

Clinico-bacteriological Profile and Outcome of Empyema Thoracis in Children at a Tertiary Care Hospital of Central Nepal

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ABSTRACT

Background: Empyema thoracis (ET) is a serious infection of the pleural space. Despite the availability of broad spectrum antibacterial, improved vaccination coverage and better diagnostic tools, Empyema Thoracis remains associated with high morbidity worldwide. Delay in early diagnosis, failure to institute appropriate antimicrobial therapy, multidrug resistant organisms, malnutrition, comorbidities, poor health seeking behaviour and high treatment cost burden contribute to increased morbidity in children. The available treatment options include intravenous broad-spectrum antibiotics either alone or in combination with surgical procedure (thoracocentesis, chest tube drainage, fibrinolytic therapy, decortications with video assisted thoracoscopic surgery (VATS) and open drainage.

Methods: Fifty Children between 1 month to 16 years admitted in the Pediatrics Ward, PICU of College of Medical Sciences, Bharatpur, Nepal. Data analysis was done by SPSS 24.0.

Results: Present study found that according to blood culture, 3 (6.0%) patients had enterococcus, 40 (80.0%) patients had no growth, 2 (4.0%) patients had pseudomonas, 4 (8.0%) patients had staphylococcus and 1 (2.0%) patients had streptococcus. We found that 20 (40.0%) patients had done CT scan thorax, 30 (60.0%) patients had not done CT scan thorax and 32 (64.0%) patients had Amoxiclav first line antibiotic and 18 (36.0%) patients had Ceftriaxone first line antibiotic.

Conclusions: Suitable antibiotics and prompt chest tube drainage is an effective method of treatment of childhood empyema, especially in resource-poor settings. Majority of the patients progress on this conservative management and have good recovery on follow up.

Keywords: clinico-bacteriological profile; empyema thoracis; children; outcome.

INTRODUCTION

Empyema thoracis (ET) is a serious infection of the pleural space. Despite the availability of broad spectrum antibacterial, improved vaccination coverage and better diagnostic tools, ET remains associated with high morbidity worldwide. Pathologically, empyema develops in three stages; exudative, fibrin purulent stage and organized stage.¹ The rise in the incidence of ET, is because of multi-drug resistant pathogenic microorganism. Optimal management of pediatric empyema is still controversial and best management option is still not clear. The available treatment options include intravenous broad-spectrum antibiotics either alone or in combination with surgical procedure (thoracocentesis, chest tube drainage, fibrinolytic therapy, decortications with video assisted thoracoscopic surgery (VATS) and open drainage.²

Pleural empyema continues to be a serious problem despite recent advances in management.¹ It is reported to occur in up to 28% children

hospitalized for community acquired pneumonia.² In developed countries the microbial profile has changed over the past five decades³ with increasing incidence of penicillin resistant *Streptococcus pneumoniae*⁴ and methicillin resistant *staphylococcus*.⁵ However, the scenario is very different in developing countries,⁶⁻¹⁰ where empyema is associated with significant morbidity and consumption of scarce hospital resources. Optimal management in children is controversial, especially the duration of parenteral antibiotics and the role of surgery. Newer therapies, that is, fibrinolysis¹¹ and video assisted thoracoscopic surgery¹² have made the issue even more complex.

Childhood empyema is an important complication of bacterial pneumonia and continues to be an important clinical problem. It is estimated that 0.6% of childhood pneumonia progress to empyema, affecting 3.3 per 1,00,000 children.^{4,12} Empyemas are significant cause of morbidity, but

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not mortality in children, as it is rare for children to have an underlying lung disease.⁴

Empyema Thoracis, a common condition in children and has significant morbidity and mortality. The aim of therapy is to ensure rapid recovery with a normal long-term pulmonary outcome. Medical therapy includes use of antibiotics and intercoastal water seal chest tube drainage. Recently early intervention in the form of Video Assisted Thoracoscopic Surgery (VATS) has been reported. A meta-analysis of operative versus non operative interventions for pediatric empyema thoracis has concluded that primary operative therapy is associated with lower mortality, shorter hospital stays and shorter duration of antibiotic therapy. Hence there is a need to know the clinico-bacteriological profile in our set up and also to optimize the management strategies for empyema.

METHODS

A cross-sectional study was conducted to know the clinico-bacteriological profile and outcome of Empyema Thoracis in children between 1 month to 16 years of age admitted in College of Medical Sciences, Bharatpur, Nepal. Study Population: 50 Children between 1 month to 16 years admitted in the Pediatrics Ward of Medical College and Hospital, Nepal. Children between 1 month to 16 years of age with diagnosis of Empyema according to ICD 10 code J869 were included in this study. While, children with prior chest tube drainage or any surgical intervention done before were excluded. Patients diagnosed to have Empyema admitted to the Department of Pediatrics, College of Medical Sciences Bharatpur, Nepal in the age group of 1 month to 16 years was studied. Informed parental consent was taken. A standardized case report form was developed to collect data on demographic, duration of prior antibiotic use, clinical, diagnostic, treatment and outcome measures of all these cases. Study period was from June 2014 to May 2019.

In all cases basic investigations, chest x-ray, pleural fluid analysis, culture & sensitivity, blood culture & sensitivity, ultrasonography of chest was done. CT scan of chest was done in cases with radiological suspicion of multiloculated or non-improvement following therapy. Pleural fluid is collected with aseptic precautions by thoracentesis or during the time of insertion of intercostal tube for drainage in a sterile culture bottle and sent for cell type and count, pH (by pH paper) , glucose (by glucose oxidase method), LDH levels (by Colorimetric Wroblewski/UV method), Gram’s stain, AFB stain, ADA (Adenosine Deaminase) levels Culture and sensitivity done. Cases were managed with chest tube drainage (CTD) in combination with intravenous antibiotics and supportive treatment like

maintenance of oxygen saturation, hydration and nutrition. Follow up was done at the end of first month after discharge on OPD basis to study the outcome. Outcome of empyema was in terms of clinical and radiological clearance with respect to different modalities of treatment used. PFT (Pulmonary function test) is also performed in children of age group of >6yrs. Statistical Analysis Plan: A total of 50 patients having Empyema Thoracis was studied and the outcome analyzed. Data analysis was done by SPSS for Windows.

RESULTS

We found that 7(14.0%) patients had ≤12-month age, 32(64.0%) patients had 13-60-month age, 11 (22.0%) patients had ≥ 60-month age and 28 (56.0%) patients had female, 22(44.0%) patients had male (Table 1).

Table 1. Distribution of Age, Sex.

Variables	Frequency	Percent
Age		
≤12 Months	7	14
13-60 Months	32	64
≥ 60 Months	11	22
Sex		
Female	28	56
Male	22	44

Our study showed that 32(64.0%) patients had PEM and 1(2.0%) patients had 5 days fever, 5 (10.0%) patients had 6 days fever, 2(4.0%) patients had 7 days fever, 21(42.0%) patients had 8 days fever, 12(24.0%) patients had 9 days fever and 9 (18.0%) patients had 10 days fever.42(84.0%) patients had cough and 28(56.0%) patients had resp distress. Our study found that 10(20.0%) patients had pain in abdomen and 9(18.0%) patients had altered sensorium. We found that 40(80.0%) patients had pallor and 32(64.0%) patients had Temperature. Our study showed that 40(80.0%) patients had Chest wall BULGE and 35(70.0%) patients had Mediastinal shift. We found that 45 (90.0%) patients had dullness on percussion and 44 (88.0%) patients had breath sounds decreased (Table 2).

Table 2. Distribution PEM, Symptoms, Sign.

Variables	Frequency	Percent
PEM	32	64
Cough	42	84
Resp Distress	28	56
Altered Sensorium	9	18
Pallor	40	80
High Temperature	32	64
Inspection BULGE	40	80
Mediastinal shift	35	70
DULLNESS on Percussion	45	90
Breath Sounds Decreased	44	88

According to chest X-ray, 1(2.0%) patients had bilateral consolidation, 3(6.0%) patients had consolidation left side, 3(6.0%) patients had consolidation right side, 22(44.0%) patients had pleural effusion left side and 21(42.0%) patients had pleural effusion right side. According to blood culture, 3(6.0%) patients had enterococcus, 40 (80.0%) patients had no growth, 2(4.0%) patients had pseudomonas, 4(8.0%) patients had staphylococcus and 1(2.0%) patients had streptococcus. We found that according to cell type of pleural fluid, 11(22.0%) patients had mononuclear mostly, 39(78.0%) patients had pmn's mostly and according to culture of pleural fluid, 1 (2.0%) patients had enterococcus, 43(86.0%) patients had no growth, 2(4.0%) patients had pseudomonas and 4(8.0%) patients had staphylococcus. All patients had no CBNAAT of pleural fluid and 2(4.0%) patients had positive mantoux test. According to USG chest, 1(2.0%) patients had b/l effusion, 5(10.0%) patients had effusion, left, 2(4.0%) patients had effusion, right, 15(30.0%) patients had empyema, left, 20(40.0%) patients had empyema, right, 4(8.0%) patients had empyema, left and 1(2.0%) patient had empyema, right. We found that 20(40.0%) patients had done CT scan thorax, 30(60.0%) patients had not done CT scan thorax and 32(64.0%) patients had Amoxyclav first line antibiotic and 18(36.0%) patients had Ceftriaxone first line antibiotic. 30 (60.0%) patients had Ceftriaxone second line antibiotics, 20(40.0%) patients had Vancomycin

second line antibiotics and 10(20.0%) patients had Meropenem third line antibiotics and 8(16.0%) patients had Vancomycin third line antibiotics. 36 (72.0%) patients had 14 days duration of antibiotics, 14(28.0%) patients had 21 days duration of antibiotics and 41(82.0%) patients had chest tube drainage. It was found from our study that 2(4.0%) patients had surgical procedure (Table 3).

We found that the mean duration of chest tube (mean± s.d.) of patients was 5.8780± 1.0049 days, the mean age (mean± s.d.) of patients was 40.8200±23.4388 years and the mean fever (mean± s.d.) of patients was 8.3000±1.2330 days. The mean Respiratory Rate (mean± s.d.) of patients was 46.8200 ± 7.2074, the mean hemoglobin (mean± s.d.) of patients was 9.2780± 1.3509 g/dl and the mean TLC (mean± s.d.) of patients was 13114.0000± 2673.5293. Our study found that the mean ESR (mean± s.d.) of patients was 31.4400± 2.7639mm, the mean cell count of pleural fluid (mean± s.d.) of patients was 11081.0000 ± 9751.7530 and the mean protein of pleural fluid (mean± s.d.) of patients was 11.9860 ± 10.0775. We found that the mean sugar of pleural fluid (mean± s.d.) of patients was 34.9800± 14.6629 mg/dl, the mean LDH of pleural fluid (mean± s.d.) of patients was 5942.7000± 4342.6852 and the mean duration of antibiotics (mean± s.d.) of patients was 15.9600± 3.1749 days (Table 4).

Table 3. Blood culture, Celltype of pleural fluid, Culture of pleural fluid, CBNAAT of pleural fluid, Mantoux Test.

Variables	Frequency	Percent
Blood Culture		
Enterococcus	3	6
No Growth	40	80
Pseudomonas	2	4
Staphylococcus	4	8
Streptococcus	1	2
Cell Type Of Pleural Fluid		
Mononuclear Mostly	11	22
Pmn's Mostly	39	78
Culture Of Pleural Fluid		
Enterococcus	1	2
No Growth	43	86
Pseudomonas	2	4
Staphylococcus	4	8
CBNAAT of Pleural Fluid		
No	50	100
Mantoux Test		
Negative	48	96
Positive	2	4

Table 4. Distribution of Mean Duration of chest tube, Age, Hemoglobin, TLC, ESR, Pleural fluid biochemical analysis and Duration of antibiotics.

Variables	Mean	SD
Duration of chest tube	5.88	1.00
Age	40.82	23.44
Fever in Days	8.30	1.23
Resp Rate	46.82	7.21
Hemoglobin	9.28	1.35
TLC	13114.00	2673.53
ESR	31.44	2.76
Cell Count of Pleural Fluid Cell	11081.00	9751.75
Protien of of Pleural Fluid	11.99	10.08
Sugar of Pleural Fluid	34.98	14.66
LDH of Pleural Fluid	5942.70	4342.69
Duration of Antibiotics	15.96	3.17

DISCUSSION

This is a cross-sectional study of 50 pediatric patients aged from 1 month to 16 years with empyema who are admitted in the Department of Pediatrics College of Medical Sciences, Bharatpur, Nepal during the period of June 2014 to May 2019. We found that 7(14.0%) patients had ≤12-month age, 32(64.0%) patients had 13-60-month age and

11(22.0%) patients had \geq 60-month age. We found that 28(56.0%) patients had female and 22(44.0%) patients had male.

Kumar et al¹³ found that 25 children (17 males) were identified with empyema with a median (range) age at presentation of 3 years (4 months -11 years). 23 were malnourished, and 5 had severe wasting. Fever, dyspnea and cough were the most common (90%) manifestations at admission. Median (range) duration of fever was 12 days (5 days - 3 months). We found that 1 (2.0%) patient had 5 days fever, 5 (10.0%) patients had 6 days fever, 2 (4.0%) patients had 7 days fever, 21 (42.0%) patients had 8 days fever, 12 (24.0%) patients had 9 days fever and 9 (18.0%) patients had 10 days fever. Present study found that 32 (64.0%) patients had PEM. We found that 42 (84.0%) patients had cough, 28 (56.0%) patients had resp. distress, 10 (20.0%) patients had pain in abdomen, 9(18.0%) patients had altered sensorium, 40(80.0%) patients had pallor and 32 (64.0%) patients had Temperature. Present study found that 40(80.0%) patients had Chest wall BULGE, 35 (70.0%) patients had Mediastinal shift, 45 (90.0%) patients had dullness on percussion and 44 (88.0%) patients had breath sounds decreased.

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Present study found that 10 (20.0%) patients had Meropenem third line antibiotics and 8 (16.0%) patients had Vancomycin third line antibiotics.

Goyal et al¹⁴ found that to the mean age of the study group was 5.44 years and 48.6% were male and 51.4% were female. The most common symptoms at admission were fever (90%), dyspnoea (73%), cough (70%) and chest pain (23%). Pleural fluid cultures were sterile in 60% of patients. The most frequently identified micro-organisms were Staphylococcus aureus (34.2%). Treatment with chest tube drainage was successful in 55 (78.6%) patients. Three patients got expired. Twelve patients had decortications, all of which were successful. The lung re-expansion time was 8.00 ± 1.68 days (range: 5-13 days) in those patients in whom chest tube drainage was successful, whereas it was 7.50 ± 2.623 days (range: 4-14 days) in patients in whom decortication was done. The post-procedure stay was 10.00 ± 1.809 days (range: 7-15 days) in patients with successful chest tube drainage and 9.5 ± 2.902 days (range: 6-17 days) in case of decortication cases. Present study found that 36 (72.0%) patients had 14 days duration of antibiotics and 14(28.0%) patients had 21 days duration of antibiotics and 41 (82.0%) patients had chest tube drainage.

Present study found that the mean Duration of chest tube (mean \pm s.d.) of patients was 5.8780 ± 1.0049 days, 2(4.0%) patients had surgical procedure and all patients had outcome CU. Present study found that the mean age (mean \pm s.d.) of patients was 40.8200 ± 23.4388 months. The mean fever (mean \pm s.d.) of patients was 8.3000 ± 1.2330 days and the mean Resp Rate (mean \pm s.d.) of patients was 46.8200 ± 7.2074 . Jain et al¹⁵ found that empyema is an uncommon complication of childhood pneumonia. Although mortality rates in pediatric empyema are very low, empyema causes

significant morbidity including substantial health care costs and burden of care. Mean age of children was 5.01 years with slight female predominance (M:F = 2:3). Mean hemoglobin was 9.45 g/dl, Total leucocytes count (TLC) 17,293 with platelet counts 2.69 lakhs. PH of blood and plural fluid was 7.39 and 6.98 respectively. Cough was the most common complain (in 72%) followed by fever, breathlessness and chest pain. Present study found that the mean hemoglobin (mean± s.d.) of patients was 9.2780± 1.3509 g/dl and the mean TLC (mean± s.d.) of patients was 13114.0000± 2673.5293. The mean protein of pleural fluid (mean± s.d.) of patients was 11.9860 ± 10.0775 and the mean sugar of pleural fluid (mean± s.d.) of patients was 34.9800± 14.6629 mg/dl. The mean duration of antibiotics (mean± s.d.) of patients was 15.9600± 3.1749 days. There was no mortality.

Laishram et al¹⁶ found that majority of patients (0.64%) were seen in age group of 1-5 years. Fever (96%), breathlessness (92%), and cough (72%) were the commonest presenting features. Bacteriological examination revealed

staphylococcus aureus as the commonest etiologic agent (20%) isolated from pleural fluid culture. Pyopneumothorax (16%) was the commonest complication seen in these patients. All patients (92%) were treated with antibiotics, and drainage of the empyema was affected by closed thoracostomy in (92%) of the cases.

CONCLUSIONS

Early diagnosis and proper treatment of pneumonia can prevent the development of empyema. Antibiotics and tube thoracostomy are an effective method of treating pyogenic empyema thoracis in children in resource poor settings. Empyema thoracis in children reasons significant morbidity. Standard treatment of Empyema thoracis includes tube drainage and antibiotics. In conclusion, suitable antibiotics and prompt chest tube drainage is an effective method of treatment of childhood empyema, especially in resource poor settings. Majority of the patients progress on this conservative management and have good pleural recovery on follow up.

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