International Journal of Contemporary Pediatrics
Meena P et al. Int J Contemp Pediatr. 2019 Nov;6(6):2433-2437
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20194712

Original Research Article

A study on clinical profile and etiological agents of empyema in hospitalised children in Jaipur, India

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Received: 18 July 2019
Revised: 27 August 2019
Accepted: 31 August 2019

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ABSTRACT

Background: Objective is to study the clinical profile and etiological agents of empyema in hospitalised children in Jaipur.
Methods: This hospital based prospective study was carried out in the Department of Pediatrics, SMS Medical College, Jaipur between April 2016 to March 2017. Children between 1 month to 18 year of age having empyema thoracis (pleural tap showing pus cells under microscopy or on gross examination purulent exudates) were included in the study. Children with Empyema secondary to post-surgical or post-traumatic cause and with tubercular effusion were excluded from the study. Relevant history, clinical examination and investigation were done. Pleural fluid studies were done for cytology, biochemical analysis , culture and antibiotic sensitivity pattern.
Results: Total 100 patients were included in study. Out of total 100 patients 62 (62%) were between 1 month to 5 years. Most common symptoms were fever (94%), breathlessness (87%) and cough (85%). 27% patients were severely malnourished as per IAP classification of PEM. Pleural fluid culture was positive in 29 (29%) patients. Most common organism isolated was *Staphylococcus aureus* (27%), 87.5% isolates of *Staphylococcus aureus* had sensitivity to vancomycin and linezolid.
Conclusions: Empyema thoracis is frequently encountered complication of bacterial pneumonia. Fever, cough, and respiratory distress were the most common presenting complaints and severe acute malnutrition was an important risk factor. Staphylococcus aureus was found to be the most common organism for childhood empyema.

Keywords: Empyema thoracis, Intercoastal drainage, Malnutrition, Pneumonia, Pleural fluid culture, *Staphylococcus aureus*

INTRODUCTION

Empyema thoracis is defined by the presence of pus in the pleural space. Pleural effusion and empyema are known complications of bacterial pneumonia.[1]

It constitutes about 5-10% of cases seen by pediatricians in India.[2,3]

The incidence of empyema thoracis is increasing worldwide causing significant childhood morbidity with an estimated 0.6% of childhood pneumonia progressing to empyema.[2,4,5]

Possible reason for this include delay in initiating treatment, oral treatment in the community with inappropriate antibiotics, inadequate drug level in the pleural space and unusual causative organism.[6]

Most patients with empyema present with clinical manifestations of bacterial pneumonia. Symptoms are characterized by an acute febrile response, pleuritic chest pain, cough, dyspnea. The inflammation of the pleural space may cause abdominal pain and vomiting.

The primary aim in the management of empyema thoracis is to obliterate and sterilize the infected pleural space completely. Thus, adequate and early drainage with the introduction of a closed intercostals tube and continous under water seal drainage along with the appropriate antibiotic is more effective and has been advocated as primary line of management of empyema.[7-9]

Thoracis empyema continues to have mortality rate of 5-7% The prognosis of empyema is usually very good.[2,4] Delay in early diagnosis, failure to institute appropriate antimicrobial therapy, drug resistant organisms, malnutrition, low socioeconomic status, contributing to increased morbidity in children. The present study was aimed at studying the clinical profile of empyema, the various microbiological agents responsible for empyema, their antibiotic sensitivity pattern and the outcome of patients.

METHODS

This was a hospital based prospective study carried out in the Department of Pediatrics, SMS Medical College, Jaipur between April 2016 to March 2017. Children between 1month to 18 year of age having empyema thoracis (Pleural tap showing pus cells under microscopy or on gross examination purulent exudates) were included in the study. Children with Empyema secondary to post-surgical or post traumatic cause and with tubercular effusion) were excluded from the study.

Patients were evaluated by taking history regarding complaints, predisposing factors, immunization status. Anthropometric measurements, clinical examination and relevant investigation were done. These include hemoglobin estimation, total leukocyte count, LFTs, RFTs and serum electrolytes. All patients suspected of pleural effusion clinically were subjected to chest X-ray, USG and (if required) CT thorax. Pleural fluid studies were done for cytology, biochemical analysis culture and antibiotic sensitivity pattern.

All admitted patients received supportive treatment and empirical antibiotics started as per the protocol lin different units. Subsequent choice and duration of antibiotics was determined by pus culture and sensitivity results. Change of antibiotic was considered in case of clinical non-improvement and the second line antibiotic were used according to pleural fluid culture.

RESULTS

Authors included 100 patients between 1 month to 18 years of age. 62% were below 5 years of age , 31% in the age group of 5 to 10 years and 7% were above 10 years of age. Mean age of patients was52.33±39.79months. (4.3 years). Study population comprised of 59% males and 41% females. Male female ratio was 1.43:1.

Fever was present in 94% patients, respiratory distress in 87%, cough in 85%, chest pain in 37 % , abdominal pain in 10% , vomiting in 7% as shown in Table 1.

Table 1: Chief complaints.

Chief complaints	Mean	SD	Percentage (%)
Fever	9.85	7.24	94%
Cough	7.09	7.09	85%
Respiratory Distress	6.21	6.21	87%
Chest Pain	6.47	6.47	37%
Abdominal Pain	1.39	1.39	10%
Vomiting	3.17	1.79	7%

In patients below 5 years of age , 11% patients had PEM grade 4, 16% had PEM grade 3, 20% had PEM grade 2, 7% had PEM grade 1 and 46% were normal as per IAP classification of PEM. Hence, 27% patients were severely malnourished as per IAP classification of PEM .

Mean value of haemoglobin was 8.68±1.30. Out of total 100 patients 53% patients had higher platelets counts (>4 lacs), 77% patients had leucocytosis (Total leucocytes count >10000).

In this study, pleural fluid culture was positive in 29(29%) patients and in 71(71%) patients pleural fluid was sterile. Most common organism isolated was Staphylococcus aureus (27%) followed by Coagulase negative *Staphylococcus* (10%), *Acinatobacter* (10%), *Enterobacter* (10%), *Pseudomonas* (10%), *Candida* (6%), *Enterobacter aerogens* (6%), *Streptococcus pneumoniae* (6%), *Enterococcus* (3.4%), *Escherichia coli* (3.4%) and *Citrobacter* (3.4%) as shown in Table 2.

Table 2: Bacteriological profile of pleural fluid culture.

Organism	Number of cases (100)	Percentage
Acinatobacter	3	3.00%
Candida species	2	2.00%
Citrobacter species	1	1.00%
Coagulase negative *Staphylococcus*	3	3.00%
Coagulase positive *Staphylococcus*	8	8.00%
Enterobacter aerogens	2	2.00%
Enterobacter cloacae	3	3.00%
Enterococcus species	1	1.00%
Escherichia coli	1	1.00%
Pseudomonas	3	3.00%
Streptococcus species	2	2.00%
Sterile	71	71%

Table 3: Antibiotic sensitivity pattern of different organism in pleural fluid culture.

Antibiotics	*Acinetobacter* (N=3)	*Candida species* (N=2)	*Citrobacter species* (N=1)	Coagulase negative *staphylococcus* (N=3)	Coagulase positive *staphylococcus* (N=8)	*Enterobacter-aerogenes* (N=2)
Amikacin	2 (66.66%)	0	1 (100%)	2 (66.66%)	0	0
Augmentin	0	0	0	1 (33.33%)	3 (37.5%)	0
Azithromycin	0	0	0	1 (33.33%)	3 (37.5%)	0
Cefoperazone sulbactam	1 (33.33%)	0	0	0	0	0
Cefotaxime	0	0	0	1 (33.33%)	2 (25%)	0
Ceftriaxone	0	0	0	0	3 (37.5%)	0
Cefuroxime	0	0	0	0	1 (12.5%)	0
Cephalexin	0	0	0	1 (33.33%)	3 (37.5%)	0
Ciprofloxacin	1 (33.33%)	0	0	0	0	0
Clindamycin	0	0	0	1 (33.33%)	5 (62.5%)	0
Colistin	0	0	0	0	0	2 (100%)
Doxycycllin	0	0	0	0	5 (62.5%)	0
Gentamycin	2 (66.66%)	0	1 (100%)	0	6 (75%)	0
Imipenam	3 (100%)	0	0	0	0	2 (100%)
Levofloxacin	1 (33.33%)	0	0	0	0	0
Linezolid	0	0	0	3 (100%)	7 (87.5%)	0
Netilmycin	3 (100%	0	1 (100%)	0	0	0
Penicillin G	0	0	0	0	1 (12.5%)	0
Teigecyclline	1 (33.33%)	0	0	0	1 (12.5%)	1 (50%)
Vancomycin	0	0	0	2 (66.66%)	7 (87.5%)	0
Piperacillinta-zobactum	1 (33.33%)	0	0	0	0	0

Antibiotics	*Enterobactercloacae* (N=3)	*Enterococcus species* (N=1)	*Escherichia coli* (N=1)	*Pseudomonas* (N=3)	*Streptococcus species* (N=2)
Amikacin	0	0	1 (100%)	0	0
Ampicillin	0	0	1 (100%)	0	0
Augmentin	0	0	0	0	1 (50%)
Azithromycin	0	0	0	0	1 (50%)
Carbenicillin	0	0	0	1 (33.33%)	0
Cefipime	0	0	1 (100%)	0	0
Cefixime	0	0	1 (100%)	0	0
Cefoperazonesulbactam	0	0	1 (100%)	0	0
Cefotaxime	0	1 (100%)	1 (100%)	0	1 (50%)
Ceftazidime	0	0	0	1 (33.33%)	0
Ceftriaxone	0	0	0	1(33.33%)	0
Chloremphenicol	0	0	0	0	1 (50%)
Ciprofloxacin	1 (33.33%)	0	0	0	0
Clindamycin	0	0	0	0	1 (50%)
Colistin	2 (66.66%)	0	0	3 (100%)	0
Doxycycllin	0	0	0	0	0
Fosfomycin	0	0	0	1 (33.33%	0
Gentamycin	1 (33.33%)	0	0	1 (33.33%)	0
Imipenam	2 (66.66%)	0	0	1 (33.33%)	0
Levofloxacin	1 (33.33%)	0	0	0	0
Linezolid	0	1 (100%)	0	0	1 (50%)
Meropenam	0	1 (100%)	0	1 (33.33%)	0
Neltimycin	1 (33.33%)	0	0	0	0
penicillin G	0	0	0	0	1 (50%)
PolymixinB	0	0	0	2 (66.66%)	0
Teigecyclline	1 (33.33%)	0	0	1 (33.33%	0
Tobramycin	0	0	0	1 (33.33%)	0
Vancomycin	0	1 (100%)	0	0	2 (100%)
Piperacillintazobactum	0	0	0	1 (33.33%	0

The 87.5% isolates of *Staphylococcus aureus* had sensitivity to vancomycin and linezolid, followed by 75% isolates sensitive to gentamycin and doxycycllin, 62.5% sensitive to clindamycin.

Only 37.5% isolates of *Staphylococcus aureus* were sensitive to amoxiclav, azithromycin, ceftriaxone, 25% sensitive to cefotaxime and 12.5% isolates were sensitive to cefuroxime as shown in Table 3.

DISCUSSION

Empyema thoracis is an important health problem in children causes significant morbidity and mortality. Possible factor contributing to this significant morbidity includes malnutrition, delay in diagnosis, inappropriate treatment, delayed referral.

Empyema was more common in children below 5 years of age. Male: female ratio was 1.43:1. Fever, respiratory distres and cough were the common presentation.

Malnutrition was found to be a important risk factor for empyema. 27 % patients were severly malnourished.

In this study, pleural fluid culture was positive in 29% patients and the most common organism isolated was staphylococcus aureus (27%).

In studies done by Ali Faisal Saleem et al, AK Baranwal et al, S hailu et al, Kumar et al, *Staphylococcus aureus* was the most common organism isolated which was similar to that observed in our study.[10-13] 87.5% isolates of *Staphylococcus aureus* had sensitivity to vancomycin and linezolid but 62.5% isolates were resistant to amoxiclav, Ceftriaxone, azithromycin, 75% resistant to cefotaxime and 87.5% isolates were resistant to cefuroxime.

Association between antibiotics taken before admission and pleural fluid positivity was not significant (p=0.15). Our study did not found any association between the use of antibiotics before admission and pleural fluid positivity (p=0.15). Similar results shown in study done by D narayanappa et al, coefficient of pleural fluid culture positivity in children who had received prior antibiotics and those who had not received any antibiotic was 0.132 which was statistically insignificant.

CONCLUSION

Empyema thoracis is a significant respiratory ailment. Fever, cough, and respiratory distress were the most common presenting complaints and severe acute malnutrition was an important association. Staphylococcus aureus was found to be the most common organism isolated from pleural fluid. Conservative management with intercostal drainage and parenteral antibiotics were adequate in most of the cases and was the mainstay of treatment. As most of the isolates of staphylococcus aureus were resistant to commonly used antibiotics like amoxicillin, cefuroxime, hence these antibiotic should not be part of the empirical treatment protocol. Sensitivity to vancomycin and linezolid makes them a good choice for the empirical protocol right from the beginning. Further treatment decisions should be based on the available culture and sensitivity reports. This can help in the ultimate better outcome of the patients with empyema in terms of improved morbidity and mortality. These observations derived from this study makes a way for further larger multicentric studies before making these recommendations generalized.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Meena P, Jain PK, Sharma A, Sharma BS. A study on clinical profile and etiological agents of empyema in hospitalised children in Jaipur. Int J Contemp Pediatr 2019;6:2433-7.