

# Empyema thoracis in children: A prospective study in rural India

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## Abstract

**Objectives:** To evaluate different modalities of treatment in empyema chest in children in respect to different stages of disease. **Methods:** 94 patients in age group 1 to 12 years admitted in department of surgery, Government Medical College, Miraj with diagnosis empyema chest managed by various treatment options according to stage of disease. **Results:** 63 patients shows improvement after intercostal drainage. Mean hospital stay was 7 days. 6 patients managed by streptokinase instillation through inter costal drain. Mean hospital stay was 11.89 days and decision thoracotomy was taken in 25 patients and mean hospital stay was 25.48 days. **Conclusion:** Management of pleural empyema in childrens depend on time of presentation. Early presentation improved by ICD and antibiotics only and surgical indication is often delayed, particularly when there is late presentation causing multiple loculations or severe sepsis. Early thoracotomy yields a better clinical outcome for pediatric patients with pleural empyema, with apparent decreased morbidity and mortality, earlier chest tube removal, earlier hospital discharge and improved response to antibiotic therapy.

**Keywords:** Empyema; children; thoracotomy;

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inflammatory injury. This process results in deposition of dense layer of fibrin on both pleural surfaces. Fibroblasts moves into the pleural space and produce septa leading to loculations.<sup>1,2,3</sup> The present study includes 94 cases of empyema chest in a district teaching hospital. We have evaluate various treatment options viz. intercostal drainage, intrapleural instillation of streptokinase and thoracotomy. Treatment option of thoracoscopy is not evaluated because of unavailability of facility being a rural hospital.

## INTRODUCTION

The development of parapneumonic effusion is gradual with the pleural fluid collection most commonly divided into three stages. **Stage 1:** Exudative stage: Parapneumonic collection that occurs in first 48-72 hours is exudative in nature, sterile. **Stage 2:** Fibrino-purulent stage: If pneumonia remains untreated the amount of pleural fluid increases with time due to endothelial injury and increased localized permeability and edema. Bacteria invade pleural space and become persistent. **Stage 3:** Organizing stage – In this stage pleural fluid becomes clottable with a large concentration of plasma protein in the pleural space and reduced fibrinolytic activity due to

## MATERIAL AND METHODS

This study was carried out in pediatric surgery ward of 94 cases of empyema chest in children were studied. Most of the patients were from peripheral villages. Detailed clinical history was noted. Time of onset of symptoms and presentation to hospital was noted. Complete clinical respiratory system examination was done to the note signs of empyema and mediastinal shift.

- Radiological study chest X-ray PA view and lateral view, ultrasonography of chest and CT scan chest.
- Pleural fluid diagnostic aspiration for cytology, gram stain, z-n stain and culture and sensitivity to antimicrobial agents.

After confirming diagnosis, all patients were managed with broad spectrum intravenous antimicrobial agents initially and culture specific antimicrobial agents thereafter along with intercostals drainage. Thoracotomy with debridement / decortication was considered in those patients who did not respond to intravenous antimicrobial agents and intercostal tube drainage within 72 hours of procedure. Improvement noted clinically and radiologically. Data collected were age, sex, socio-economic status, presenting symptoms and signs, investigations, culture results, drainage procedure, operative procedure, number of days in hospital and complications.

Patients with AFB positive on culture were excluded from study.

### OBSERVATIONS

Important observations of studies are as follows:

**Table 1:** Table showing duration of symptoms in weeks before diagnosis was established

Duration in weeks	Number of cases	Percentage
< 1	45	48
1-2	18	19
2-4	20	22
> 4	11	11
<b>Total</b>	<b>94</b>	<b>100</b>

In present study 45 patients were presented in first week of disease. 18 patients presented in 2<sup>nd</sup> week, 20 patients in 3<sup>rd</sup> week and 10 patients in 4<sup>th</sup> week. Shortest period of presentation is 5 days and longest is 39 days.

**Table 2:** Table showing causative organisms isolated from pleural fluid culture

Organism	No. of cases	Percentage
Staphylococcus aureus	48	51
Streptococcus pneumonia	15	16
Klebsiella pneumonia	12	13
No Organism	19	20

**Table 3:** Stages of disease and number of patients

Stage Of empyema	Number of patients
Stage 1	45
Stage 2	18
Stage 3	31

In present study 45 patients are of stage 1, 18 patients are of stage 2 and 31 patients are of stage 3 empyema as per radiological and clinical correlation.

**Table 3:** Table showing methods of treatment of empyema chest

Type of treatment	No of cases	Percentage
Intercostal tube drainage	63	67
Thoracotomy	25	27
VATS	Nil	Nil
Streptokinase instillation	6	6
<b>Total</b>	<b>94</b>	<b>100</b>

In this study, 63 patients were treated with intercostal tube drainage alone and recovered, while 31 patients did not improve totally after putting intercostal drainage tube. Out of 31 patients 6 were improved after streptokinase instillation through ICD. 25 patients undergone thoracotomy and debridement/decortications/lobectomy. All cases which underwent thoracotomy belonged to stage III empyema. These cases did not respond to routine management with intravenous antimicrobial agents and intercostal drainage tube.

**Table 4:** Table showing mean hospital stay

Sr. no	Procedure	No. of cases	Mean Hospital stay
1	ICD	63	7 days
2	Intrapleural streptokinase	6	11.89 days
3	Thoracotomy	25	25.48 days

Mean hospital stay in cases treated by ICD were 7 days , in cases treated by Intrapleural streptokinase were 11.89, and in cases treated by thoracotomy was 25.48 days.

### DISCUSSION

In our study, empyema chest was more common in children between 1-5 years of age (52.5%). Geha *et al*<sup>4</sup> observed empyema chest in children more commonly below the age of 10 years. He states two peaks of the disease, in first year of life and in third year of life. Similarly in the present series, empyema chest was more common in 1-5 year age group. Magnete *et al*<sup>5</sup>, Goyal *et al*<sup>6</sup> also found most of the patients from low socio-economic status. The reason behind the fact was that pulmonary infections are more common with poverty, illiteracy, unemployment and overcrowding. Patient presented with fever, cough (100%) and breathlessness (95%). Goyal *et al*<sup>6</sup> found cough in 100% cases and breathlessness in 92% cases. Foglia *et al*<sup>7</sup> had considered fever as a indicator of clinical improvement with other factor such as leukocytosis and CT scan findings. cause of breathlessness was collapse of underlying lung in the affected side of empyema. In this study 45 cases presented in first week of their illness. Anemia and malnutrition was found in all patients in our series. Goyal *et al*<sup>6</sup> found anemia in all cases. Lung infections were more common in malnourished and anemic children. In present study, right sided empyema was more common (72.5%) cases. Similar findings were observed in Stephen *et al*<sup>8</sup> and Goyal *et al*<sup>6</sup> right sided bronchus is more in line with trachea than that of left side. So lung infections are more common on right side and empyema is also common in right side. In present study, most common chest X ray finding was hydrothorax in all 94 cases. Hydro pneumothorax found in 7 cases and mediastinal

shift was present in 33 cases indicating massive empyema. Goyal *et al*<sup>6</sup> found encysted empyema in 9.43% cases. chest x ray did not clearly indicate pleural thickening and loculations. In present study, chest ultrasonography was done to confirm the diagnosis, to know the nature of the fluid collection and to stage the disease.

- **Stage 1:** Collection of echoic fluid without septations.
- **Stage 2:** Collection of echoic fluid with thin septations.
- **Stage 3:** Collection of echoic fluid with loculations and thickened pleura more than 5mm thickness.

In this study 45 patient showed stage 1 empyema. 18 patients were stage 2 empyema and 31 patients were stage 3 empyema. We did chest ultrasound at regular intervals to assess the progress of disease, residual pleural collection, pleural thickening and loculations. We did CT scan chest in 31 of our patients who did not respond to treatment with IV antibiotics and intercostal tube drainage. Loculations, collapsed lung and thickened pleura were common findings in these patients. The parietal and visceral pleura are separated by interposed empyema fluid giving rise to 'split pleura sign' of empyema. CT scan differentiates extrapleural and subcostal fat external to thickened pleura by its much lower CT attenuation. It usually differentiates empyema from consolidation and lung abscess. In present study, out of 94 cases, causative organisms were isolated in 75 cases. Out of 16 cases, 15 showed single organism and one case showed two organisms. Staphylococcus Aureus was the most common organism isolated from 48 cases, Klebsiella Pneumoniae from 15 cases and Streptococcus pneumoniae from 12 case. 19 cases showed no organisms cultured after 48 hours of incubation period (60%). Geha *et al*<sup>4</sup> found Staphylococcus Aureus (28%) was most common pathogen followed by Pseudomonas Pyocynae in 27% cases.

Sterile empyema in our series was due to following causes:

- Prior antibiotic treatment
- Failure of culture of anaerobes

In our series, ninety five percent cases were synpneumonic empyema. Only 5% cases were of tuberculous origin. This is because pneumonia is more common in paediatric age group. Higher incidence of synpneumonic empyema may be due to

- Most of our patients from rural area with poor socio economic status
- Ignorance towards the disease and complaints
- Inadequate and inappropriate treatment

Other cause of empyema in our study was tuberculous empyema. With the introduction of prompt antikoch's treatment such as DOTS therapy, this complication of tuberculosis was declined significantly (Goyal *et al*<sup>6</sup>)

The aims of treatment of established empyema must be as follows:

1. To drain all pus from pleural cavity
2. To achieve full expansion of the underlying lung.
3. Identifying stage of disease and treating accordingly.

In present study, antibiotics were used in all patients. Initially combination of ampicillin + Cloxacillin was used. Later on antibiotic treatment was carried out according to pus culture sensitivity. In 75 patients specific antibiotics were used. In patients whose culture reports were negative broad spectrum antibiotics covering both aerobes and anaerobes were used.

Intravenous fluids and oxygen inhalation were given to all patients with severe respiratory distress. Blood transfusion was given to the patients who were severely anaemic. Geha *et al*<sup>4</sup>, Stephen *et al*<sup>8</sup>, Magnete *et al*<sup>5</sup>, Chan *et al*<sup>9</sup> state similar concept about use of antibiotics in the treatment of empyema in children. The method by which drainage of pus with other aims of treatment achieved are:

1. Thoracostomy tube drainage
2. Thoracostomy tube drainage with intrapleural fibrinolytic instillation.
3. Thoracostomy and debridement of empyema with decortications.

None of these patients were treated with repeated thoracocentesis, and video-assisted thoracoscopic surgery. VATS option was not available during study period. In this study, initially all patients were treated with thoracostomy tube drainage immediately after admission. All patients were relieved from dyspnoea after drainage of pus. Chest physiotherapy and breathing exercise were advised to children with the help of balloon and whistle. Repeat chest x-ray and ultrasound chest was done after 48 hours of I.C.D. insertion. Full expansion of lung was indicated by improved air entry to affected side and ceasation of water column movement and also it is assessed by chest X-ray and ultrasound chest. In this study 63 patients showed recovery clinically and radiologically. Many workers have established role of thoracostomy tube drainage. Geha *et al*<sup>4</sup>, Goyal *et al*<sup>6</sup> mentioned closed drainage is better than repeated thoracocentesis. Stephen *et al*<sup>8</sup> treated 44 patients in his series with I.C.D. with success rate of 45%. Magnete *et al*<sup>5</sup> stated that 55 out of 59 patients were successfully treated with I.C.D. only and decortication required for only one patient. Chan *et al* stated 82% of his patients were responded for I.C.D. Certain disadvantages of

intercostals tube drainage were observed during treatment.

1. Many times tube gets blocked due to thick pus.
2. Outside infection may be introduced in pleural cavity.

Intrapleural administration of fibrinolytics such as streptokinase, urokinase has been shown to be effective treatment for complicated parapneumonic effusion and pleural empyema. In present study, intrapleural instillation of streptokinase was done in 6 patients. Desmothenes *et al*<sup>10</sup> stated excellent result of intrapleural streptokinase administration in his 20 patients. This is recent trend in the management of empyema chest. As this facility was not available in our hospital none of our patient receives this modality of treatment. But recent studies showed good result with VATS. Stovoroff *et al*<sup>11</sup> initially studied thoroscopic debridement in 12 children. After surgery all children had prompt clinical improvement with complete resolution of empyema on follow up. Krasna *et al*<sup>12</sup> studied complication of thoracoscopy in 321 patient stated complication rate of only 6%. In present study out of 94 patients, 25 patients didn't respond to initial intercostals drainage and antibiotics. These patients were undergone thoracotomy. Out of these 25 patients, debridement of empyema was done in all patient (100%), additional decortications was done in 9 patients (70%) and lobectomy was done in one patient (8%). All these patients showed clinical as well as radiological recovery in first week of operation. Indications for thoracotomy. All these cases were stage III empyema on ultrasonography chest. Also CT scan of these patient shows –

- Collapse of lung.
- Encysted empyema.
- Thickened pleura more than 5 mm thick.

In present study, in cases of thoracotomy mean hospital stay was 25.48 days. Avansino *et al*<sup>13</sup> shows better result in patients treated by primary thoracotomy with mean hospital stay of 20 days.

### Complications

Following complications were encountered in this study.

- Bronchopleural fistula in 2 patients.
- Wound infection in 1 patient.

### Result

In present study 94 patients of empyema chest in children were studied. Treatment option is broadly categorized according to stage of disease. 63 patients were treated with antibiotics and ICD only and recovered. There was no morbidity and mortality with average hospital stay of 7 days. 6 patients of stage 2 empyema treated with intrapleural instillation of streptokinase with improvement and mean hospital stay 11.89 days. Decision of thoracotomy taken early in 25 cases because

of which outcome is improved without much complications. 25 patients were treated with thoracotomy and decortications. These patients were also improved in first week of operation. There was no morbidity and mortality in these cases. The average post operative hospital stay was 12.38 days with total hospital stay of 25.48.

### Follow up

In present study of 94 patients of empyema chest in children, patients were advised to come for follow up on regular interval. In 1st month weekly in 2nd month fortnightly and from 3rd month onwards monthly. In the follow up we assessed following points

- General condition of patient regarding nourishment, weight and anemia.
- Respiratory system examination regarding chest sinuses, wound, chest deformity and intercostal indrawing.
- Radiological investigations – X ray chest PA view for restrictive lung disease, collapse, consolidation.

In our study, eighty percent patient showed excellent improvement in their general condition and lung functions in first follow up. Fifteen percent patients had complaints of pain at wound site and cough in first follow up. Rest five percent did not come for follow up. We followed our patients for maximum 18 months and minimum one month.

### CONCLUSIONS

Management of pleural empyema in childrens depend on time of presentation. Early presentation improved by ICD and antibiotics only and surgical indication is often delayed, particularly when there is late presentation causing multiple loculations or severe sepsis. Early thoracotomy yields a better clinical outcome for pediatric patients with pleural empyema, with apparent decreased morbidity and mortality, earlier chest tube removal, earlier hospital discharge and improved response to antibiotic therapy.

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