Clinical Outcome Of Surgical Management Of Stage 2 And 3 Empyema Thoracis In Paediatric Age Group

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Abstract:

Background: Empyema thoracis, defined as purulent pleural effusion, describes the presence of collection of pus in intrapleural cavity. Empyema thoracis is classified into 3 different phases which describe the progression of disease, namely purulent phase, fibrinopurulent phase and organizing phase based on the contents of pleural cavity.

Materials and Methods: Thirty children range(1month to 12 years) with stage 2-3 empyema who underwent surgical decortications in our unit from Dec 23 to Dec 24 were included. Total leucocyte count, crp, pleural fluid analysis, chest x ray, cect thorax done. Surgical approach- posterolateral thoracotomy and decortication done. Statistical analysis – measures of central tendency, paired t-test, p value < 0.05 considered significant.

Results: mean age of the children was 4 years, range 1 month to 12 years, male and female distribution was 21(70%) and 9(30%) respectively. admitted on day 5 ± 3 of illness. Fever (100%), cough (100%) and respiratory distress (80%). Icu admission was required for 60% of patients, left lung(17 pts), right lung(13 pts), no bilateral lung involvement.30 patients had tube thoracostomy done, referred for decortication by day 8 of admission, time from referral to surgery was 2 days. Post-operatively, all patients were extubated in the OT, chest tubes removed on day 4 (range 1-7 days). 24 patients were discharged by day 6 (range 4-9 days). Postoperative air leak occurred in 2 patients(6%).

Conclusion: This study shows that management of stage 2-3 empyema with surgical intervention done promptly -provides good clinical outcome, preventing prolonged morbidity in patients managed with intercoastal drainage alone and persistent non lung expansion, thus influencing the decision to firmly go ahead with surgery in stage 2-3 empyema without delay.

Key Word: Empyema, Decortication

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I. Introduction

Empyema thoracis, defined as purulent pleural effusion, describes the presence of collection of pus in intrapleural cavity. Empyema thoracis is classified into 3 different phases which describe the progression of disease, namely purulent phase, fibrinopurulent phase and organizing phase based on the contents of pleural cavity. Children admitted for community acquired pneumonia were complicated with pleural empyema^[1] Optimal treatment for empyema in children remains controversial in term of the choice and duration of parenteral antibiotics, the timing and duration of tube thoracostomy, as well as the role and timing of surgical decortication .This study analyzes the clinical outcome of surgical decortication for empyema thoracis in paediatric age group patients .

II. **Material And Methods**

This prospective study was carried out on patients of Department of Cardiothoracic and Vascular Surgery, Gauhati Medical College, SSUHS University, Guwahati, Assam, India. Thirty children of age 1month to 12 years with stage 2-3 empyema who underwent surgical decortications in our unit from Dec 2023 to Dec 2024 were included in this study.

Study Design: Prospective analytical study

Study Location: This was a tertiary care hospital based study done in Department of Cardiothoracic and Vascular Surgery, Gauhati Medical College, SSUHS University, Guwahati, Assam, India

Study Duration: December 2023 to December 2024.

Sample size: 30 patients.

Sample size calculation: The sample size was estimated from the population of 32 patients who were referred for surgical decortication with stage 2-3 empyema in one year from December 2023 to December 2024, confidence level being 95%, population proportion 50 $\%^{[1]}$ (as per previous studies), margin of error 5%.

Inclusion criteria:

Age <=12 years
Male and Female patients
All patients had tube thoracostomy done

Exclusion criteria:

1. Patients who were immunocompromised , undernourished not suitable for immediate surgical intervention 2. Patients with malignancy

Procedure methodology

Informed consent was obtained from the parents. All necessary investigations were done .TC,CRP,pleural fluid analysis, chest x ray, cect thorax done. Surgical approach- posterolateral thoracotomy and decortication done, breakdown of loculations followed by drainage of intrapleural space, adhesiolyis ,excision of the thickened layers of pleura.

Statistical analysis All data was entered into a Microsoft Office Excel spreadsheet which was prepared and validated for the study data to avoid errors. Statistical analysis was done using the GraphPad Prism. Paired T Test, Two Tailed P Value<0.05 –was considered Statistically Significant.

III. Results

Mean age of the children was 4 years, range 1 month to 12 years, male and female distribution was 21(70%) and 9(30%) respectively admitted on day 5 ± 3 of illness. Fever (100%),cough (100%) and respiratory distress (80%). Icu admission was required for 60% of patients, left lung(17 pts), right lung(13 pts), no bilateral lung involvement.

Pleural fluid analysis was done which showed exudative nature for all of the children. The total white cell count and C-reactive protein (CRP) were significantly raised on hospital admission, with marked reduction after surgical decortication. Pleural fluid cultures were negative in all the patients ,as 100% of the patients had received empirical antibiotics .

CHEST X RAY revealed opacification. 30 patients had tube thoracostomy done .



Fig 1: Chest x ray before and after intercoastal drainage

CT THORAX revealed thickened layers of pleura with loculated collection

Fig 2 : CT thorax showing the thickened layers of pleura



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Referred for decortication by day 8 of admission, time from referral to surgery was 2 days. The mean duration of surgical decortication was 2.5 hours, and all of the children underwent a posterolateral thoracotomy , breakdown of loculations followed by drainage of intrapleural space, adhesiolyis ,excision of the thickened layers of pleura. Out of the 30 children who underwent surgical decortication, 5 (16.6%) children in the study was diagnosed of stage 2 empyema, the other 25 (83.3%) children have stage 3 empyema .

Fig 3: Excision of the thickened parietal and visceral layers



Post-operatively, all patients were extubated in the OT, chest tubes removed on day 4 (range 1-7 days).





24 patients were discharged by day 6 (range 4-9 days). Post-operative air leak occurred in 2 patients(6%).

Paired t test, two tailed p value was <0.0001 – which was statistically significant mean body temperature decreased to normal ranges after decortication.

Table 1 : Paired t-test derived from data used for mean body temperature before and after decortication						
GROUP	AFTER INTERCOASTAL DRAINAGE	AFTER DECORTICATION				
MEAN	100.130	98.367				
SD	1.466	0.403				

0.268

Ν	30	30	
Paired t test to	vo tailed n value was <0 0001 – which was sta	tistically significant duration of hos	snita

Paired t test, two tailed p value was <0.0001 – which was statistically significant ,duration of hospital stay-before and after surgical decortication, after is decreased (6days)

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GROUP	AFTER INTERCOASTAL DRAINAGE	AFTER
		DECORTICATION
MEAN	9.70	6.07
SD	0.84	0.83
SEM	0.15	0.15
N	30	30



Fig 5 : Scatter plot showing the duration of hospital days after(y axis) surgical decortication decreased to 6 days

SEM

0.074

IV. Discussion

Thoracic empyema is a life-threatening condition in paediatric surgical practice and the appropriate management still remains controversial. Parapneumonic pleural effusion (PPE) occurring in early-stage (stage I) pleural empyema (PE) can be managed by chest tube drainage, which should be performed as soon as possible, to achieve re-expansion of the pulmonary parenchyma. Chronic disease leads to fibrin deposits on both pleural surfaces (stage II), followed by a thickened pleura peel (stage III). A trapped or compressed lung can only be released by surgical decortication, which may be performed with a minimally-invasive approach (video-assisted thoracoscopy) or an open technique (thoracotomy).

In this study we have reviewed 30 cases of empyema thoracis who underwent thoracotomy and decortication between December 2023 to December 2024. The initial diagnosis based on history, physical examination and radiology was confirmed by thoracentesis. Fever, cough and dyspnoea were the most common presenting symptoms. In all cases pleural fluid cultures were done . All patients had tube drainage as an initial treatment. The duration of the disease had a direct relationship with the thickness of the pleura and injury to the underlying lung. Delayed referral causes irreversible changes in the lung prolonging recovery. Meticulous open surgical debridement gave gratifying results. The status of the lung at the end of surgery is a major prognostic factor. 24 patients were discharged by day 6 (range 4-9 days). Post-operative air leak occurred in 2 patients(6%).

As compared to another study of 30 paediatric patients done by Dept. of Cardiothoracic Surgery by YL Ho, M Fauzi, Sothee K, A Salleh, AY Khamis and Basheer A Kareem (2020) Paediatric Empyema Thoracis: Roles and Outcomes of Surgical Intervention in Advanced Disease.Int J Respir Pulm Med 2020, 7:126, Volume 7 / Issue 1

the mean age was 5.2yrs(2mths to 12 yrs) compared to our study where mean age was 4yrs(1mths - 12 yrs), day of admission 5+/- 3 in both the studies, referred for decortication by 8 days in both the studies, tube thoracostomy done in 100% patients in both the studies, fibrinolysis 17% done in the comparative study ,not done in our study. Post operatively intercoastal tube was removed on mean 3.8(1-7) days and 4 (1-7) days in our study. Discharged by mean day 6 in both studies. I ncidence of air leak occurred in 2 patients (6%) in both the studies. No mortality or reoperation was required in either study.

Thus, surgical decortication in chronic pleural empyema improves lung function and increases perfusion. Besides a significant enhancement of spirometric parameters, re-expansion of the diseased lung leads to equalisation of thoracic asymmetry and may even prevent loss of volume in the affected lung.

V. Conclusion

This study shows that management of stage 2-3 empyema with surgical intervention done promptly provides good clinical outcome, preventing prolonged morbidity in patients managed with intercoastal drainage alone and persistent non lung expansion, thus influencing the decision to firmly go ahead with surgery in stage 2-3 empyema without delay.

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