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Original Research Article

Analysis of the Clinical Bacteriological Profile and Treatment Strategies for Empyema Thoracis in Children

Nikki Kumari[1], Punita Kumari[2], Bhupendra Narain[3], Amresh Kumar Jha[4]

[1]Senior Resident, Neonatology, PMCH, Patna
[2]Medical Officer, (NICU) Department of Pediatrics, PMCH, Patna
[3]Professor & Head, Department of Pediatrics, PMCH, Patna
[4]Professor & Head, Neonatology, PMCH, Patna

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Corresponding Author: Dr. Punita Kumari
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Abstract:

Background: Childhood empyema is an important complication of bacterial pneumonia. The incidence of empyema is increasing worldwide. Despite being recognized since the ancient times, the appropriate management of paediatric empyema thoracis remains controversial.

Objectives: To study the clinical, bacteriological profile and various therapeutic options in childhood empyema thoracis in a tertiary care hospital.

Methods: The present descriptive study was done at Patna Medical College and Hospital Patna. Study duration of One years. 40 patients were included in the age group of 1 month to 15 years with the diagnosis of empyema. All the patients were analyzed for the clinical course of the disease, radiological investigations, pleural fluid biochemical and microbiological parameters, and various treatment options. Short term follow up was done for complications and sequelae.

Conclusion: Management of primary empyema continues to be controversial in terms of duration of antibiotic therapy and the indications for and timing of surgery. There should be a changing trend towards VATS with the emphasis laid on minimizing the duration of hospital stay to bring down expenditure, psychological stress and more importantly nosocomial infections due to multidrug resistant organisms.

Keywords: Empyema, Children, Parapneumonic effusion, Pneumonia.

Introduction

The clinical condition of empyema, by contrast, has been recognized since antiquity. [1] Empyema thoracis is still a common entity in developing countries along with high incidence of pneumonia because of multiple factors.[2] Empyemas are a significant cause of morbidity but, fortunately, not mortality in children and at times can be a therapeutic challenge. Part of the problem has been the lack of evidence from paediatric trials, and it is inappropriate simply to extrapolate adult data to children. There are differences between adult and paediatric pleural infections. The principal one is that, since it is rare for children to have an underlying lung disease, the final outcome is almost always excellent. Furthermore, adult empyema carries a 20% mortality rate which is related to comorbidity (for example, malignancy, immunodeficiency, prolonged hospital stay and nosocomially acquired infection). [3] Incidence of empyema was 0.8% of total pediatric admissions. [2] Effusions occur in atleast 40% of bacterial pneumonias, with upto 60% of effusions resulting in the formation of empyema in all age groups. Recent studies have noted an increase in the incidence of empyemas in children. [4] In developed countries, the microbial profile has changed over the past five decades4 with increasing incidence of penicillin resistant streptococcus pneumonia[5] and methicillin resistant staphylococcus.[6] However, the scenario is very different in Optimal management in children is controversial, especially the duration of parenteral antibiotics and the role of surgery.[3] Current treatment of empyema in children is highly variable due to in part both provider experiences and a wide spectrum of clinical presentations. [7] Newer therapies such as fibrinolysis [3] and Video Assisted Thoracoscopic Surgery [8] have made the issue even more complex. With this scenario in mind, we decided to conduct this study in our epidemiological setup to define the clinical course, bacteriological profile, radiological features, various modalities of treatment and their outcome.

Objectives

To study the clinical profile of children with empyema in a tertiary hospital.

To study the bacteriological profile in empyema cases.

To evaluate various therapeutic options in empyema cases.

Material and Methods

The present descriptive clinical evaluation study was done at Patna medical college and Hospital Patna, Bihar. Study duration of One years. 40 children in the age group of 1 month to 15 years who were admitted with the diagnosis of empyema were included in the study.

Inclusion Criteria

Children in the age group of 1 month to 15 years with the diagnosis of empyema with the following criteria were included in the study.

1) Frank pus on thoracocentesis
2) If pleural fluid is non-purulent, a positive gram stain or a positive culture.

Diagnosis was based on history, clinical examination, supported further by the evidence of chest x-ray, ultrasonography, computed tomography scan (wherever feasible) and diagnostic thoracocentesis.

Exclusion Criteria

1) Transudative causes of pleural effusion
2) Post surgical empyema
3) Post-traumatic empyema
4) Immunodeficiency states

40 suspected cases of empyema after admission had a detailed history taking as per the proforma, with emphasis on duration of symptoms, previous medication, contact history of tuberculosis and course of illness before admission. Patients were examined thoroughly for vital signs, nutritional status and respiratory signs of empyema thoracis. Suspected cases were confirmed after chest x-ray and ultrasonography. In all clinically suspected cases diagnostic thoracocentesis was performed under local anesthesia with 2% xylocaine using sterile disposable syringe (needle size- 18 G), which was introduced through 5th intercostal space in mid axillary line or area of maximal dullness, appearance of pus clinches the diagnosis. About 5 ml of pus was drawn in each case and sent for cytology, biochemistry for pH, LDH, glucose, protein, microbiology for gram stain, AFB stain and culture sensitivity.m Routine investigations like Hemoglobin, total and differential count, ESR were done in all cases. Mantoux was done in suspected cases of tuberculosis. Those in severe distress underwent immediate ICD and those who were not were evaluated by USG and managed accordingly. Those diagnosed to have non loculated empyema on USG underwent ICD. Intercostal drainage procedure was done with all aseptic precautions with prior consent taken from parents. ICD tube sizes were selected based on the age of the child and viscosity of the fluid and inserted in 5th intercostal space in mid axillary line, outer end of the tube was connected to an under water seal kept in sterile condition. Initially intravenous antibiotics like Amoxicillin-clavulanic acid started in the dose of 100 mg/kg/day in three divided doses and Amikacin in the dose of15-20 mg/kg/day in two divided doses were started. If any suspected staphylococcal pneumonia, vancomycin was given as an infusion in the dose of 40 mg/kg/day in four divided doses. Appropriate antibiotics were added according to culture sensitivity reports.

All the patients with persistent clinical symptoms, incomplete lung expansion on ICD and antibiotics, multiple loculations and thick pleural peel seen on ultrasonography at admission or developed during the course of hospital stay were subjected to surgical line of management.

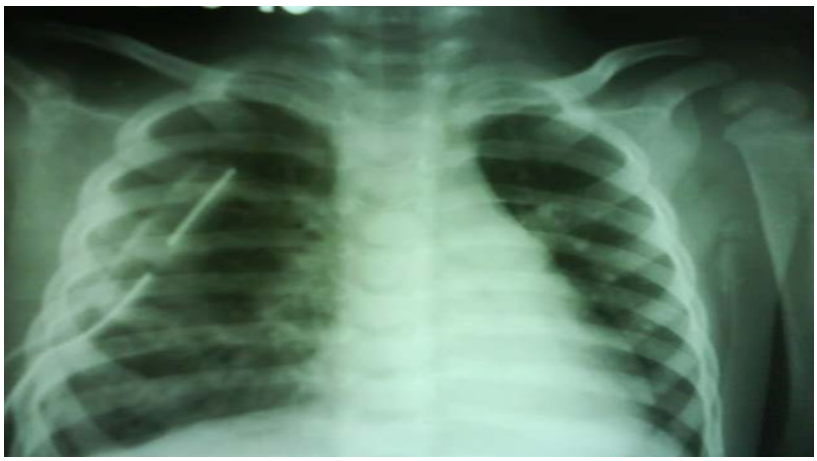

Figure 1: Chest radiograph showing resolving empyema with intercostal tube in situ on the right side

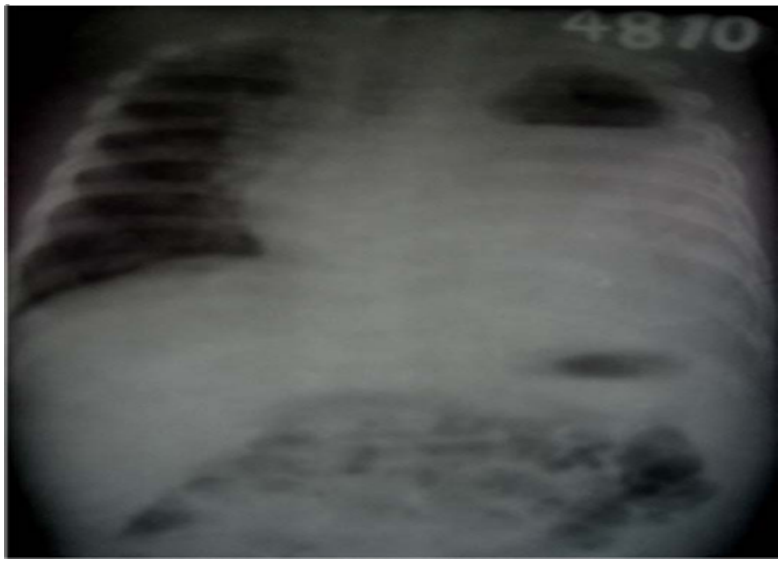

Figure 2: Plain radiograph chest and abdomen showing Hydropneumothorax on the left side

Results

Table 5: Age distribution of empyema in children (n=40)

Age in years	Number of patients	%
<1 year	7	17.5
1-4 years	17	42.5
5-9 years	11	27.5
10 & above years	5	12.5
Total	40	100.0

17/40 (42.5%) of affected patients were between 1 to 4 years. 7 (17.5%) cases were seen in infancy. Youngest child was 5 months old and the oldest was 15 years old.

Table 6: Gender distribution (n=40)

Gender	Number of cases	%
Male	24	60.0
Female	16	40.0
Total	40	100.0

Table 3: Socio-economic status (modified Kuppuswamy's classification)

Socioeconomic status	Number of cases	%
Upper class	0	-
Upper Middle class	3	7.5
Lower Middle class	6	15
Upper Lower class	6	15
Lower class	25	62.5
Total	40	100

31/40 (77.5%) belonged to lower socio-economic status. None of them belonged to upper class.

Table 4: Effects of previous treatment on bacteriology

Treatment	Total No. of patients	Percentage	Culture positive		Culture negative	
			No.	%	No.	%
Taken	37	92.5	9	100	28	90.3
Not taken	3	7.5	-	-	3	9.6
Total	40	100	9	100	31	100

In culture positive group, all patients received antibiotics prior to admission. In the culture negative group 3/31 (9.6%) did not receive any antibiotics prior to admission. However, blood culture yielded streptococcus pneumoniae growth in one case who had not received antibiotics.

Table 5: Treatment modalities in empyema

Treatment	Number of patients (n=40)	%	95%CI
TSD	19	47.5	32.94-62.50
TT	9	22.5	12.32-37.50
TT+TSD	3	7.5	2.58-19.86
TCD	9	22.5	12.32-37.50

12/40 (30%) were managed with ICD and antibiotics though 3/12(7.5%) required secondary TSD. Amount of pus drained the first few days ranged from 50 ml to 1000 ml, minimum duration noted for lung expansion was 7 days and maximum 12 days. 19/40 (47.5%) underwent Thoracoscopic debridement. 9/40 (22.5%) required thoracotomy and decortication of which 2 of them had lung abscess.

Table 6: Incidence of complications in childhood empyema

Complications	Number of patients (n=40)	%	95%CI
No complications	35	87.5	73.89-94.54
Complications	5	12.5	5.46-26.11
Lung abscess	2	5.0	1.38-16.50
Pyopneumothorax	2	5.0	1.38-16.50
Expired	1	2.5	0.4-12.88

2/40 (5%) had lung abscess for which they underwent decortication with drainage, 2/40 (5%) had pyopneumothorax in which one had grown klebsiella sps. One succumbed to death due to severe sepsis.

Table 7: Follow-up

OUTCOME	Number of patients (n=39)	%	95%CI
Good Lung Expansion	35	89.7	73.89-94.54
Pleural thickening	3	7.7	2.58-19.88
Collapse	1	2.6	0.4-12.88

35/39 (89.7%) had good lung expansion on follow-up. 3/39(7.7%) had minimal pleural thickening. One had persistent collapse who improved further on physiotherapy. Pulmonary function tests were done in 2 of the decorticated patients which showed normal lung function.

Discussion

Lower respiratory tract infections (LRTI's) are a leading cause of morbidity and mortality in children throughout the world. In developing countries poverty, HIV infection and lack of universal access to new vaccines contribute to the high incidence of severe and complicated pneumonia. Parapneumonic effusion and empyema most frequently occur as a complication of bacterial pneumonia. Due to poor facilities for culture, delay in seeking medical opinion and indiscriminate use of antibiotics, it is very difficult to isolate microorganisms in Indian conditions. There are no universally accepted guidelines for management of empyema thoracis. It is another issue of controversy with multiple options and the literature assists little in establishing the ideal treatment. We had 40 children with empyema treated in this department over twenty months with the aim of studying the clinical course of the disease, bacteriological profile and various treatment options. In the present study, 17(42.5%) patients were between 1 to 4 years and 7(17.5%) were infants. Gerald et al and Baranwal AK et al reported similar incidence. Langley et al M [9] however found 3 to 5 years to be the commonly affected group. The higher incidence in children aged 1 to 4 years can be partly explained due to the increased susceptibility to staphylococcal and steptococcal pneumonia, which are the common cause of empyema.

In the present study 23(57.5%) of them presented in the months of October to march accounting for majority occurring in the winter and early spring. Only 5(12.5%) presented in the months of April to June. Few earlier studies have reported most cases in winter and early spring, probably due to the increased spread of infections due to overcrowding, ill ventilation, chilling breeze and soaking rain.

Socioeconomic status

Karmarkar et al [10] in 1978 and Mangete et al in 1993 reported that all their study group belonged to low socioeconomic group. [11] In the present study 31(77.5%) belonged to low socioeconomic status. Poverty, overcrowding, delay in seeking medical care due to negligence are few of the common explanations. [12]

Clinical features

The classical picture of a child with empyema used to be that of a very sick, breathless child, running high fever and looking toxic presenting late in fibrinopurulent stage.

The present clinical picture in contrast, revealed that 25(62.5%) were not in frank respiratory distress at the time of presentation. The former clinical picture was seen in only 5(12.5%) of the cases. The

commonest symptoms were fever in 40 (100%), cough in 40(100%) and hurried respiration in 29(72.5%) of the patients, chest pain in 12(30%) and pain abdomen in 2(5%) of the cases.

Table 8: Comparison of mortality

Hailu et al (2000)[11]	Baranwal et al (2003)[12]	Ulku et al (2004)[11]	Present study (2008-2010)
15%	1.6%	1.28%	2.5%

Follow-up

All 39 patients were followed up after the discharge at 1 and 3 months. All of them were evaluated clinically and radiographically. Most of the patients 35/39(89.7%) were asymptomatic and had good lung expansion. 3/39(7.7%) were clinically normal but revealed pleural thickening. 1/39(2.6%) had persistent collapse. All the decorticated patients had normal lung functions.

A study done by Baranwal et al (2003) reported on follow up that, all children were doing well. None had clinically significant restrictive disease.

All over the world, these days there is an emphasis on minimising the length of the hospital stay. Early intervention is being recommended strongly in view of this. Prolonged hospitalisation taxes the patient in the form of increased expenditure, psychological trauma and stress, and may even invite multidrug resistant nosocomial infections.

Conclusion

Empyema continues to be prevalent in our country particularly in the lower socioeconomic strata due to the delay in seeking medical care, inappropriate antibiotics and dosages and duration of antibiotic treatment. Indiscriminate use of antibiotics might have increased the overgrowth of multiresistant organisms, there on leading to chronicity and morbidity of empyema.

Empyema fluid is diagnostic for pathogens if appropriate handling and early cultures but in the present scenario with prior antibiotic treatment, the fluid is sterile most of the times. Pleural fluid biochemical parameters would also vary depending on the stage of empyema, severity and previous antibiotic therapy.

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