Asian Journal of Clinical Pediatrics and Neonatology Original Article

Empyema Thoracis in Children: Experience from a tertiary care hospital in Pune, India

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Abstract

Background: Empyema thoracis in children has remained a therapeutic problem despite advances in treatment modalities in developing countries. Objective: To study demographic and clinical profile, laboratory characteristics, causative organisms, treatment modalities, complications and outcome of children admitted with empyema thoracis. Materials and Methods: A cross sectional study was conducted over three years from February 2007 to February 2010 in a tertiary care hospital. The study group included patients of 0-12 years age group hospitalised with diagnosis of empyema thoracis. Demographic details and clinical profile was analysed retrospectively from hospital records. Results: 60 patients in the age group of 0-12 years were included in the study. Among total cases, (50%) were infants and children up to 3 years of age. Incidence was more in summer 42 (70%) than in monsoon and winter. Fifty three percent children were undernourished. Fever, cough, and breathlessness were the commonest symptoms (96.66%, 83.33% and 73.33% respectively). Gram stain showed organisms in 50% cases while culture was positive in 58.33% cases. In this study, pyogenic aetiology was seen in 95% cases while tubercular in 5%. Staphylococcus aureus was the most common organism found on pleural fluid gram stain and culture. Fifteen percent children were treated conservatively, where as 85% required ICD (Inter costal drain) insertion along with antibiotics. Out of these patients requiring ICD, 25% required decortication and 10% required video assisted thoracoscopic surgery (VATS). Pneumothorax was the most common complication 8 (13.33% cases). 15 (25%) children, who required ICD for more than 15 days, had high LDH level above 3000 IU/L. Conclusion: Staphylococcus aureus was the most common organism found on pleural fluid culture.

Keywords: Empyem thoracis, children.

INTRODUCTION

Empyema thoracis is a known complication of bacterial pneumonia in children. Clinically thoracic empyema can be defined as pleural effusion that fulfilled at least one of the following criteria: (1) presence of frank pus on pleural aspiration; (2) presence of organism on pleural fluid culture; (3) positive pleural fluid Gram stain; (4) pleural fluid PH<7.2 and neutrophil>100,000/µL.[1]

Parapneumonic effusions (PPE) develop in about half of the patients hospitalized with pneumonia and their presence cause a four-fold increase in mortality. Empyema thoracis is associated with high mortality ranging between 6% and 24%.[2] Incidence of empyema complicating community-acquired pneumonia is increasing and causes significant childhood morbidity.[3-4] Pneumococcal infection remains the most common isolated organism in developed countries, while staphylococcus aureus is the predominant pathogen in the developing world.[3] Newer molecular techniques utilizing the polymerase chain reaction have led to an increase in identification of causative organisms, previously not isolated by conventional culture techniques. This remains an important tool for epidemiological studies, and may help in guiding correct antibiotic use in the future.[3] However, at community level pleural fluid analysis and culture remains the useful diagnostic tools, especially in resource limited settings.

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Treatment options include antibiotics alone or antibiotics with thoracocentesis, tube thoracostomy, intrapleural fibrinolytics, video assisted thoracoscopic surgery (VATS) and open decortications.[5-7] Only few reports are available describing various aspects of empyema thoracis in Indian children.[1,8-9]. Hence, this study was undertaken to find out the clinical features, aetiology, management and complications of empyema thoracis in children from a tertiary care centre in India.

METHODS AND MATERIALS

A cross sectional study conducted over 3 years from Feb 2007 to Feb 2010 amongst hospitalised children diagnosed as 'empyema thoracis'.[1] The study was approved by the Ethics committee of the hospital and parent's written consent was taken for the same.

Data was entered by a single investigator into the database that consists of information about clinical variables, laboratory findings such as complete blood count, blood culture, gram stain, culture of pleural fluid, PCR (polymerase chain reaction) and ADA (adensoine deaminase) of fluid if done. The radiological studies done were also entered in database which included chest radiograph; ultrasonography and CT (computed tomography) scan if available. All patients were treated as per standard treatment protocol of our hospital as described below.

Treatment protocol

Diagnostic pleural tapping done in all cases. Patient detected in early stages and those having small effusions were managed by antibiotic as per the clinical status at admission plus thoracentesis. The initial choice of antibiotics depends on the. Antibiotics are then modified as per the clinical response and the

results of Gram's stain of pleural fluid and sputum and of the culture and sensitivity. As a rule, antibiotics are continued until (1) the patient is afebrile for 48 hours and the white blood cell count is normal, (2) the tube thoracostomy drainage yields <50 ml of fluid daily at any age, (3) the chest radiograph shows considerable clearing. Typically, antibiotics are required for 3 to 6 weeks. If the patient fails to improve clinically and radiographically within 48 h, ultrasonic or CT examination of the pleural space is performed to detect undrained loculated fluid. In patients with inadequate drainage, the choices were (1) image (CT/ ultrasound) guided placement of additional chest tubes; (2) suction therapy, i.e., the use of negative suction to break loculations; (3) use of intrapleural fibrinolytic agents like streptokinase and urokinase; (4) video-assisted thoracoscopic surgery with breakdown of adhesions; (5) thoracotomy with digital lysis of adhesions and operative placement of chest tubes with or without decortications.[10-12]

Paediatric surgeons and paediatrics pulmonologists were being involved in the management of these children. The final data was analysed using descriptive statistics.

Table I : Demographic Profile of the cases

Variables		No. of cases	% of cases
Gender	Male	32	53.33
	Female	28	46.67
Age (in years)	0-3	30	50
	3-6	18	30
	6-9	6	10
	9-12	6	10
Seasonal prevalence	Monsoon	11	18.33
	Winter	7	11.67
	Summer	42	70
Nutritional status	No PEM	28	46.67
	Grade I	15	25
	Grade II	8	13.33
	Grade III	6	10
	Grade IV	5	5
Presenting complaints/ Symptoms	Fever	58	96.6%
	Dyspnea	44	73.3%
	Chest pain	17	28.3%
	Abdominal pain	7	11.6%
	Diarrhea	6	10%
	Refusal of Feed	13	21.6%
	Cough	50	83.3%

RESULTS

Demographic and clinical profiles of cases are shown in table 1.The highest incidence of empyema (50%) was found in the age group of 0-3 years. The mean age group was 3.5 yr (SD-29.09). Gram stain of the pleural fluid showed organisms in 50% and culture was positive in 58.3% of the cases (table 2). Pleural fluid analysis is shown in table 3. Radiological evaluation was done by single radiologist in all cases. On chest X-ray, pneumonic infiltrates was seen in 54.54% cases, peumatoceles in 3.63%, pneumothorax in 3.63%. Most organisms were sensitive to Penicillin, Cloxacillin, Aminoglycoside and Cephalosporins. Fifteen percent of children required conservative treatment in the form of antibiotics and pleural tapping, whereas 85% required ICD (Inter costal drain) insertion along with antibiotics. Out of these 85% children, 15 (25%) required decortication and 6 (10%) required VATS. Due to controversial role and parental decision, fibrinolytic treatment was not used in any case. Three (5%) children required ICD for 0 – 5 days, 21(35%) children required

Table II: Bacteriological profile of cases

Organisms	On staining	On culture
Staphylococci	14 (23.33%	17 (28.33%)
Streptococci	4 (6.67%)	10 (16.67%)
Pneumococci	2 (3.33%)	2 (3.33%)
Gram negative bacilli	1 (1.67%)	-
Acid fast bacilli (AFB)	3 (5.00%)	-
Mixed infection	1 (1.67%)	
Pseudomonas	-	3 (5.00%)
Klebsiella	-	1 (1.67%)
E- coli	-	1 (1.67%)
Coagulase -ve Staphylococci	-	1 (1.67%)

Table 3: Characteristic feature of pleural fluid

Characteristics		Number of patients (%)
Pleural PH	<6	7 (11.67)
	6-7	42 (70.00)
	7-8	11 (18.33)
Pleural Protein	= 3	11 (18.33)
	3-6	34 (56.67)
	>6	15 (25.00)
Pleural Glucose	= 20	33 (55.00)
	20-40	18 (30.00)
	>40	9 (15.00)

ICD for 5 – 10 days, 12 (20%) children required ICD for 10 – 15 days and 15 (25%) children required ICD for more than 15 days. In all these children requiring ICD for more than 15 days, LDH level was above 3000 IU/L. Pneumothorax was the most common complication in 8 (13.33%) cases followed by pleural thickening in 5 (8.33%), bronchopleural fistula in 2 (3.33%), empyema necessitance in 2 (3.33%) and pericardial effusion in 1 (1.67%) case. Survival rate was 58 (96.67%) and mortality rate was 2 (3%) in the present study. Two children who died in this study were critically sick when referred to us and died due to septic shock; however, complete evaluation of the patients was could not be done due to critical illness. There was no significant correlation between the ICD duration and complications with respect to age of the child or the causative organism

DISCUSSION

High incidence of empyema in infants and children in developing countries could be due to the prevalence of malnutrition, delayed referral and the type and virulence of pathogens. Bacterial pneumonia is the most common cause of pleural effusion in children,[13-14] Out of 60 cases, 53% were males and 47% were females. In the study by Ghosh et al and Beg et al,[15,16] the percentage of male and female was 65.9% and 76.9% respectively. In the study done by Langley et al,[17] 51.4% were males. In present study, highest incidence of empyema was found in the age group of 0-3 years 50%. In Langley et al,[17] those <or= 5 years of age comprised 57% of the cases. Arya et al,[20] encountered only 4 (8%) children below 1 year of age comparable to 7 (11.6%) children in the present study.

Seasonal prevalence was observed in present study. 42 cases (70%) occurred in summer, 11(18.33%) in monsoon and only 7 (11.67%) cases were seen in winter season. Hardie et al,[2] identified 50% incidence in winter season. In this study 53.33% children were undernourished, of which 25% children had grade I malnutrition, 13.33% had grade II malnutrition, 10.0% had grade III malnutrition and 5% had grade IV malnutrition. In study by Padmini et al,[18] 17.7%, 23.2%, 26% were noticed to have grade I, II, and III malnutrition respectively, while study by Ghosh et al,[15] showed 73.2% of malnutrition in their study. In the present study fever, cough and breathlessness were the commonest symptoms as reported by other authors also.[16,18-19] In study by Tasnee et al,[22] pneumonic infiltrates associated with empyema in 52%, pneumatoceles in 10% cases.

In the present study, 28.33% of cases grew staphylococcus, 16.67% streptococcus pneumoniae, 5% pseudomonas and 1.67% Klebsiella. Previous stufies showed Staphylococcus aureus was the most common organism isolated, followed by Streptococcus pneumoniae, Pseudomonas aeruginosa and Klebsiella. In present study there were anaerobic 1 (1.67%) bacteria isolated in children. Brook I and Frazier E H et al,[25] found 13% children with anaerobic and 23% culture shows mix aerobic and anaerobic bacteria. In present study, pyogenic etiology was seen in 95% cases while tubercular in 5%. Chylothorax was not seen in any patient. Padmini et al,[18] found that response to cloxacillin and gentamycin was better than that of crystalline penicillin and gentamycin.

In present study, 15% cases were treated conservatively. Intercostal tube drainage (ICD) was done in 85% cases, 5% required ICD for < 5 days, 35% for 5-10 days, 20% for 10-15days, while 25% required ICD for > 15 days. In Padmini et al [18], ICD was required for less than 14 days in 69.7%, 14-30 days in 25% cases and for more than 30 days in 53% cases respectively. Beg et al,[16] treated 88% cases with ICD. Pothula et al,[26] reported that prolonged and unsuccessful tube drainage is associated with increased morbidity and mortality. Langley et al 75% had chest tube placement.[17] In same study, all tubercular empyema 5% were managed conservatively. Some required surgical treatment 25% children required decortication and 10% children required VATS. Campobasso et al,[27] stated that further work on surgical management of empyema should be considered when the intercostal drainage fails to reduce the fever and respiratory distress within 4-5 days and if there was persistence of loculated pyothorax.

Pothula et al,[26] also recommended early aggressive surgical approach including formal thoracotomy and definitive treatment in patients who do not respond to a short course of ICD.

In the present study, complications were seen in 33.1% case commonest being pneumothorax (in 13.33% cases) followed by thickened pleura and bronchopleural fistula. Arya et al also reported pneumothorax as the commonest complication.[20] In present study, 12% cases required mechanical ventilation with 3% mortality. Mortality rates varied in different studies ranging from 3.5% as reported by Mangete et al,[19] to as high as 19.6% in a study by Arya et al.[20] More prospective randomized case control studies are required to confirm these findings.

CONCLUSION

In the present study it can be concluded with proper use of antibiotic, timely use of ICD in children with empyema like severe resipartory distress and cases not responding to antibiotic had a very good outcome in developing countries.

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