

Clinico-etiological profile of Empyema Thoracis in children: A Descriptive Analysis

Dr. Anubhav Jain¹, Dr. Maincy Devadiya², Dr. Sushant Mane³, Dr. Mukesh Meena⁴ and Dr. Mahesh Verma^{5§}

¹Resident, Department of Pediatrics, Grant Medical College, Mumbai, India, India

²Resident, Department of Gynecology and Obstetrics, Indraprastha Apollo Hospital, New Delhi, India

³Associate Professor, Department of Pediatrics, Grant Medical College, Mumbai, India, India

⁴Resident, Department of Pediatrics, SMS Medical College, Jaipur (Rajasthan) India

⁵Associate Professor, Department of Community Medicine, SMS Medical College, Jaipur (Rajasthan) India

[§]Email of Corresponding Author: verma.drmaresh5@gmail.com

Abstract—*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. A descriptive observational study was conducted on 40 Empyema Thoracis in 0-12 years aged. Empyema was diagnosed as per "GOLDEN CRITERIA. Clinical profile including signs and symptoms was recorded with biosocial profile. Blood and Plural fluid examinations were also done. Microbiology and histo-pathological examinations were also done. Data collected were analysed, qualitative data were expressed in percentage and quantitative data were expressed in mean ± SD. Mean age of children was 5.01 years with slight female predominance (M:F = 2:3). Mean haemoglobine 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. Likewise tackypnea was the most common sign elicited followed by pallor conjunctiva and cervical lymphadenopathy. On examination trachea was shifted either on right or left side in 52% cases, Creptations were observed in 72.5% of cases and Ronchi were observed in one (2.5%) case. Dullness on percussion, decrease air entry and decreased vocal resonance was observed in all the cases. Gram positive cocci and Gram negative bacilli were observed in 25% and 2.5% cases respectively. Out of these micro-organism, Streptococci, Staphylococci and Klebsela Pneumoniae were found in 7.5%, 12.5% and 2.55 of cases respectively. Acute inflammation was found in 7.5%, chronic inflammation was found in 7% whereas Koch's was found in 18% of cases in histology.*

Key word: *Children, Empyema Thoracis, Clinico-Etiological Profile.*

I. INTRODUCTION

Empyema is defined as pus in the pleural space. Empyema is an uncommon complication of childhood pneumonia and general pediatricians may only see a few cases in their career.¹ Although mortality rates in pediatric empyema are very low, empyema causes significant morbidity including substantial health care costs and burden of care.

Half of the patients with empyema develop it as a complication of pneumonia.² Factors that predispose a patient to pulmonary infection and empyema are poor orodental hygiene, periodontal disease, mental retardation, cardiac failure, sedative drug use, corticosteroid or immune-suppressive therapy and aspiration syndromes.³⁻⁶ Other factors which can predispose to empyema are IV drug abuse, sub diaphragmatic infection, lung abscess, retropharyngeal abscess, abscessed mediastinal lymph nodes, paravertebral abscess, introduction of organism related to upper abdominal surgery, trauma, thoracic surgery or thorocentesis.⁴⁻⁷ Neglected foreign body can cause bronchiectasis and predispose to

empyema.⁸ Predisposing conditions unique to children include cerebral palsy, immunosuppression, congenital heart disease and prematurity.⁹⁻¹¹ Cerebral palsy and congenital heart disease predispose to empyema due to aspiration and poor nutritional status respectively. Some cases of empyema occur without a predisposing factor.^{6,13}

Childhood empyema is an important complication of bacterial pneumonia. It is estimated that 0.6% of childhood pneumonia's progress to empyema, affecting 3.3 per 1,00,000 children.^{87,88} Due to delay in seeking medical opinion, poor facilities for culture and indiscriminate use of antibiotics

Common aerobic and anaerobic bacteria leading to empyema are *Staphylococcus aureus*, *Streptococcus pneumoniae* and *Streptococcus pyogenes* are the organisms most commonly implicated in empyema thoracic.^{11,12} *S. aureus* is the most common pathogen.^{1,13}

As its management is varied but if clinicoepidemiological factors are known then it can become easier. But there is paucity of research in this direction hence this study aims to study the clinico-bacteriological profile of empyema thoracis in children so which can help in better management of these cases.

II. METHODOLOGY

A descriptive observational study was conducted on 40 Empyema Thoracis pediatric cases (0-12 years aged) after approval of Institutional Ethical Committee was obtained.

Clinical data like signs and symptoms along with introductory data of these patient were observed and entered in semi-structured proforma. Symptomatology was recorded at time of presentation including fever, breathlessness, cough, chest pain and trauma to chest wall.

Temperature was recorded by mercury thermometer with axillary temperature recorded by care giver for full 2 minutes. A "high grade" fever is defined as when the oral temperature is above 38.2°C.⁸³

Respiratory rate was counted to find any tachypnoea and Blood pressure was recorded by age appropriate size cuff in right arm in supine position, any pallor or Lymphadenopathy (with location) if present was noted

Breathlessness or tachypnoea was defined as per IMNCI¹⁴ classification i.e. if respiratory rate is >60, >50 and >40/minute at <2 months, 2-12 months and >12 months respectively.

Respiratory system examination was done in detail to note first on inspection for any intercostal fullness and decrease chest movement and whether trachea to is central to find mediastinal shift, percussion was done to find the note (dull in case of pleural collection and underlying consolidation) and finally vocal resonance was used to differentiate between lung consolidation (increase vocal resonance) and pleural collection (decreased vocal resonance).

Empyema was diagnosed as per "GOLDEN CRITERIA"- pleural effusion with macroscopic presence of pus, a positive Gram stain or culture of pleural fluid, or a pleural fluid pH under 7.2 with normal peripheral blood PH.^{84, 85} Pleural fluid, blood culture, histopathology of pleura, CT scan of thorax and ADA.^{15,16} of pleural fluid were used to establish the diagnosis of the empyema with its causative organism.

Final diagnosis was based on the culture isolate from either pleural fluid or blood culture. Patients whose cultures were suggestive of bacteria were diagnosed as bacterial empyema, those were suggestive of fungus were diagnosed with fungal empyema and tubercular (Koch's) empyema diagnosed if-

1. Histopathology of pleura was suggestive of caseous necrosis with granulomatous inflammation.
2. Sputum or gastric lavage of patient isolates AFB.
3. Necrotic lymph nodes in CT thorax with other cultures being negative

Data thus collected were compiled in MS-EXCE in the form of master chart. These data were classified and analysed as per aims and objectives. Qualitative data were expressed in percentage and quantitative data were expressed in mean \pm SD.

III. RESULTS

In present study out of 40 patients, 16 (40%) were males and 24 (60%) females so there is slight female predominance. Overall mean age of patients were 5.01 years with SD 3.86 years and the mean age for males 3.95 years with SD 4.12 years whereas for females 5.72 years with SD 3.6 years. (Figure 1).

Figure: 1

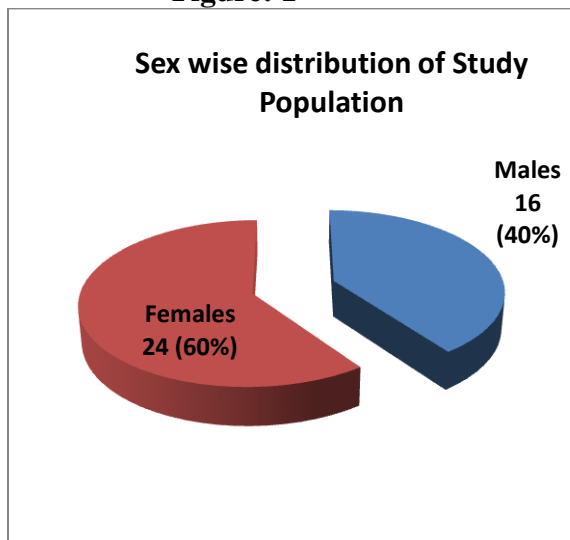
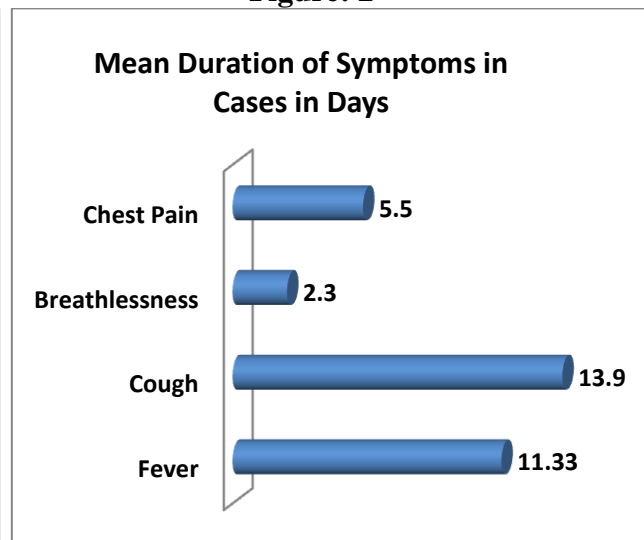


Figure: 2



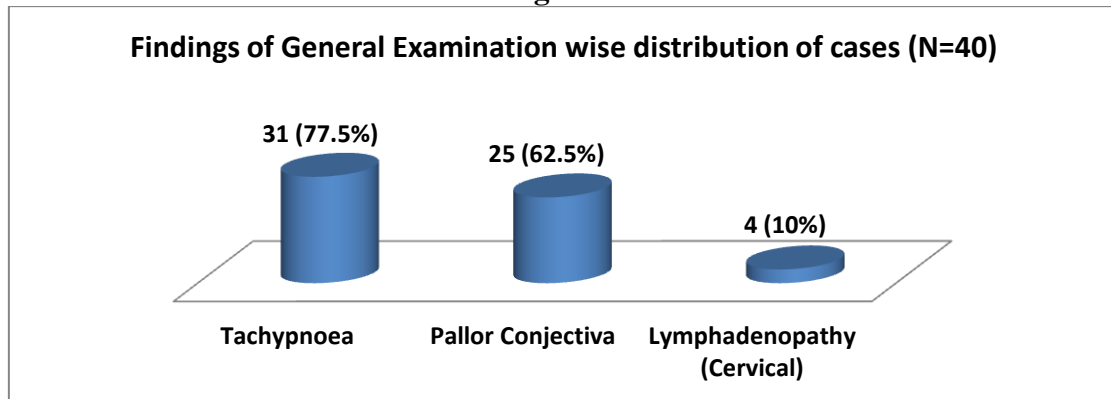
Among the 40 patients that were studied 39 had fever on presentation out of them 28 had high grade fever and remaining 11 had low grade fever .10 of them presented with chest pain and 90 % of being unilateral, 23 had breathless on presentation and 29 complained of cough while none of them had h/o trauma pertaining to thorax. (Table 1) Figure 2).

Table 1
Presenting Symptoms wise distribution of cases (N=40)

Symptoms		No	%
Fever	High	28	70
	Low	11	27.5
Chest Pain	Unilateral	9	22.5
	Bilateral	1	2.5
Breathlessness		23	57.5
Cough		29	72.5

Mean duration of fever in patients who had fever was 11.3 with SD of 5.14 days, while for cough was 13.9 with SD of 8.47 days. Mean duration of breathlessness and chest pain was observed 2.3 days with SD 0.5 and 5.5 with SD 1.3 days. Mean body temperature of children was found 100.98 F⁰ with 1.99 SD variation. (Figure 2)

Figure 3



On Examination Tachypnoea, Pallor conjunctiva and Lymphadenopathy was found in 31(77.5%), 25(62.5%) and 4(10%) respectively. (Figure 3)

Trachea was central in 19 patients while was deviated to opposite side of empyema in remaining subjects. Side of empyema in thorax was dull on auscultation with increased vocal resonance, bilateral empyema was present in 1 subject, 5 of patient had associated pneumonia of opposite lung as depicted by consolidation and increased vocal resonance. All 40 patients had decreased air entry on involved side but only 28 of them had associated crepts while only 1 of them had ronchi. (Table 2)

Table 2

Respiratory system Examination wise distribution of cases (N=40)

Variables		No	%
Trachea	Right	12	30
	Left	9	22.5
	Central	19	47.5
Percussion (Dull)	Right	17	42.5
	Left	18	45
	Bilateral	5	12.5
Auscultation	Decreased Air Entry(DAE)	11	27.5
	DAE+ Crepts	28	70
	DAE+ Crepts+ Rhonchi	1	2.5
Vocal Resonance Decreased	Right	19	47.5
	Left	20	50
	Bilateral	1	2.5

On investigation, mean haemoglobin was 9.48 with SD of 2.13, while mean leucocytes count was 17,293 with SD of 8,830 with predominant cell being neutrophils (70%) and remaining (20%) lymphocytes. Mean platelet count was 2.69 lakh with SD of 1.79 lakh. (Table 3)

Mean PH of Pleural fluid was found 6.98. Mean number of cells in pleural fluid being 603 with SD of 0.10. Mean proteins of pleural fluid being 1.71 g/dl with SD of 1.45. Sugar of pleural fluid means being 30.62 mg/dl with SD 14.97. (Table 3)

Table 3
Investigations related to Blood and Plural Fluid

S. No.	Variable related to Blood (Mean \pm SD)	Variable related to Plural Fluid (Mean \pm SD)
1	Blood pH	P. Fluid PH
	7.39 \pm 0.03	6.98 \pm 0.1
2	Haemoglobin (g/dl)	Cells
	9.48 \pm 2.13	603.8 \pm 452.28
3	Total Leukocyte Count (/μl)	Protien (g/dl)
	17,293 \pm 8830	1.71 \pm 1.45
4	Platelet count (/μl)	Sugar
	2,69,930 \pm 1.79389	30.62 \pm 14.97

In gram staining of pleural fluid, 10 (25%) had gram positive cocci and 1(2.5%) had gram negative bacilli while in 29 (72.5%) had no microorganism could be identified. (Figure 4).

Figure 4

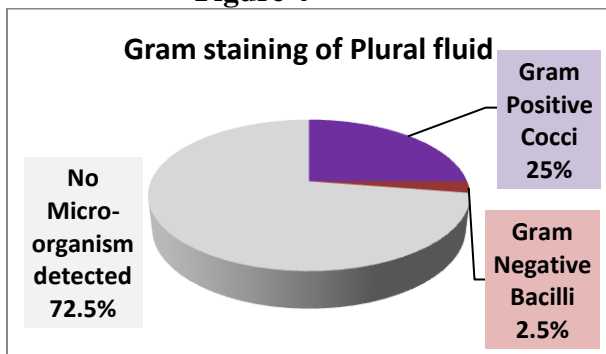
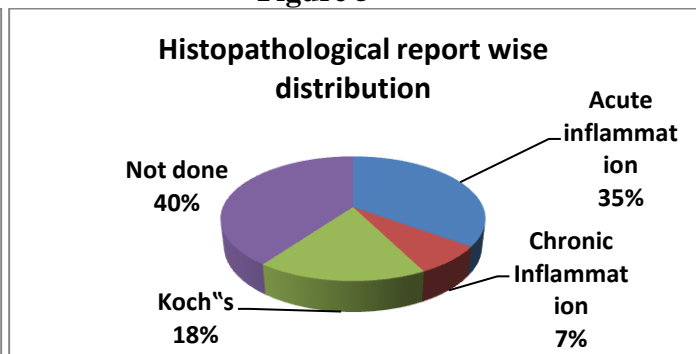


Figure 5



On pleural fluid culture out of 40, in 9 patient's plural culture micro-organism were found out of that 3 streptococci, 5 Staphylococcus aureus (3 MRSA +2 MSSA) and 1 was Klebsiella pneumonia. (Table 4)

Table 4
Micro-organism on Culture wise distribution of Study Population

S. No.	Microorganisms on Culture	No.	Percentage
1	Streptococci	3	7.5
2	Streptococci	5	12.5
	MRSA	3	7.5
	MSSA	2	5
3	K. Pneumoniae	1	2.5
4	NOI	31	77.5
	Total	40	100

On Histopathological examination of pleura in patient in patients whose pleura was sent for the same after they have undergone VATS -14 had acute inflammation, 3 had chronic inflammation, pleural of 7 patient had findings s/o Koch's; while pleura was not analyzed in 16 patient who did not required VATS. (Figure 5).

IV. DISCUSSION

In present study females were predominant as compared to males which is also in other studies like Goyal V et al¹⁷ in which 51.4 % were females which could be attributed to poor health status and malnutrition in female children in our community which predisposes them for superimposed infection. However study from north eastern part of country have reported a male predominance that could be related to existing social structure in a particular area.

Mean age of presentation in present study was 5 years which was very equal to that reported by Dass R et al¹⁸ and Cohen E et al¹⁹ which could be attributed to poor nutrition status at that age and associated exposure to environment pathogens

Most common symptoms of presentation in present study was fever (97.5 %) followed by cough (72.5 %), breathlessness (57.5 %) and chest pain (25 %) which is same as in other studies done by Dass R et al¹⁸ and Goyal V et al.¹⁷

Possible cause of fever being most important could failure of localisation of infection near airways and slow nature of progression of disease. As the collection get massive it starts irritating pleura causing cough first and later breathlessness

In present study pleural fluid culture came positive for organism in only 33.3% of cases which also correlates with other studies like done by Dass R et al¹⁸ and Nyambat B et al.²⁰ Staphylococcus was most common isolated organism in our study (65 % of culture positive cases) followed by streptococcus and other gram negative organism.²¹ Similar studies done by Nyambat B et al²⁰ and Baranwal A K et al²² also found staphylococcus as the most common organism followed by streptococcus and other gram negative organism. However the study done by Dass R et al¹⁸ concluded differently with most common organism according to them being streptococcus followed by staphylococcus and other gram negative bacteria.

V. CONCLUSION

In these emphysema cases, mean hemoglobin, Total leucocytes count (TLC) and platelet counts were in normal range. PH of blood and plural fluid was 7.39 and 6.98 respectively. Cough was the most common complain followed by fever, breathlessness and chest pain. Likewise tackypnea was the most common sign elicited followed by pallor conjunctiva and cervical lymphadenopathy. On examination trachea was shifted either on right or left side in about half of cases, Creptations were observed in majority of cases and Ronchi were observed in very few. Dullness on percussion, decrease air entry and decreased vocal resonance was observed in all the cases. Gram positive cocci were most observed micro-organism. Most observed micro-organism was Staphylococci followed by Streptococci and Klebsela Pneumoniae. Koch's was found in about one fifth of cases otherwise Acute inflammation chronic inflammation was found in about one tenth of cases.

CONFLICT

None declared till date.

REFERENCES

- [1] Strachan RE, Jaffe A. Assessment of the burden of paediatric empyema in Australia. *J Paediatr Child Health* 2009;45:431-436
- [2] Guyatt GH, Oxman AD, Kunz R et al. What is "quality of evidence" and why is it important to clinicians? *BMJ* 2008;336(7651):995-998
- [3] Jaffe A, Balfour-Lynn IM. Management of empyema in children. *Pediatr Pulmonol* 2005;40(2):148-56
- [4] Bekri H, Cohen R, Varon E et al. Streptococcus pneumoniae serotypes involved in children with pleural empyemas in France. *Arch Pediatr* 2007;14(3):239-243
- [5] Byington CL, Spencer LY, Johnson TA et al. An epidemiological investigation of a sustained high rate of pediatric parapneumonic empyema: Risk factors and microbiological associations. *Clin Infect Dis* 2002;34(4):434-440
- [6] Byington CL, Korgenski K, Daly J et al. Impact of the pneumococcal conjugate vaccine on pneumococcal parapneumonic empyema. *Pediatr Infect Dis J* 2006;25(3):250-254

- [7] Calbo E, Garau J. Invasive pneumococcal disease in children: changing serotypes and clinical expression of disease. *Clin Infect Dis* 2005;41(12):1821-1822
- [8] Calbo E, Diaz A, Canadell E et al. Invasive pneumococcal disease among children in a health district of Barcelona: early impact of pneumococcal conjugate vaccine. *Clin Microbiol Infect* 2006;12(9):867-872
- [9] Fletcher MP, Leeming JP, Cartwright KF, Finn AP, on behalf of the South West of England Invasive Community Acquired Infection Study Group. Childhood empyema: Limited potential impact of 7-valent pneumococcal conjugate vaccine. *Pediatr Infect Dis J* 2006;25(6):559-560
- [10] Gupta R, Crowley S. Increasing paediatric empyema admissions. *Thorax* 2006;61(2):179-180
- [11] Obando I, Arroyo LA, Sanchez-Tatay D et al. Molecular typing of pneumococci causing parapneumonic empyema in Spanish children using multilocus sequence typing directly on pleural fluid samples. *Pediatr Infect Dis J* 2006;25(10):962-963
- [12] Obando I, Arroyo LA, Sanchez-Tatay D et al. Molecular epidemiology of paediatric invasive pneumococcal disease in southern Spain after the introduction of heptavalent pneumococcal conjugate vaccine. *Clin Microbiol Infect* 2007;13(3):347-348
- [13] Roxburgh CS, Youngson GG, Townend JA, Turner SW. Trends in pneumonia and empyema in Scottish children in the past 25 years. *Arch Dis Child* 2008;93(4):316-318
- [14] <http://nrhm.gov.in/nrhm-components/rmnc-h-a/child-health-immunization/child-health/guidelines.html>
- [15] Porcel JM, Esquerda A, Bielsa S. *Eur J Intern Med.* 2010 Oct;21(5):419-23
- [16] Liang QL, Shi HZ, Wang K, Qin SM, Qin XJ. *Respir Med.* 2008 May; 102(5):744-54
- [17] Goyal V1, Kumar A, Gupta M, Sandhu HP, Dhir S. *Afr J Paediatr Surg.* 2014 Jul Sep; 11(3):206-10
- [18] Dass R, Deka NM, Barman H, Duwarah SG, Khyriem AB, Saikia MK, Hoque R, Mili D. *Indian J Pediatr.* 2011 Nov; 78(11):1371-7
- [19] Cohen E, Mahant S, Dell SD, Traubici J, Ragone A, Wadhwa A, Connolly B, Weinstein M. *Arch Pediatr Adolesc Med.* 2012 Nov;166(11):999-1004
- [20] Nyambat B, Kilgore PE, Yong DE, Anh DD, Chiu CH, Shen X, Jodar L, Ng TL, Bock HL, Hausdorff WP. *BMC Infect Dis.* 2008 Jul 11;8:90
- [21] I M Balfour-Lynn, E Abrahamson, G Cohen, S King, D Parikh, A H Thomson, et al BTS guidelines for management of pleural infection in children. *Thorax* 2005; 60(suppl1):i1-21
- [22] Baranwal A K , Singh M , Marwaha R K, Kumar L Empyema Thoracis ;A 10 year comparative review of hospitalized children from south Asia.*Arch Dis Child* 2003;88:1009-1014.