

CLINICAL, RADIOLOGICAL AND BACTERIOLOGICAL STUDY OF EMPYEMA THORACIS IN CHILDRENA. Krishna Prasad¹, K. Koteswara Rao², K. Adi Reddy³, Solomon Saawan P⁴, S. Anusha⁵**HOW TO CITE THIS ARTICLE:**

A. Krishna Prasad, K. Koteswara Rao, K. Adi Reddy, Solomon Saawan P, S. Anusha. "Clinical, Radiological and Bacteriological Study of Empyema Thoracis in Children". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 77, September 24; Page: 13286-13299, DOI: 10.14260/jemds/2015/1911

ABSTRACT: Empyema thoracis is a purulent pleural effusion, common complication in children.¹ with the advent of antimicrobial drugs the incidence of empyema has been drastically reduced. In developing countries like India, even though the incidence of empyema has reduced drastically, it continues to be a major problem despite the availability of new and more potent antimicrobial drugs and improved surgical techniques.

KEYWORDS: Empyema, Pyopneumothorax, Pleural effusion, ICTD.

INTRODUCTION:

STUDY METHODS: The study includes children diagnosed to have empyema or pyopneumothorax in pediatric wards of Govt. General Hospital, Kakinada from June 2014 to March 2015. This is a Prospective study. The study includes 39 children.

RESULTS:

- Age distribution ranged from 3 months to 12 years. The youngest child with empyema in this study was 3 months old and the oldest 12 years old. Highest no of cases i.e. 21(53.81%) occurred in the age group of 1-5 years.²
- A high prevalence has been observed in males.64.10% of cases being males and 35.89% being females
- The incidence of empyema was more common on right side.³ 61.35% cases occurred on the right side and 33.46% on the left side.
- The fever was the most common and consistent symptom, followed by breathlessness and cough.⁴
- The most consistent physical sign is dull note on percussion (100%) next common signs are diminished vocal resonance, decreased breath sounds and respiratory distress.
- In 19 cases 48.5% the duration of symptoms is between 4 to 7 days. In 25(64.10%) the symptoms are less than one week duration.
- In our study, 61.53 cases showed some degree of malnutrition.⁵
- On bacteriological examination, 21 positive gram's stain preparations showed gram positive cocci in clusters, interpreted as staphylococci of which 8 cases gave positive culture for coagulase positive staphylococci.
- Staphylococci alone were found to be the commonest organism causing Empyema.⁶ in children in about 53.84 cases.
- On radiological examination, we found empyema thoracis in 28 cases.⁷ (71.79%) and pyopneumothorax in 9 cases (23.07%).

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- Of the remaining 36 cases, where ICTD (Intercostal Chest Tube Drainage) was kept, 2 cases expired. The duration of ICTD in surviving 34 cases: 55.88% cases needed ICTD for a period of between 11 -20 days. 91.17%cases required less than 20 days of ICTD.
- The duration of hospital stay in the surviving 36 cases: Hospital stay ranged from 7 days to 65 days, 41.66% required less than 20 days and 91.66% were discharged within 30 days of admission.

CONCLUSION: Empyema is a still common complication and good degree of suspicion is required for early diagnosis. Empyema was more frequently found in boys. The male to female ratio was 1.8:1. The age group that was most frequently found to be effected was 1- 5 years. On a whole 61.53% of children showed some degree of malnutrition. Right side 63.53% was more frequently affected than left. The average duration of symptoms before coming to hospital was 4 to 7. The prominent symptoms were fever 97.43% breathlessness and cough 94.87 %. Radiologically 71.79% cases were empyema, 23.07% of cases were pyopneumothorax. ICTD was kept for a period of 10- 20 days on an average 91.17% cases required ICTD for less than 20 days. The average duration of hospital stay was 20-30 days during the whole period of which antibiotics were given. The overall mortality rate was 7.69%.

MATERIALS AND METHODS:

Source of Data: The study includes children diagnosed to have empyema or pyopneumothorax in pediatric ICU/ OPD and wards of Govt. General Hospital, Kakinada from June 2014 to March 2015. This is a Prospective study. The study includes 39 children.

Inclusion Criteria: All children with clinical or radiological features of empyema coming to ICU / OPD in department of Pediatrics, Govt. General Hospital, Kakinada.

Exclusion Criteria: children with cardiac disease, renal failure, acute chest injury, congenital malformations of lungs, malignancy were excluded from study.

Method of Collection of Data: A detailed history was taken and a thorough physical examination was carried out in all patients. Foci of infection like pyoderma, chronic suppurative otitis media (CSOM).⁸ are noted if present. The following investigations were carried out routinely.

INVESTIGATIONS:

1. **Urine:** Examined for the presence of albumin and sugar.
2. **Stool:** Examined for the presence of ova and cysts, especially cysts of *Entamoeba histolytica*.
3. **Blood:** Examined for W.B.C count and differential count. Hemoglobin percentage was estimated in all cases.
4. **E.S.R.** was done in all cases.
5. **B.C.G/Montoux Testings:** Mantoux testing where the child has been vaccinated with BCG and BCG testing in UN-vaccinated children was done.
6. **Chest X-ray:** Chest X-Ray P.A view and in selected patients lateral view were taken at time of admission, during therapy and at discharge. In some cases, Chest X-Ray was taken on follow up visits also.

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7. **Pleural Fluid:** Pleural fluid was aspirated.⁹ with full aseptic precautions and the following tests were performed.
 - Macroscopic appearance: Colour, odour, consistency.
 - Gram's staining.
 - Acid fasts staining by Zeihl-Nelson methods in some cases, i.e.in cases of children above 3 years and in those cases with chronic or insidious history.
 - Culture & Sensitivity of Pyogenic organisms.
 - Estimation of total protein content of pleural fluid.
8. Ultrasonography.

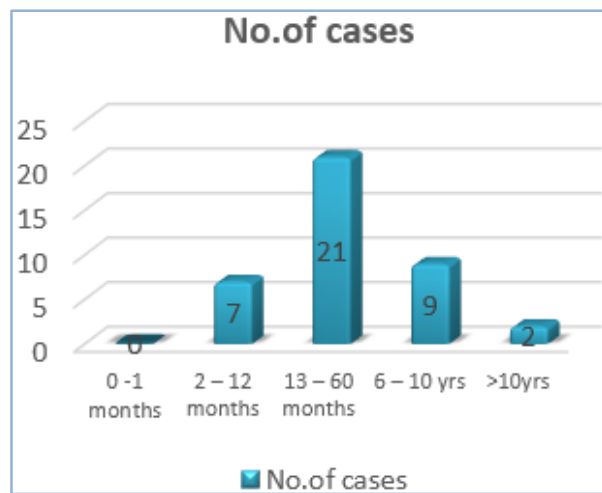
Management Methods: The following principles were observed in all cases:

- **Pleural Aspiration and Intercostal Tube Drainage.**^{10:} As soon diagnosis of Empyema was established, intercostal tube drainage with underwater seal (ICTD) was performed in most of the cases. In few cases where the fluid was minimal in amount or as an emergency measure to relieve acute dyspnea, thoracocentesis was done which in some cases was followed by ICTD techniques. The tube was removed in general, when collection of pus was small i.e. less than 30cc, or symptomatic relief when the child became afebrile for 4 - 5 days continuously.
- **Chemotherapy:** Along with ICTD patients were put on antibiotics.
- **General Measures:** All the patients were given high protein diet.¹¹ as long as they stayed in hospital. Anti-pyretics and analgesics were used for symptomatic relief.

Follow Up: All the patients were advised to come for follow up after 15 days - 1 month.

RESULTS: 39 children were studied with respect to the clinical, radiological and bacteriological aspects. The response to treatment, mortality and morbidity was assessed.

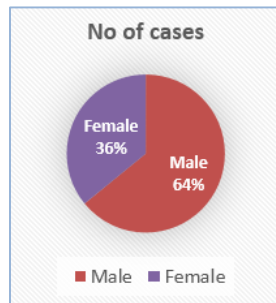
1. **Age Distribution of Empyema in Children:** Age distribution ranged from 3 months to 12 yrs. The youngest child with empyema in this study was 3 months old and the oldest 12 yrs. old. Highest no of cases i.e. 21(53.81%) occurred in the age group of 1-5 yrs.



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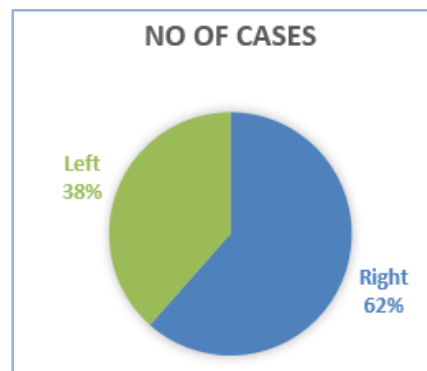
Age Group	No. of cases	%
0 - 1 months	0	0
2 - 12 months	7	17.94%
13 - 60 months	21	53.84%
6 - 10 yrs.	9	23.07%
>6 yrs.	2	5.12%
	39	100%

2. **Sex Distribution:** A high prevalence has been observed in males. 64.10% of cases being males and 35.89% being females.¹²



Sex	No. of cases	%
Male	25	64.10%
Female	14	35.89%
	39	100%

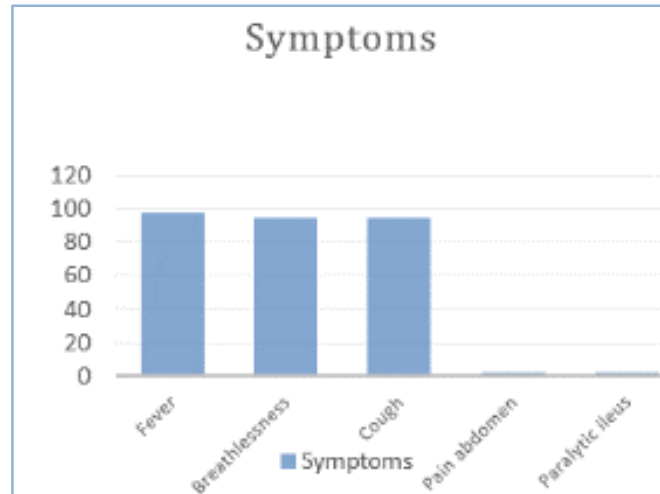
3. **Side of lesion:** The incidence of empyema was more common on right side. 61.35% cases occurred on the right side and 38.46% on the left side.



Sex	No of cases	%
Right	25	61.53%
Left	15	38.46%
	39	100%

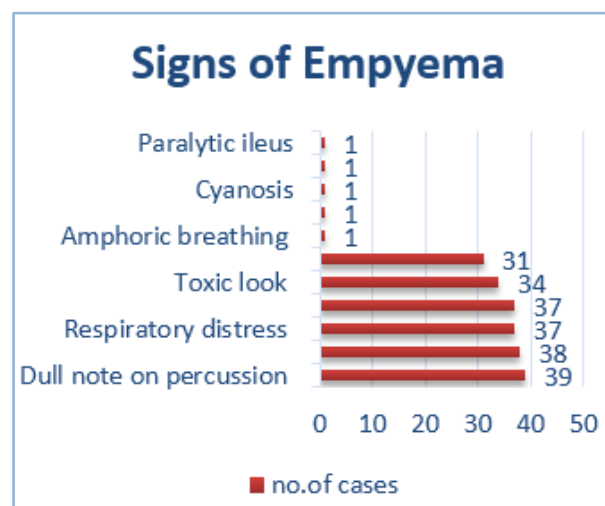
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4. **Mode of Presentation of Empyema:** The fever was the most common and consistent symptom, followed by breathlessness and cough. There was one case which presented with fever and abdominal pain, but without respiratory symptoms. A three month old child presented with only dyspnea but without fever or cough.



Symptoms	No. of cases	%
Fever	38	97.43%
Breathlessness	37	94.87%
Cough	37	94.87%
Pain abdomen	1	2.56%
Paralytic ileus	1	2.56%

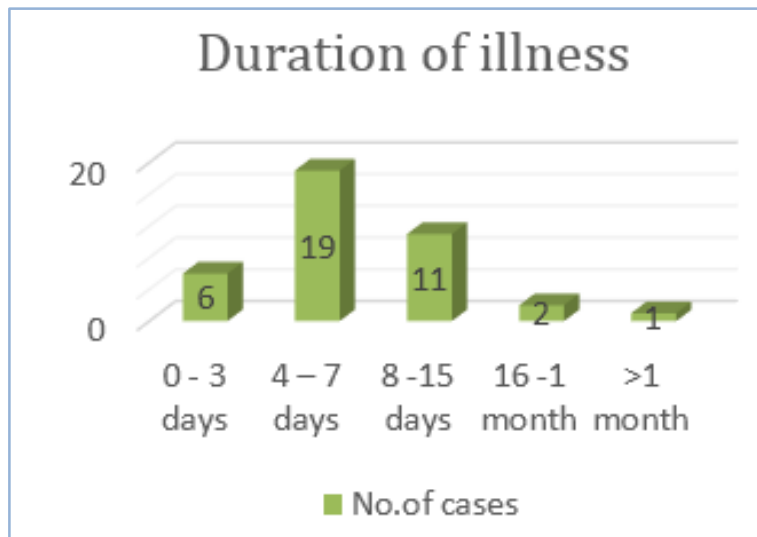
5. **Signs of Empyema:** The most consistent physical sign is dull note on percussion (100%) next common signs are diminished vocal resonance, decreased breath sounds and respiratory distress. One case presented with Broncho pleural fistula and amphoric breathing.¹³



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Signs of Empyema	No. of cases	%
Dull note on percussion	39	100%
Diminished vocal resonance	38	97.43%
Respiratory distress	37	94.87%
Diminished breath sounds	37	94.87%
Toxic look	34	87.17%
Mediastinal shift	31	79.48%
Amphoric breathing	1	2.56%
Raised VR	1	2.56%
Cyanosis	1	2.56%
Subcutaneous Emphysema	1	2.56%
Paralytic ileus	1	2.56%

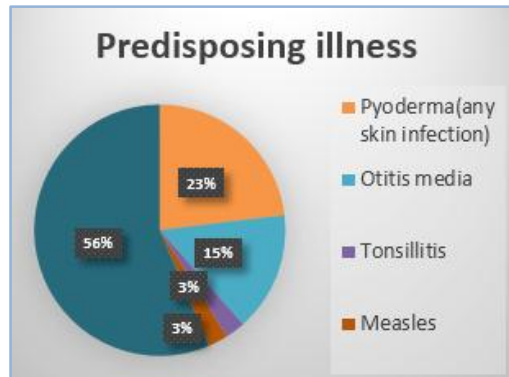
- 6. Duration of Illness Prior to Hospitalization:** In 19 cases 48.5% the duration of symptoms is between 4 to 7 days. In 25 (64.10%) the symptoms are less than one week duration. Only one case has duration of symptoms more than one month. The rest of the cases duration of symptoms ranged from 1 week to 1 month.



Duration of illness	No. of cases	%
0 - 3 days	6	15.38%
4 - 7 days	19	48.71%
8 - 15 days	11	28.20%
16 - 1 month	2	5.12%
>1 month	1	2.56%
	39	100%

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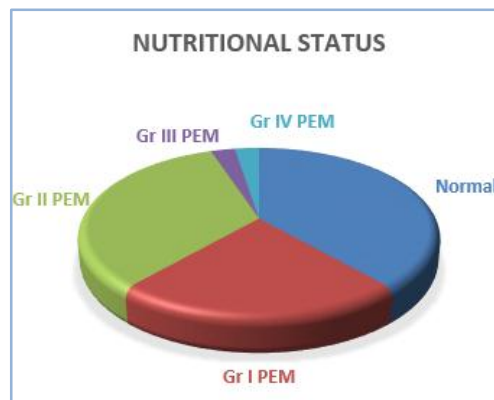
7. Predisposing illness: Only those cases where the predisposing illness was present before the presenting symptoms were taken into study.



Predisposing Illness	No. of cases	%
Pyoderma (Any skin infection)	9	23.07%
Otitis media	6	15.38%
Tonsillitis	1	2.56%
Measles	1	2.56%
None	22	56.42%
	39	100%

8. Nutritional Status: The Indian Academy of Pediatrics Classification was followed in grading the nutritional status of the children.

On the whole 61.53 cases showed some degree of malnutrition.



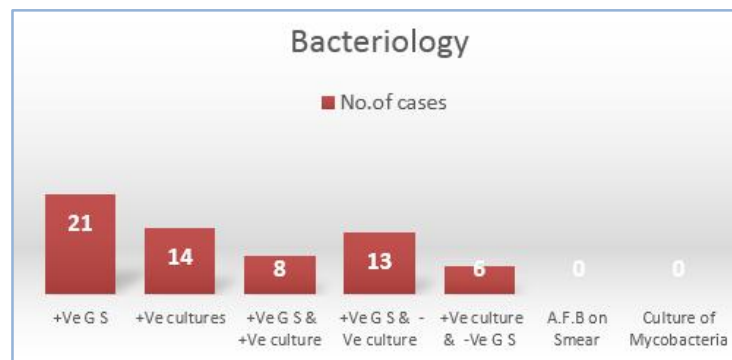
Nutritional Status	No. of cases	%
Normal	15	38.46%
Gr I PEM	9	23.07%
Gr II PEM	13	33.33%
Gr III PEM	1	2.56%
Gr IV PEM	1	2.56%
	39	100%

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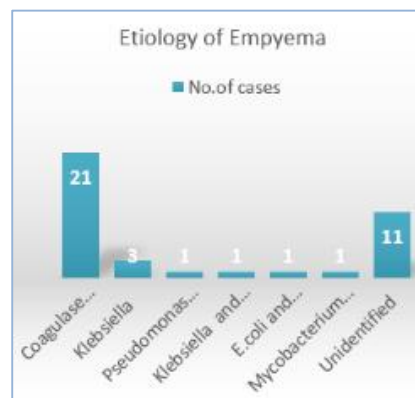
9. Bacteriology: In all the 39 cases, after aspiration of pus Gram's staining was done and the pus was sent for culture and sensitivity. In 3 patients who have a positive contact history with tuberculous patients A.F.B staining was done and subjected to culture of mycobacterium.

Staining & Culture	No. of cases	%
Gram's staining positivity	21	53.84%
Positive cultures	14	35.89%
Positive Gram's staining but negative culture	8	20.51%
Positive culture but negative Gram's staining	13	33.33%
Positive culture & Gram's staining	6	15.38%
A.F.B on Smear	0	0
Culture of Mycobacteria	0	0

21 positive gram's stain preparations showed gram positive cocci in clusters, interpreted as staphylococci of which 8 cases gave positive culture for coagulase positive staphylococci. On only one occasion culture for staphylococci was positive where Gram's stain did not show organisms. But in this case both E. coli and Staphylococci were cultured.¹⁴



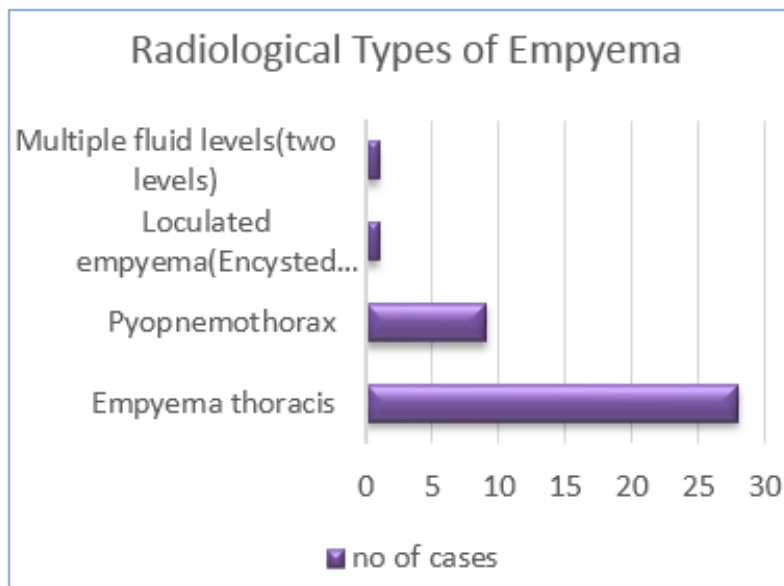
10. Etiology of Empyema: Staphylococci alone were found to be the commonest organism causing Empyema in children in about 53.84 cases. In one case, Staphylococci and E.coli were together isolated. The Staphylococci was found to be causative organism in 22 cases (56.41%). They constituted 85.71% of the cases where organism were identified. Tuberculous empyema constituted 2.56%. In 28.20% of cases the organism could not be identified bacteriologically.¹⁵



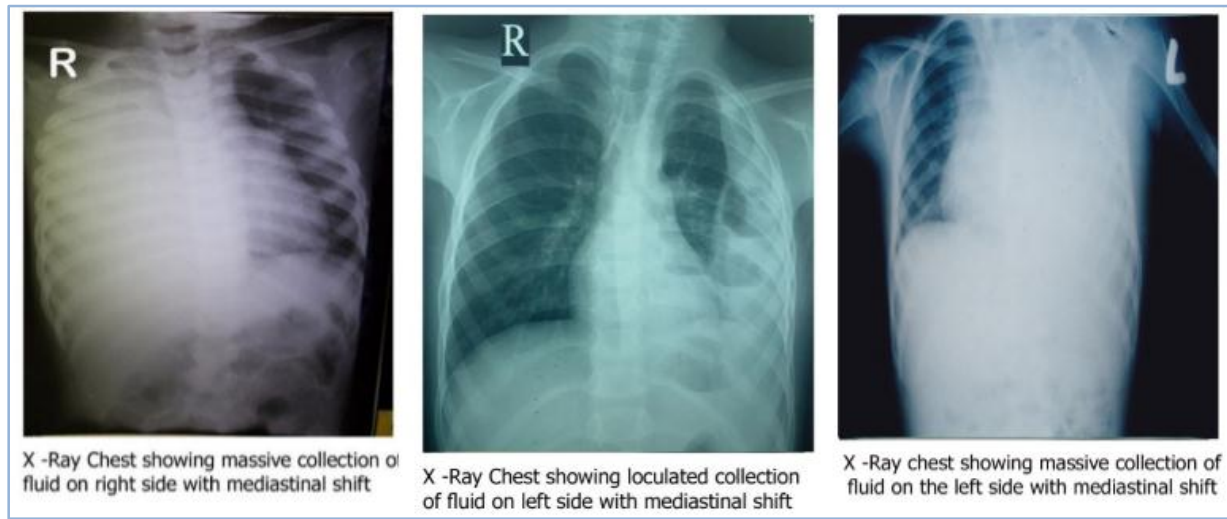
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Etiological organism	No. of cases	%
Coagulase positive staphylococci	21	53.84%
Klebsiella	3	7.69%
Pseudomonas aeruginosa	1	2.56%
Klebsiella and E.coli	1	2.56%
E.coli and Coagulase positive staphylococci	1	2.56%
Mycobacterium tuberculosis (Possibly)	1	2.56%
Unidentified	11	28.20%
	39	100

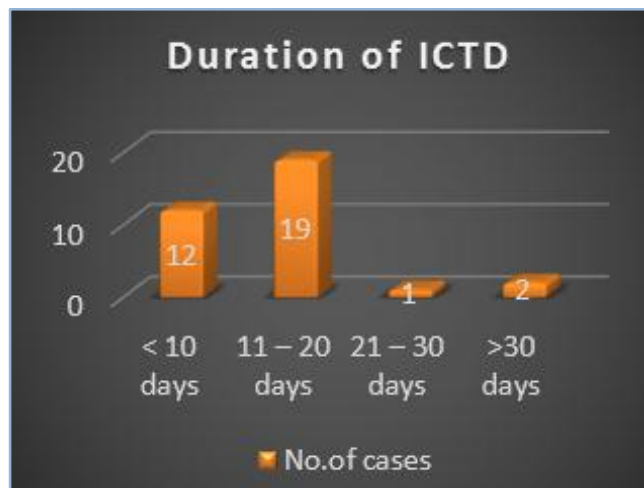
- 11. Radiological types of Empyema Thoracis:** In all cases Chest X-rays was taken in different views. Ultrasonography was used in three cases.



Diagnosis	No. of cases	%
Empyema thoracis	28	71.79%
Pyopneumothorax	9	23.07%
Loculated empyema (Encysted empyema)	1	2.56%
Multiple fluid levels (two levels)	1	2.56%
	39	



12. Duration of intercostal tube drainage: In all but three cases, ICTD was performed. Of these three cases, one was tuberculous empyema, one was loculated empyema and one case expired even before ICTD was attempted. Of the remaining 36 cases, where ICTD was kept, 2 cases expired. The duration of ICTD in surviving 34 cases: 55.88% cases needed ICTD for a period of between 11 -20 days. 91.17% cases required less than 20 days of ICTD. Needle aspiration was done only in three cases.¹⁶



Duration of ICTD	No. of cases	%
< 10 days	12	35.29%
11 - 20 days	19	55.88%
21 - 30 days	1	2.94%
>30 days	2	5.88%
	34	

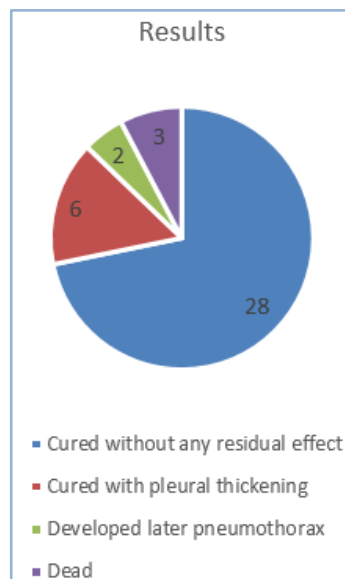
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13. Duration of hospital stay: The duration of hospital stay in the surviving 36 cases: Hospital stay ranged from 7 days to 65 days, 41.66% required less than 20 days and 91.66% were discharged within 30 days of admission.



No. of cases	No. of cases	%
<10 days	1	2.77%
11-20 days	14	38.88%
21-30 days	18	50%
>30 days	3	8.33%
	36	

14. Results of Treatment: 28 cases (71.79 %) were cured without any residual defects i.e. no fever, normal breath sounds, resonant percussion note and x-ray evidence. Of the 6 which were cured with pleural thickening¹⁷, 4 cases did not show any further improvement during the follow up and two cases showed improvement to almost normal during the follow up. Of the two cases with pneumothorax one case improved with conservative management while the other case was lost for follow up. Of the three deaths, one expired within few hours of admission. In another two cases one was thought to be malnutrition and aspiration and other due to empyema and its unrelieved toxicity.



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Results	No. of cases	%
Cured without any residual effect	28	71.79%
Cured with pleural thickening	6	15.38%
Developed later pneumothorax	2	5.12%
Dead	3	7.69%
	39	

DISCUSSION: Males are more affected than females in the present study. The incidence of empyema was more on right side compared to left side in our study. The duration of symptoms prior to hospitalization is about 4 to 7 days. The commonest symptoms are fever, breathlessness and cough. Malnutrition can be an associated feature and predisposing factor for Empyema. Predisposing illness in the form of pyrogenic focus or measles infection was reported in the previous studies. Coagulase positive staphylococci was found to be the commonest organism. For identification of organism Gram's staining was found to be superior to culture¹⁸. All the cases except 3 were treated by ICTD and antibiotics as soon as possible. No attempt was made to compare the results of ICTD versus repeated aspirations. The average duration of ICTD was 16 days. The mortality rate in the present study was 7.69 %. Two cases developed pneumothorax of which one case improved and the other was lost for follow up. Decortication and other radiological procedures were not required in any of our cases.



**7Yr/Fch IP 459812
Right empyema With
ICD in situ**

**5Yr/Mch IP 567401
Right empyema With
ICD in situ**

**4Yr/Mch IP 642917
Right empyema With
ICD in situ**

CONCLUSION: Empyema is a still common complication and good degree of suspicion is required for early diagnosis. Empyema was more frequently found in boys. The male to female ratio was 1.8:1. The age group that was most frequently found to be effected was 1- 5 years. On a whole 61.53% of children showed some degree of malnutrition. Right side 63.53% was more frequently affected than left. The average duration of symptoms before coming to hospital was 4 to 7. The prominent symptoms were fever 97.43% breathlessness and cough 94.87 %. Radiologically 71.79%cases were empyema, 23.07% of cases were pyopneumothorax. ICTD was kept for a period of 10- 20 days on an average 91.17%cases required ICTD for less than 20 days. The average duration of hospital stay was 20-30 days during the whole period of which antibiotics were given.

The overall mortality rate was 7.69%. X- Ray chest, Ultrasonography of chest and CT scan are useful modalities for diagnosis and follow up. Thoracocentesis and pleural fluid analysis help in deciding therapy. Proper antibiotic coverage and prompt drainage by chest tube reduces the mortality and morbidity considerably. Hence early recognition and treatment of ARI in children lessens admission into hospital and prevents mortality and morbidity following complications like empyema.

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