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Original research article

THE STUDY OF UNDERLYING LUNG CONDITION IN CHRONIC EMPYEMA THORACIS IN CHILDREN

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Abstract

Aim of the study: To study the outcome of patients having chronic empyema with cavitatory parenchymal lung disease in children after surgery. An Empyema is accumulation of purulent fluid in the pleural cavity. Most commonly as a complication of pneumonia. In this study open Decortication was done for chronic Empyema cases and Decortication plus non anatomical lung resection (lobectomy) was done in severely necrosed lung parenchyma cases and the outcome was studied.

Materials and Methods: All chronic Empyema thoracis cases requiring surgery are admitted in pediatric surgery department were investigated and included in the study. Total of 30 cases were studied.

Results: Only Decortication was done in 70% cases and both Decortication along with non-anatomical lung resection was done in 30% of cases in which there is severe lung parenchymal necrosis.

Conclusion: According to our study we conclude that Open decortication in chronic empyema is safe, effective and well tolerated by children with both parenchymal involvement and pleural involvement. Non anatomical lung resection (lobectomy) can be safely done when there is necrosed lung parenchyma. Early surgery reduces morbidity and hospital stay.

Keywords: Chronic Empyema, Decortication, pleura, necrosis, non-anatomical lobectomy

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Introduction

An Empyema is the accumulation of purulent fluid in the pleural cavity and complicates pneumonia in 1 of 150 affected children. It may also occur following trauma, neoplastic processes, intrathoracic esophageal perforation, or as a complication of intrathoracic surgery. Normally, the pleural membranes are permeable to liquid, and a small amount of fluid exists between the visceral and parietal pleura to minimize friction during respiration. When the adjacent lung is healthy, the pleural cavity is generally resistant to infection.

Empyema, once established, exhibits three characteristic stages (1) an exudative or early stage when the fluid is thin and of low cellular content. Stage (2) an intermediate or fibrinopurulent stage during which large numbers of poly- morphonuclear cells and fibrin are deposited in the pleural space, progressively impairing lung expansion and leading to the formation of fluid loculations, and stage (3) a final stage or organizing empyema during which a thick exudate forms and fibroblasts invade the fibrinous peel. The empyema may be diffuse and involve the entire pleural space or it may be localized and encapsulated in an interlobar, diaphragmatic, or paramediastinal location.

Currently, the most common organisms in childhood empyema are Streptococcus pneumoniae, *Staphylococcus aureus*, and *Haemophilus influenzae*. Other streptococci, mixed oral flora, and anaerobes have also been classically associated with the development of empyema. The changes in bacteriology are likely due to changing antibiotic resistance patterns. However the incidence of empyema may be increasing and the virulence of the causative organisms appears to impact the natural course and ultimately, the management of these patients. Tuberculous empyema is much rarer than effusion and is associated with a high bacterial load within the pleural space. Mycobacterial resistance is a problem in this situation because of the poor pleural penetration of standard anti tubercular agents. The symptoms of empyema in a child include a short history of pulmonary infection, followed by respiratory distress, fever, and cough. Chest or shoulder pain coupled with abdominal pain, distension, and ileus may intensify the respiratory difficulty. The radiographic appearance often includes bilateral pulmonary involvement, with pneumatoceles occasionally identified within the lung. Haziness of a hemithorax may represent either pulmonary consolidation or pleural fluid.

Thoracocentesis may provide valuable information on the quality of pleural fluid. The progression to advanced stage empyema may be suspected if the fluid demonstrates any of the following characteristics after diagnostic thoracocentesis: (1) gross pus, (2) pH less than 7.0, (3) lactate dehydrogenase greater than 1000 U/mL, (4) glucose less than 40 mg/dL, and (5) bacteria visible on Gram stain.

Blood and pleural fluid cultures are negative in the majority of patients. A chest X ray is sufficient to make the diagnosis in the early stages. This shows the characteristic signs of a pleural effusion, with the fluid going up to the axilla. In some cases there may be a total white-out with mediastinal shift. An ultrasound of the chest gives adequate information in the fibrinopurulent stage. Findings include clear or turbid, septated or loculated fluid. The location of the drainage site can be marked at this time. Computed tomogram (CT) scanning should be reserved for complicated cases: failure of fibrinolysis or surgery, bronchopleural fistula or lung abscess formation.

Thoracotomy should be done for chronic or complicated empyema and failure or

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complications of fibrinolysis or thoracoscopy. Complications include bleeding, lung injury, bronchopleural fistula and recurrence. The present study is undertaken to study outcome of patient having chronic empyema with parenchymal disease.

Materials and Methods

This prospective study was done from 2021 to 2022 for 2 years in the department of pediatric surgery in a Tertiary care government hospital after taking Ethics Committee approval. 30 cases of chronic Empyema requiring surgery are nonrandomly selected and included in the study. Thoracic tumours are excluded from the study.

After admission, history was taken, physical examination was conducted on each patient admitted in pediatric surgery unit with chronic empyema. Informed written consent was taken from the children parents or their guardian willing to participate in the study. All necessary investigations like X-ray, USG, and CECT chest are done. Other investigations like CBP, coagulation profile, RFT, LFT, was done.

After consent from children parents, case is taken for surgery. Under general anaesthesia Open Thoracotomy was done and Operative findings were noted. Decortication was done for all cases and If Lung parenchyma severely necrosed then Non Anatomical Lobectomy was also done. Specimen is sent for Biopsy.

Post operatively, Spirometry and physiotherapy were started on first POD. Chest X ray were taken on second POD and fifth POD. ICD removal was done on POD-5 depending on expansion of lung on Chest X ray. Data collection sheets were filled in by the investigator himself. SPSS software is used for statistical analysis.

Fig 1: X ray chest of Empyema with multiple Loculations

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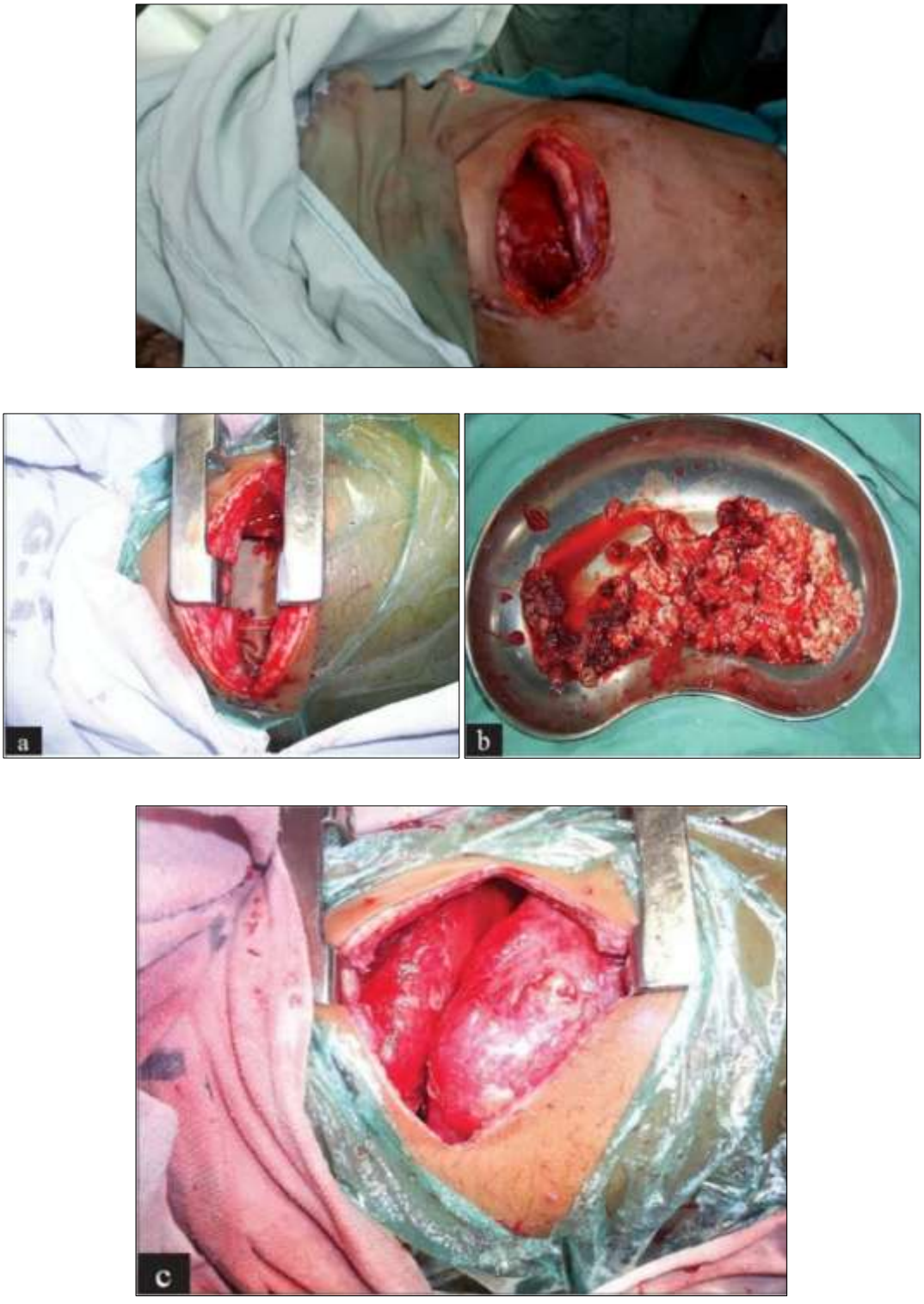

Fig 2: Thoracotomy

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Results

Age Distribution

Table 1: Age wise distribution of chronic empyema

Age	Number	Percentage
<1 yrs.	5	17%
1-5 yrs.	17	54%
5-10 yrs.	7	24%
10-12 yrs.	1	4%

Age of patients ranged from 6 months to 12 years. 5 cases (17%) belonged to age less than 1 year. 17 cases (54%) were of age group 1-5yrs. 7 cases (24%) were of age 5- 12 years. 1 case were of age group 12 yrs. More number of Cases were seen in age group of 1-5 years.

Sex Distribution

Table 2: Sex distribution

Sex	Number	Percentage
Male	15	50%
Female	15	50%

15 cases (50%) were male patients and 15 cases (50%) were female.

Duration of Symptoms

Table 3: Duration of symptoms

Duration	Number	Percentage
> 2 weeks	20	67%
< 2 weeks	10	33%

20 cases have symptoms more than 2 wks and 10 cases have less than 2 wks.

Symptoms

Table 4: Symptoms

Symptoms	Number	Percentage
Fever	30	100%
Cough	15	50%
Shortness of breath	10	33%

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All 30 cases presented with fever, 15 cases with cough and 10 cases with shortness of breath.

Pathology

Table 5: Lung involvement

Involvement	Number	Percentage
Right lung	24	80%
Left lung	6	20%

24 cases have Right lung involvement and 6 cases have Left lung involvement.

Surgery

Table 6: Type of surgery

Surgery	Number	Percentage
Decoration only	21	70%
Decoration with Non Anatomical Lobectomy	9	30%

21 Cases underwent only Decortication, 9 cases underwent decortication plus Non Anatomical Lobectomy

Operative Findings

Table 7: Operative findings

Involvement	Number	Percentage
Pleura without parenchyma	6	13%
Pleura+ Parenchyma	24	87%

All cases have Pleural involvement. In 24 cases pleura plus parenchyma involved and in 6 cases pleura without parenchyma involved.

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Post-operative stay

Table 8: Duration of post-operative stay

Post-operative stay	Number of cases	Percentage
1-7 days	2	7%
7-14 days	22	73%
14-21 days	4	13%
21-30 days	2	7%

Two cases had post-operative stay between 1- 7 days. Twenty two cases post-operative stay was 7-14 days. Four cases post-operative stay was between 14-21 days, and two cases had post-operative stay between 21-30 days.

Post-Operative Complications

Table 9: Post-operative complications

Complications	Number of cases	Percentage
Broncho pleural fistula	1	3%
Prolong ICU + Oxygen requirement	5	16%
Death	2	6%
Wound site infection	1	3%

One case was complicated with Bronchopleural fistula. 5 cases have prolonged ICU stay and Oxygen requirement. 2 cases died as both of them had bilateral lung involvement with necrotising pneumonia. One case had wound site infection.

Discussion

Empyema, an accumulation of infected fluid within the thoracic cavity, is commonly secondary to post- infectious pneumonia. It can also occur after thoracic operations, trauma or esophageal leaks. The American Thoracic Society has described 3 stages of empyema, namely exudative, fibrinopurulent and organized. More or less based on the characteristics of the contents of the pleural cavity [1].

Apart from the fluid, organized fibrinous deposits appear early in the disease preventing complete drainage of fluid as well as penetration of antibiotics. An inflammatory peel of variable thickness soon forms preventing complete lung expansion. This leads to a variable clinical course creating a lot of confusion about the exact method of management. The disease becomes chronic and delayed referral to the surgeons by the community physicians is common world over.

We have also observed like others, a definite discrepancy in the treatment modality advocated by non- surgical and surgical specialists [2]. Surgeons themselves are reluctant to operate partly due to inexperience and also because of the fear of “post-operative morbidity” mentioned in pediatric literature. However, it is a condition which

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if approached by the correct surgical technique gives excellent results with minimal morbidity.

A common clinical problem encountered is that the chest tube has stopped draining although the patient is still symptomatic. This may be secondary to the tube missing the pocket of loculated air or pus altogether or due to the consistency of the debris. Lung expansion may be prevented by the thick pleura encasing the lung or presence of necrotic lung tissue. These features are easily made out on a CT scan as compared to a chest radiograph.

In our study chronic empyema are showing equal incidence among males and females, around male: female ratio 1:1 [3]. This was nearly comparable to other studies like Arabinica *et al.* study.

In our study the most common age of presentation was about 1-5 years, which was comparable to others studies Shotley Bridge *et al.* [2, 9], and Liese JG *et al.* [4]. In our study most chronic empyema cases presented with duration of symptoms more than 2 weeks, Which was comparable to other studies of Liese JG *et al.* [5], where the most common duration of symptoms more than 2 weeks.

Most common symptom of chronic empyema presenting in our study is fever. All the cases had history of fever.15 cases have cough, which made it the 2nd most common symptom.10 cases have shortness of breath as symptom, which was comparable to the study done by Shotley Bridge *et al.* [4].

In our study most cases involved the right compared to left, which was comparable with other studies where the most common involved lung in chronic empyema was also right lung. (Jingwen Li *et al.* [6]).

In our study of 30 cases, All cases underwent Decortication, out of which 9 cases underwent Non Anatomical lobectomy, (Witold Rzyman *et al.* [7]).

In our study of 30 cases, CT scan suggested pleural involvement in all cases, and 28 had both pleura and parenchymal involvement where most of the cases shown and useful in surgery, which was comparable with other studies of Wong KS *et al.* [8].

In our study of 30 cases, intra-operatively all cases have pleura involvement whereas 24 cases have both pleura and parenchymal involvement, which was comparable to other studies, Wong KS *et al.* [8].

In our study of 30 cases of chronic empyema, 22 cases had post-operative stay of 7 to 14 days, four of them had post-operative stay of 14 to 21 days, two cases had post-operative stay of 14-21 days, whereas only two cases had post-operative stay of 21-30 days, which was comparable to Subramaniam R *et al.* [9] study.

In our study of 30 cases, a single case developed bronchopleural fistula, 5 cases required prolong ICU stay and oxygen requirement, and one case had wound site infection, Unfortunately we lost 2 cases post operatively, And this results made our study comparable with other studies making Open decortication an excellent option for chronic empyema and less post-operative complications, (Alexiou *et al.* [10]).

Conclusion

Empyema thoracis with parapneumonic effusions is a progressive disease and associated with a lot of morbidity unless treated adequately and on time. In patients who present within a week of onset of fluid collection, antibiotics would be sufficient. The pleural fluid should be sent for culture and analyzed for purpose of

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prognostication. If the period is more than 7 days, then an additional CECT chest should be performed which exactly quantifies the disease and the patient treated as per stage and progress of disease process.

In our study, cases presenting with duration more than 2 weeks are associated with lung parenchymal involvement and need decortication. Cases of empyema with Necrotising pneumonia benefit with decortication and lobectomy. Prognosis for cases with parenchymal involvement is poorer when compared to cases of chronic empyema without parenchymal involvement. Outcome of cases of chronic empyema is good with surgery along with antibiotics. Early surgery reduces morbidity and hospital stay. Open decortication in chronic empyema is safe, effective and well tolerated by children with both parenchymal involvement and pleural involvement.

Conflict of Interest: None.

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