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Original Article

Clinical and Etiological Profile, Outcome and Prognostic Factors in Children less than 12 years with Empyema Thoracis Attending an Urban Referral Centre

Authors
Bagavathy Perumal[1], Arul Prasadh[2], Nivothini[3], Pavithra[4], Soorya[5], Shanmugapriya[6]
[1,2]Assistant Professor, Department of Pediatrics, Kanyakumari Government Medical College
[3]Intern, Department of Pediatrics, Kanyakumari Government Medical College
[4,5,6]Intern, Department of Pediatrics, Kanyakumari Medical College
Corresponding Author
Arul Prasadh
Assistant Professor, Department of Pediatrics, Kanyakumari Government Medical College

Abstract

Background: *Empyema thoracis, an accumulation of pus in the pleural space is most often associated with pneumonia due to Streptococcus pneumoniae, although Staphylococcus aureus is most common in developing nations and in post-traumatic empyema. Empyema is most frequently encountered in infants and preschool children. It*
occurs in 5 - 10% of children with bacterial pneumonia. This study was conducted to find the etiological profile of empyema in our setup, and factors that influence the outcome of empyema. This may help in effective management of empyema thoracis in future.

Methodology: *All the children 1 month to 12 years old diagnosed as having empyema thoracis during the period June 2003 - October 2004, attending our hospital and willing to adhere to our study protocol were enrolled in our study.*
Detailed history was elicited from the patient and a thorough clinical examination done. Diagnosis was confirmed with proper investigations. Pleural aspiration was done and pleural aspirate subjected to biochemical examination, gram staining was done and sample was sent for pus culture and sensitivity.
Complete blood count, X-ray chest, ultrasonogram of chest if needed, Mantoux were done. Blood was also sent for blood culture. Tube thoracostomy was done in all patients confirmed to have empyema thoracis. Inter Costal Drainage Tube of adequate size was inserted to ensure proper and complete drainage.

Results: *In our study we find that gram positive organisms were isolated in 49% of culture proven cases and gram negative organisms were isolated from 51% of culture proven empyema thoracis cases.*
Locality wise distribution helps us to compare the adequacy of treatment in urban and rural areas.
70% of children presenting with empyema thoracis had undernutrition. Duration of illness also significantly affect the outcome. When the duration of illness is > 7 days prior to insertion of ICD tube chances are high that the empyema would have progressed beyond stage I and empyema is in stage II or III.

Conclusion: *Gram negative organisms were more isolated from the children with empyema thoracis.empyema thoracis is more common among undernourished children.Duration of illness also significantly affect outcome.*

Introduction

Empyema thoracis, an accumulation of pus in the pleural space is most often associated with pneumonia due to Streptococcus pneumoniae, although Staphylococcus aureus is most common in developing nations and in post-traumatic empyema. The relative incidence of Haemophilus influenza empyema has decreased since the introduction of Hib vaccination. Group A streptococcus, gram negative organisms, tuberculosis, fungi and malignancy are less common causes. Empyema is most frequently encountered in infants and preschool children. It occurs in 5 - 10% of children with bacterial pneumonia. The disease may also be produced by rupture of a lung abscess into the pleural space, by contamination introduced from trauma or thoracic surgery or rarely by mediastinitis or the extension of intra - abdominal abscesses.[1]

Aim of the Study

To study

1. The causative organism in empyema thoracis in our institute.
2. The factors associated with poor prognosis in empyema thoracis in children.

Subjects and Methods

Study design- Descriptive/Nested Case Control Study.

Study place- ICH & HC

Study period- June 2003 - October 2004

Study population - Children 1 month to 12 years diagnosed as having empyema thoracis.

Exclusion criteria- Patients and physicians not willing to adhere to our study protocol.

Sample size - All children 1 month to 12 years diagnosed as having empyema thoracis who satisfy above criteria.

Manoeuvre

All the children 1 month to 12 years old diagnosed as having empyema thoracis during the period June 2003 - October 2004, attending our hospital and willing to adhere to our study protocol were enrolled in our study.

Detailed history was elicited from the patient and a thorough clinical examination done. Diagnosis was confirmed with proper investigations. Pleural aspiration was done and pleural aspirate subjected to biochemical examination, gram staining was done and sample was sent for pus culture and sensitivity.

Complete blood count, X-ray chest, ultrasonogram of chest if needed, Mantoux were done. Blood was also sent for blood culture. Tube thoracostomy was done in all patients confirmed to have empyema thoracis. Inter Costal Drainage Tube of adequate size was inserted to ensure proper and complete drainage.

Statistical Analysis

a) The proportion of various etiological agents and outcome were arrived.

b) To study the prognostic factors, odds ratio with 95% confidence interval was arrived at for each risk factor byunivariate analysis by constructing a 2x2 table. To adjust for confounding variables, adjusted odds ratio with 95% confidence interval was arrived at by multivariate anaylsis for the signifant risk factors with univariate anaylsis. P value <0.05 will be considered for statistical significance.

Observation

Total number of empyema thorocis patients during the study period : 106

No : Children who recovered without complications : 60 (Control)

No : Children who recovered with complication and / or decortications : 32

Death : 4 36 (cases)

Organisms were grown in pus culture and / or blood culture in 37 cases (36%) Organisms grown in our institute were

Table – 1

Staphylococcus aureus	15
Klebsiella	13
Pseudomonas	5
Pneumococci	3
E. coli	1

Clinical Profile

Table – 2

Symptoms	No.	%
Fever	103	97%
Cough	89	84%
Difficulty in breathing	85	80%
Vomiting	14	13%
Abdominal distension	12	11%
Chest Pain	7	6.5%

Thus we find that fever, cough, difficulty in breathing are the predominant symptoms, while 13% of patients had vomiting and 11% of patients had abdominal distension (Table 2). Empyema was right sided in 62 children (58.5%) and left sided in 44 children (41.5%). 80% of the children has a total counts > 10,000.

Age Pattern of Cases and Control

Table - 3

Age months	Case (%)	Control (%)	Total
0-12 months	7 (19.4%)	26 (37.1%)	33 (31.1%)
13-36 months	12 (33.3%)	13 (18.6%)	25 (23.6%)
37-60 months	8 (22.2%)	19 (27.1%)	27 (25.5%)
6 1 - 120 months	9 (25%)	12 (17.1%)	21 (19.8%)

In our study, children less than 12 months constitute 31% of total empyema cases. Children less than 36 months account for 55% of empyema thoracis cases while children less than 5 years constitute almost 80% and only 20% of empyema thoracis cases is in children more than 5 years old (Table 3).

Sex Wise Distribution Of Cases And Controls

Table – 4

	Case	Control	Total
Male	21 (58.3%)	36 (51.4%)	57 (53.8%)
Female	15 (41.7%)	34 (48.6%)	49 (46.2%)

There is a slight preponderance of males in our study.

Males constitute 54% of empyema thoracis cases Female account for 46% of empyema thoracis cases (Table 4).

Locality Wise Distribution of Cases and Controls

Table - 5

	Case	Control	Total
Chennai	21 (58.3%)	30 (42.86%)	51 (48.1%)
TN outside chennai	7 (19.4%)	22 (31.4%)	29 (27.4%)
Other States	8 (22.2%)	18 (25.7%)	26 (24.5%)

About 50% of patients are from Chennai while 25% of cases were from other states. 25% of patients were from rural areas of Tamil Nadu (Table 5). Locality wise distribution helps us to study the referral pattern of our hospital and also comparing adequacy of treatment in urban vs rural setup.

Nutritional Status Wise Distribution

Table – 6

Nutritional status	Case	Control	Total
Normal	6 (16.7%)	29 (41.4%)	35 (33%)
Grade I PEM	14 (38.9%)	17 (24.3%)	31 (29.2%)
Grade II PEM	9 (25%)	10 (14.3%)	19 (18%)
Grade III PEM	7 (19.4%)	14 (20%)	21 (19.8%)

33% of the patients were nutritionally normal while the rest 67% were undernourished. Grade I PEM was present in 30% of patients. Grade II PEM was seen in 18% of patients. Grade III PEM was seen in 20% of patients. None of the patients were of Grade IV PEM (Table 6).

Statistical Analysis

1) Comparison Of Risk Factors Among Cases And
2) Controls By Univariate Analysis

Nutritional Status

Table - 7

	Cases	Control
Undernutrition +	30	4 1
Undernutrition -	6	29

Odds Ratio = 3.537 with
95% Confidence Interval (1.305 - 9.587)

Thus we find that undernutrition is significantly associated with cases as per univariate analysis. Further multivariate analysis is required for adjusting for confounding variables.
Thus we find that the odds of a child being undernourished is 3.5 times more common among children who go for complication / decortication when compared to children who recover without complication.

Duration Of Illness Prior To Icd Insertion
Table – 8

	Case	Control
> 7 days	21	23
≥ 7 days	15	45

Odds Ratio = 2.739 with a
95% Confidence Interval of 1.193 - 6.291
which is also significant by univariate analysis. Further multivariate analysis is required for adjusting for confounding variables.

Thus we find that the odds of a child presenting after 7 days of illness is 2.7 times more common among children who go for complication / decortication when compared to children who recover without complication.

Previous Treatment
Table - 9

	Case	Control
Previous treatment +	15	14
Previous treatment -	2 1	56

Odds Ratio - 2.857
95% Confidence Interval of 1.18 - 6.92

Thus we find that history of previous treatment is significant by univariate analysis. The odds of a child having been treated previously is 2.8 times more common among children who go for complication / decortication when compared to children who recover without complication.

Congenital Anamoly and Associatedillness
Table - 10

	Cases	Control
Congenital anamoly & associated illness +	5	3
Congenital anarnoly & associated illness -	3 1	67

Odds Ratio - 3.602
95% Confidence Interval of 0.809 - 16.037

Comparing Other Factors
Sex of the Child
Table - 11

	Cases	Control
Male	21	36
Female	15	34

Odds Ratio - 1.32
95% Confidence Interval of 0.587 - 2.977

Micro Organism
Table – 12

	Cases	Control
Organism grown	16	21
No organism grown	20	49

Odds Ratio - 1.867
95% Confidence Interval of 0.812 - 4.293

Comparing Individual Micro Organism
Table – 13

Organism	Case	Control	OR
Klebsiella	7	6	1.8 (0.556 – 5.822)
Staph.aureus	10	5	0.968 (0.304 – 3.08)
Pseudomonas	2	3	5 (0.478 – 18.8)
Pneumococci	1	2	4.06 (0.355 – 46.35)

We find that none of the organism is significantly associated with poor prognosis.

Locality of the Child
Table - 14

	Cases	Control
Urban	2 1	30
Rural	15	40

Odds Ratio - 1.867
95% Confidence Interval of 0.827 - 4.214

Age of the Child

Table - 15

	Cases	Control
Older children	29	44
Infant	7	26

Odds Ratio - 2.448
95% Confidence Interval of 0.94 - 6.376
COMPARING DIFFERENT AGE GROUPS

Table - 16

Age	Case	Control	OR
0-12 mo	7	26	0.408 (0.157 - 1.064)
13-36 mo	12	13	2.192 (0.875 - 5.49)
37-60 mo	8	19	0.767 (0.298 - 1.975)
61-120 mo	9	12	1.61 1 (0.606 - 4.28

Thus by univariate analysis, we find that none of the risk factors except nutritional status, duration of illness prior to ICD insertion, history of previous treatment is significantly associated with poor prognosis in empyema thoracis.

Multivariate Analysis

Multivariate analysis was done on the following variables
Age
Sex
Duration of illness
Previous treatment
Nutritional category.

Table – 17

	B	S.E	Wald	Sig.
Age	0.011	0.007	2.628	0.105
Male Sex	0.384	0.461	0.694	0.405
Duration of Illness > 7 days	0.656	0.485	1.829	0.176
Previous treatment	1.206	0.529	5.189	0.023
Undernutrition	-1.455	0.572	6.479	0.011

X^2 value = 20.144
Nagelkerke R Square value = 0.240
By Chi-square it was found that these factors have a significant association with the outcome. By Nagelkerke R square value we find that these risk factors contribute 24% to the outcome.
Thus we find that history of previous treatment and undernutrition are significantly associated with poor outcome. Duration of illness > 7 days though significant by univariate analysis did not achieve statistical significance in multivariate analysis (Table 17).

Discussion

106 children of empyema thoracis who attended our institute were included in our study. 103 children had fever (97%), 89 children had cough (84%), 85 children had difficulty in breathing (80%), 12 children had abdominal distension (1 1%) 7 children had chest pain (6.5%). Beg et a1[24]. have found that cough was found in 98% of children with empyema thoracis, fever in 95% of children with empyema. Breathlessness in 85% and chest pain in 83% Ghosh et a1[23] have found that abdominal distension is present in 43% of children.
In our study we find that the empyema thoracis was right sided in 62 children (58.5%) There was a mild male preponderance. Males constitute 54% of total cases and children less than 3 years constitute 55% of the total empyema thoracis cases Ghosh et a123 has found that the empyema is right sided in 61% of cases, males constitute 65% and children < 2 years constitute 70%. 80% of children in our study had total count more than 10,000 while other study in the literature had total count more than 10,000 in 94% of empyema thoracis cases[21]. In several studies done so far organism isolation rate range from 10%[11] to 50%[27]. In our study, organisms were isolated from 37 cases (35%) which is fairly good. Previous antibiotic therapy outside could have decreased the organism isolation rate.
Though there are literatures saying gram + organism are the most common' in empyema thoracis, there are a few Indian studies which find that gram - organism are isolated in 84% of culture proven cases of empyema thoracis[12]. In our study we find that gram positive organisms

were isolated in 49% of culture proven cases and gram negative organisms were isolated from 51% of culture proven empyema thoracis cases.

In locality wise distribution of empyema thoracis cases we find that about 50% of patients are from chennai which is to be expected. While a 25% of cases were from rural Tamilnadu and another 25% were from Andra Pradesh. Locality wise distribution helps us to compare the adequacy of treatment in urban and rural areas. Only 30% of children presenting with empyema thoracis were of normal nutrition. 70% had undernutrition which is higher than the prevailing undernutrition in the community. This could be due to the referral pattern of our hospital and also also as malnutrition predisposes to infection.

When all the risk factor were subjected to univariate analysis we found that Undernutrition - OR 3.537 95% CI (1.305 - 9.387)

Duration of illness > 7 day - OR 2.739 95% CI (1.193 - 6.291)

History of Previous treatment - OR 2.857 95% CI (1.18 - 6.92) were significantly associated with poor outcome in the from of complication *I* death / decortication in empyema thoracis.

Undernutrition in these children predispose them to infection. Most of these undernutrition is due to nutritional deficit due to poor socio economic status of their parents and they usually get medical help late when the empyema would have progressed from stage I to stage II or Stage 111.

Duration of illness also significantly affect the outcome. When the duration of illness is > 7 days prior to insertion of ICD tube chances are high that the empyema would have progressed beyond stage I and empyema is in stage II or III.

History previous treatment also affect the outcome[28] as most of the children who get treated outside are partially treated and no drainage is done. In these partially treated children, symptoms are masked and they get proper medical care quiet late when the empyema thoracis would have progressed to later stages.

The other risk factor like age group, associated congenital anamolies underlying illness, specific organisms were not significantly associated with poor outcome. While there are few studies which say staphylococci, pneurnococci are more prone to go for decortications (Mandal et al),[18] our study could not established such an association.

When these risk factors were subjected to multivariate analysis by Logistic regression method we found that Malnutrition with a p value of 0.011 History of previous treatment with a p value of 0.023 were independently associated with poor outcome and these risk factor contribute 24% to the outcome.

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