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Original Research Article

Assessment of bacteriological profile and outcome of empyema thoracis in hospitalized children in a tertiary care hospital of Raipur city, Chhattisgarh, India

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ABSTRACT

Background: An empyema is a purulent collection in the pleural space. Empyema Thoracis is a disease that, despite centuries of study, still causes significant morbidity & mortality. It is very commonly seen in children all over the world, more frequently as a complication of pneumonic infections. Pediatric empyema has a much more favorable prognosis compared to adult cases. Empyema thoracic is a common complication of pneumonia. Children of poor socio-economic status and below 3 years of age are most commonly affected.
Methods: The present prospective observational study was conducted in Department of Surgery, Pediatric Surgery unit, Pt. J. N. M. Medical College and Dr. B. R. A. M. Hospital, Raipur (C.G.) during study period July 2011 to October 2012. This study includes 40 study subjects of the patients of empyema who were diagnosed by the aspiration of gross pus from the pleural space. Complete History was taken, and physical examination was performed in all the cases.
Results: The commonest symptoms at presentation were fever seen in 40 patients (100%), cough with expectoration seen in 36 patients (50%-90%) and dyspnea seen in 32 patients (80%). Left pleura was more commonly affected than the right pleura. The most common organism isolated were *Staphylococcus aureus* in 28 patients (70%), followed by *Klebsiella* in 7 patients (17.50%), then *E.coli* in 3 patients (7.5%) & Streptococcal species in 2 patients (5%). The use of antibiotic therapy alone was effective in 25 patients (62.50%) Antibiotic therapy along with tube thoracostomy was required in 15 patients (37.50%). Operative intervention was required in none of the patients. Out of 40 patients, 28 (70%) had complete lung expansion, while 12 (30%) had only partial expansion. Patients with partial expansion mainly comprised of those who presented late in the course of the disease.
Conclusions: It is concluded from the study that early diagnosis and management is critically important in reducing the unfavourable outcome in pediatric espuma thoracis cases.

Keywords: Clinico etiological profile, Empyema Thoracis, Tube thoracostomy

INTRODUCTION

An empyema is a purulent collection in the pleural space. It constitutes an actual abscess and the pleurae formerly thin and glistening are abscess walls, thickened granular and inflamed supporting pyogenic growth.[1] Empyema Thoracis is a disease that, despite centuries of study, still causes significant morbidity and mortality. Approximately 1.2 million people per year are affected by pneumonia in the United States. Empyema Thoracis in

children is very commonly seen all over the world, more frequently as a complication of pneumonic infections. In pediatric patients, thoracis empyema complicates pneumonia 36% to 57% of the time with a range of incidence between 0.4 and 6.0 cases per 1000 pediatric admissions.[2,3]

Pediatric empyema has a much more favorable prognosis compared to adult cases. Several factors have been postulated, one is bacteriology. The bacteriology of pleural infection is complex and has changed over time. Identifying the causative organism(s) is important to guide antimicrobial therapy. A wide range of microbes have been cultured from empyema, and mixed organisms do occur. Relative frequencies of causative microbes vary over time and with geographic locations, source of infection, and among hosts. Upto 40% of empyema fluid failed to reveal any microorganisms by conventional culture, and antibiotics have to be prescribed empirically. Different postulations to explain the low culture rate include antibiotic treatment before sample collection, potential presence of biofilm in the pleura, poor sensitivity of conventional culture techniques in acidic pleural fluid, or pus developing as an excessive immune response after the causative organism(s) has already been eliminated.[4-6]

Empyema thoracic is a common complication of pneumonia. Children of poor socio-economic status and below 3 years of age are most commonly affected. *Staphylococcus aureus* is the most common causative organism. A high index of suspicion helps in diagnosis. X-ray chest and CT scan are most useful modalities for diagnosis and followup. With the above background, the present study was conducted to assess the clinicoetiological profile of pediatric empyema thoracis in hospitalized patients.[6,7]

With the above background the present study was conducted to identify clinico etiological profile of pediatric empyema thoracis cases.

METHODS

The present prospective observational study was conducted in Department Of Surgery, Pediatric Surgery unit, Pt. J. N. M. Medical College and Dr. B. R. A. M. Hospital, Raipur (CG) during study period July 2011 to October 2012.

Inclusion criteria

- Any patients between the ages 0 to 14 years admitted with clinical and radiological evidence of pleural infection were included in the study.

Exclusion criteria

- Patients who refused to be part of the study.
- Known case of Tuberculosis.
- Known immune-compromise and malignancy.

This study includes 40 study subjects of the patients of empyema who were diagnosed by the aspiration of gross pus from the pleural space.

Complete History was taken, and physical examination was performed in all the cases. The data was recorded including age, sex, length of hospital stay, physical findings and history was taken, and physical examination was performed in all the cases. Symptoms at presentation, duration of symptoms, clinical outcome, and potential risk factors for empyema including antibiotic exposure before admission, immunization status, history of recent viral illness, immunodeficiency and chronic illness.

Various blood investigations were done. Chest X-ray was taken on day of admission, after intercostals tube insertion and after ICD removal and at time of discharge and aspiration of pleural fluid was carried out after obtaining a written informed consent.

The pleural fluid samples were collected under aseptic conditions and were processed according to standard procedures including routine cultures and sensitivity test for pyogenic organisms. Where needed, ultrasound thorax or computed tomography (CT) of the thorax was done. A bacteriological study of diagnostics aspirates was done and appropriate antibiotics were started. Antibiotics were changed based on the culture and sensitive reports. Outcome assessment done based on the duration of hospital stay and lung expansion seen in chest radiograph. Data was compiled in MS-Excel.

RESULTS

Youngest patient was of 5 months and oldest was of 12 years. Peak age was in the range of 0 to 1 years. In our study of 40 cases, it was found that 25 patients (62.50%) were male and 15 patients (37.50%) were female (Table 1).

Table 1: Age and sex wise distribution of study subjects.

	No.	%
Age at presentation		
0-1 Years	15	37.50
2-5 Years	12	30
6-10 Years	10	25
11-14 Years	03	7.50
Gender		
Male	25	62.50
Female	15	37.50

35 patients (87.50%) had anemia. 32 patients (80%) were malnourished. 25 patients (62.50%) were having hypoproteinemia. 22 patients (55%) having history of recurrent infection.

The commonest symptoms at presentation were fever seen in 40 patients (100%), cough with expectoration seen in 36 patients (50%-90%) and dyspnea seen in 32 patients (80%). In addition, constitutional symptoms like abdominal pain and weight loss seen in 5 patients (5%-7%) (Table 2).

Table 2: Etiological factors predisposing and clinical presentation empyema thoracis in children.

	No.	%
Etiological Factors		
Pneumonia	18	45
Poor Orodental hygiene	12	30
Anemia	35	87.50
Vitamin A deficiency	15	37.50
Pericardial effusion	5	12.50
Hypoproteinemia	25	62.50
Malnutrition	32	80
H/O Recurrent infection	22	55
Clinical Presentation		
Fever	40	100
Cough	36	90
Expectoration	20	50
Chest pain	14	35
Dyspnoea	32	80
Hemoptysis	0	0
Abdominal pain	2	5
Weight loss	3	7.5
Extra thoracic sepsis	5	12.50
Shock	0	0

Left pleura was more commonly affected than the right pleura. (Table 3).

Table 3: Involvement of side of chest in empyema thoracis.

Side of chest involvement	No	%
Bilateral	7	17.50
Right	11	27.50
Left	22	55

The most common organism isolated were *Staphylococcus aureus* in 28 patients (70%), followed by *Klebsiella* in 7 patients (17.50%), then *E.coli* in 3 patients (7.5%) and Streptococcal species in 2 patients (5%) (Table 4).

Table 4: Micro-organisms identified in pus culture.

Micro-organism	Number	%
Staphylococcus aureus	28	70
Klebsiella	7	17.50
E.coli	3	7.50
Streptococcal species	2	5

The use of antibiotic therapy alone was effective in 25 patients (62.50%) Antibiotic therapy along with tube thoracostomy was required in 15 patients (37.50%). Operative intervention was required in none of the patients (Table 5).

Out of 40 patients, 28 (70%) had complete lung expansion, while 12 (30%) had only partial expansion. Patients with partial expansion mainly comprised of those who presented late in the course of the disease (Table 6).

Table 5: Need for various therapeutic interventions in patients with empyema thoracis.

Therapeutic Interventions	No.	%
Antibiotic therapy	25	62.50%
Antibiotic therapy along with tube thoracostomy	15	37.50%
Operative intervention	0	0%

Table 6: Lung expansion visualized in chest x-ray.

Lung Expansion	No.	%
Complete	28	70
Partial	12	30

Out of 40 patients, 25 patients (62.50%) received antibiotic therapy only, out of which 16 patients (40%) stays in hospital for 20-30 days and 1 patient (2.5%) stays for <10 days. 15 patients (37.50%) in which tube thoracostomy done along with the antibiotic therapy, out of which 8 patients (20%) stays for 20-40 days and 1patient (2.5%) stays for < 10 days (Table 7).

Table 7: Comparison of hospital stay in relation to various modalities of treatment.

Therapy	Total patients who received the therapy	Stay in Hospital (Days)	
		20-40	<10
Antibiotic therapy	25(62.50%)	16(40%)	1(205%)
Antibiotic therapy along with tube thoracostomy	15(37.50%)	8(20%)	1(2.5%)

DISCUSSION

In the present study, we included children between 0 to 14 years of age. Youngest patient aged 5 months and oldest was 12 years old.

Table 8: Comparison of age incidences observed in various studies.

Studies	Age range
EraslanBalci A et al[8]	3 to 14 years
Baranwale et al[9]	1 month to 12 years
Demirhan R et al[10]	18 months to 14 years
Present study	5 months to 12 years

15 patients (37.50%) were between 0 to 1 year of age. In the present study, 25 patients (62.50%) were male and 15 (37.50%) patients were female.

Table 9: Comparison of present study is compared with other studies in sex incidence.

Series	Observation	
	Male	Female
EraslanBalci A et al[8]	68.18%	31.81%
Baranwal AK et al[9]	50%	50%
Demirhan R et al[10]	51.35%	30.63%
Present study	62.50%	37.50%

In the present study of 40 patients, 18 patients (45%) develop it as a complication of pneumonia, 12 patients (30%) were having poor oriental hygiene, 35 (87.50%) patients were anemic, 15 patients (37.50%) were having vitamin A deficiency and 5 patients (12.50%) were having pericardial effusion. 25 patients were having low protein level, 32 patients (80%) were suffering from malnutrition and 22 patients (55%) were having history of recurrent infections.

The commonest symptoms at presentation were fever, seen in all 40 patients (100%), cough in 36 patients (90%), followed by dyspnea, expectoration and chest pain.

Table 10: Comparison of present study is compared with other studies in sex incidence.

Series	Clinical presentation			
	Fever	Cough	Dyspnea	Chest pain
Ashish KG et al[11]	80.6%	90%	60%	-
Ahmet C et al[12]	87%	79%	58%	46%
Demirhan. R et al[10]	87%	79%	58%	46%
Present study	100%	90%	80%	35%

Extra thoracic abscess seen in 5 patients (12.50%). In addition, constitutional symptoms, abdominal pain, weight loss were noted in 5 patients (12.50%). This study, is compared with the Table 10. Out of 40 patients, 22(55%) patients involve left side of chest and 11 patients (27.50%) right side. Bilateral chest involvement seen in 7 patients (17.50%) and is compared with other study.

Table 11: Comparison of the types of chest incidences observed in various studies.

Series	Right side	Left side	Both side
Cekirdekei A et al[12]	26%	70%	4%
Demirhan R et al[10]	64%	36%	0%
Present study	27.50%	55%	17.50%

In one study, X-ray done in all patients, Ultrasonography done in 46 (96%) Abd CT scan in 3 (6%).[13] In the present study X-ray chest done in all (100%) cases. In all the cases of empyema thoracis, there were varying degrees of mediastinal shift to opposite side. Opacity and hazyness were found in maximum cases of empyema indicating collection and pleural thickening.

Table 12: Comparison of the growth of microrganims in pus culture in various studies with the present one.

Series	Micro organisms				
	Staph. Aureus	*Strepto. Species*	*Klebsiella*	*E. coli*	*Sterile*
Gupta AK et al[11]	20%	18.3%	8.3%	21.7%	28.3%
Carey JA et al[14]	-	11.76%	-	-	-
Demirhan R et al[10]	13.52%	32.43%	-	-	50.45%
Hiliard TN[13]	12.5%	8.33%	-	-	70.83%
Present study	70%	5%	17.50%	7.5%	0%

Pus culture was done in all 40 (100%) patients, in which staphylococcus species seen in 28 (70%) cases, *klebsiella* in 7 (17.50%), *E. coli* in 3 (7.5%) and *streptococcus* in 2 (5%) patients and compared with the following series.

One of the study reported a series of 22 children with empyema referred to a pediatric cardiothoracic unit. Those children who had immediate thoracotomy (18 cases) were afebrile and had their chest tube removed by

2 days and fever resolved within 48 hrs. Their mean hospital stay was 4 days.[14] A series of 60 pediatric thoracis empyema cases thoracotomy and decorications revealed a more rapid recovery with a decreased number of chest tube days and decreased length of hospital stay and success rate of 96.6%.

Another series of 748 patients intercostals drain followed by intrapleuralfibrinolytic therapy and 24 (50%) had thoracotomy in which median length of stay (interquartile range) for which initial procedure was 15 days (6-20) for intercostals drain alone, 8 days (6-12 days) for fibrinolytic therapy, and 6.5 days (5-9) for thoracotomy.[11,13]

CONCLUSION

In the current study most common etiological factor related to empyma thoracis were anemia, malnutrition, hypo-proteinemia followed by others and fewer and cough was the most common clinical presentations among empyma thoracis cases. It is concluded from the study that early diagnosis and management is critically important in reducing the high mortality and morbidity in pediatric empyma thoracis cases.

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