilities for culturing fastidious organism like anaerobes. Pneumococcus is the major pathogen in developed countries. (17,18)

White blood cell count of parapneumonic effusions is known to be a non-reliable parameter in the diagnosis of patients with empyema. (7) Similar findings were observed in four of our patients (16%) who had pleural WBC count <10,000/mm³ in the presence of positive results on bacteriologic studies. This emphasizes the need for microbiologic examination of suspected pleural fluid even though cell counts are low.

The median duration of hospital stay was comparable to other studies on conservative management. (36,37,38) In the present study, all patients responded to conservative management and one patient required decortication and one requiring VATS. Previous studies suggest a success rate of 61-100% with chest tube drainage and antibiotics. (39,40) These treatment outcome were similar to other studies. (21,29)

A meta-analysis comparing operative and non-operative procedures has also concluded that conservative management leads to recovery in more than 76% of the patients. Average duration of antibiotics used in this study was longer than the previously reported studies from developed countries. (37,38) The reason for this could be a higher incidence of staphylococcal infection in our study that required a longer duration of therapy as compared to streptococcal and H. influenza infection. The choice of antibiotics was governed by the culture and sensitivity pattern prevalent in that particular region. The complications on admission were studied, pyopneumothorax was the commonest associated complication with empyema followed by pneumothorax. In the treated patients of empyema thoracis, thickened pleura were the commonest complications. There was no case fatality rate in this study. This outcome is similar to other studies done where 100% is the survival. (41) Recovery and long-term outcome is good with appropriate treatment. However, in the present study complete pleural recovery could not be documented due to shorter period of followup and was a major limitation. Spirometry could not be done for a majority of the patients because of a younger age and was a limitation.

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