The Egyptian Journal of Hospital Medicine (July 2025) Vol. 100, Page 4313-4315

Primary Thoracoscopic Drainage of Fibro Purulent Stage Empyema in Children Versus Conventional Chest Tube Drainage as Regard Time of Hospital Stay and Need for Further Surgical Intervention in Form of Open Decortication

Ayman Abdelmotelb*[1], Ahmed Mohamed Ahmed Abdelmabood[1], Enas Khalifa Ahmed[2], Mohsen Saber Mohammed Ahmed[1]

Departments of [1]Cardiothoracic Surgery and [2]Chest Diseases, Faculty of Medicine, Sohag University Hospital, Sohag Egypt

***Corresponding author:** Ayman Abdelmotelb, **Mobile:** (+20) 01017886273, **E-mail:** aymanabdelmotelb86@gmail.com

ABSTRACT

Background: Empyema is a common purulent complication of bacterial pneumonia in children. The condition progresses through three stages: Exudative, fibro purulent, and organizational. Empyema complicates 0.6% to 2% of pediatric pneumonia cases. Treatment strategies for pediatric para-pneumonic effusions and empyema remain controversial, with significant variations in approaches.

Objective: This study aimed to evaluate the effectiveness of primary thoracoscopic drainage of fibro purulent stage empyema in children in decreasing the hospital stay and the need for further decortication compared to the conventional chest tube drainage.

Methods: A prospective study was conducted on 100 pediatric patients (ages 1.2 to 12 years) with empyema admitted to Sohag University Hospital from March 2018 to April 2022. Fifty patients underwent conventional chest tube drainage with antibiotic therapy, while fifty patients received primary thoracoscopic drainage under general anesthesia. Data collected included hospital stay, chest tube duration, and need for further interventions like open decortication.

Results: Both groups were found to have fibro-purulent empyema at the time of surgery. The thoracoscopic group had significantly shorter hospital stays (7.4 ± 0.3 days vs. 20.6 ± 6.3 days) and chest tube drainage durations (3.0 ± 0.5 days vs. 12.2 ± 6.1 days) compared to the conventional group ($P < 0.001$). Additionally, the thoracoscopic group had a significantly lower incidence of open decortication (4% vs. 30%, $P < 0.001$).

Conclusion: Thoracoscopic drainage significantly reduced hospital stay, the duration of chest tube drainage, and the need for secondary surgical interventions in pediatric empyema. These results suggest that thoracoscopy should be considered a first-line treatment for advanced or loculated para-pneumonic effusions in children, especially in regions with limited postoperative care adherence.

Keywords: Empyema, Thoracoscopy, Pediatric empyema.

INTRODUCTION

Empyema is a prevalent purulent complications in pediatric patients with bacterial pneumonia. As para-pneumonic effusion progresses, fibrin buildup results in the creation of septated purulent fluid and the development of a dense peel across the visceral and parietal pleura. Para-pneumonic pleural effusion is classified into three pathological stages: Exudative (stage 1), fibrinopurulent (stage 2), and organizational (stage 3) [1]. Empyema complicates approximately 0.6% to 2% of pediatric pneumonia cases [2].

There is still disagreement about how to treat juvenile parapneumonic effusions and empyema, especially when it comes to how early treatment measures affect clinical outcomes. A recent study from central Europe revealed significant variation in the treatment approaches for this condition [3].

In Upper Egypt, empyema continues to be a prevalent issue among children, often attributed to delays in initiating appropriate medical treatment. These delays are typically caused by late diagnosis and, in some cases, the negligence of families in seeking timely medical attention. Our hospitals in Upper Egypt regularly face a high volume of empyema cases, especially during seasonal climate changes, such as winter and summer. Historically, most hospitals and senior surgeons have relied on conventional therapy, including chest tube drainage and intravenous antibiotic coverage, which has been the standard treatment for many years [4].

During our training and early career stages, we observed several limitations of this traditional approach, particularly the prolonged hospital admissions and the high incidence of cases requiring open decortication following treatment failure. However, with the introduction of video-assisted thoracoscopic surgery (VATS) in our region around 2014-2015, we gained valuable experience with thoracoscopy, which encouraged us to apply it in managing empyema cases in both adults and children. This shift in approach aimed to reduce hospital stays and the frequent need for subsequent decortication [5-8].

We believe that documenting our experiences and outcomes will be valuable to our colleagues, including pediatricians and thoracic surgeons, in shaping their strategies and decision-making when treating fibro-purulent empyema in pediatric patients. Therefore, this study aimed to evaluate the effectiveness of primary thoracoscopic drainage of fibro purulent stage empyema in children in decreasing the hospital stay and the need for further decortication compared to the conventional chest tube drainage.

Received: 30/04/2025
Accepted: 30/06/2025

PATIENTS AND METHODS

Our study was done on 100 children (1.2 to 12 years) with empyema admitted to Sohag University Hospital Paediatric Department over 4 years from March 2018 to April 2022 (prospective study).

All patients were investigated as a routine before management in form of CT (computed tomography) chest, chest ultrasound, complete blood picture, culture and sensitivity for organisms and pleural fluid analysis.

Fifty patients underwent chest tube insertion under simple sedation with antibiotic cover according to culture and sensitivity (conventional group). Fifty patients underwent double port thoracoscopic evacuation of empyema under general anaesthesia (thoracoscopic group) with cutting and lysis of all adhesions in chest cavity. The 1st port (working port) in the 5th intercostal space in anterior axillary line and the second port (camera port) in the 7th intercostal space more anterior to the 1st port. One chest drain under thoracoscopic guidance was inserted posteriorly in each patient after thoracoscopy.

Data of every patient in both groups was recorded in form of the total hospital stay after beginning of the treatment, the needed time before chest tube removal, and the need for further intervention in form of open decortication.

Every patient in both groups had routine plain chest x-ray 24 h after intervention, after stoppage of chest tube drainage, and before discharge after chest tube removal.

Ethical approval: Sohag Faculty of Medicine's Ethics Committee accepted this work. After receiving all the information, each participant signed an informed consent. The Helsinki Declaration was followed throughout the course of the investigation.

Statistical Analysis

The descriptive analysis was carried out using SPSS version 24.0. Continuous data were presented as Mean ± SD, whereas categorical data were represented as numbers and percentages. The X^2-test was used to compare qualitative characteristics across many groups. A significant p-value was defined as one that is equal to or less than 0.05.

RESULTS

All patients in both groups were found to have fibro purulent empyema at the time of the operation. There was a male/female ratio of 1.2:1 in the conventional group (chest tube plus adequate antibiotic), whereas the ratio was 2:1 in the thoracoscopic group. The mean age in the conventional group was 6 ± 4years, whereas the mean age in the thoracoscopic group was 7±3 years. In the conventional group there were 10 patients (20%) left-sided empyema and 40 (80%) right-sided empyema. In the thoracoscopic group there were 18 (36%) left-sided empyema and 32 (64%) right-sided empyema. Pleural fluid cultures were positive in 20 patients (40%) in the conventional group with the most common organism isolated being Staphylococcus aureus [35%]. In the thoracoscopic group, 30 patients (60%) had a positive pleural fluid culture, with Streptococcus pneumonia being the most prevalent pathogen (40%). The major invasive intervention in the conventional group was the insertion of a chest drain, which was performed on all 50 patients. There were no patients in the thoracoscopic group who received a chest drain as their first invasive intervention (Table 1).

Table (1): Patient demographics

	Conventional group	**Thoracoscopic group**
Number of patients	50	50
Male/female ratio	1.2:1	2:1
Age (in years)	6±4	7±3

In the conventional group management was failed in 15 (30%) of the cases and the patients required open thoracotomy and decortication. 2 patients in the thoracoscopic group (4%) required open thoracotomy. Compared with the conventional group, the thoracoscopic group patients had a significantly shorter duration of chest tubes in situ (12.2 ± 6.1 vs. 3.0 ± 0.5 days, P.001), and hospital stays (20.6 ± 6.3 vs. 7.4 ± 0.3 days, P0.001) as shown in table (2).

Table (2): Durations of hospital stay, chest tube drainage, and incidence of open decortication in both groups

	Conventional group	**Thoracoscopic group**	**P value**
Days of chest tube drainage	12.2 ± 6	3.0 ± 0.5	0.001
Days of hospital stay	20.6 ± 6.3	7.4 ± 0.3	0.001
Incidence of open decortication	15 patients (30%)	2 patients (4%)	0.0001

DISCUSSION

Empyema thoracis is a well-documented and persistent clinical condition characterized by the accumulation of purulent material within the pleural space. Although it often results from pulmonary infections, the source can occasionally be extra pulmonary, originating from the chest wall, sub diaphragmatic regions, or mediastinum. It may also arise as a complication following thoracic surgeries or traumatic hemithoraces. In children, the majority of cases are parapneumonic in origin. The normal pleural cavity typically resists infection, however when the

space becomes abnormal, due to the presence of air, blood, or fluid, it becomes more susceptible to bacterial invasion and empyema formation [4]. Historically, the evolution of empyema management has progressed significantly. The 19th century marked the introduction of pleural aspiration as a therapeutic intervention. This technique, further refined through closed-tube thoracostomy and rubber tube insertion, laid the foundation for modern pleural drainage techniques [5, 6]. The advent of VATS in the late 20th century represented a major advancement in both diagnostic and therapeutic approaches. It enabled direct visualization and targeted debridement of infected pleural spaces, facilitating improved outcomes especially when performed within the early stages of the disease [7, 8].

In the current study, two primary modalities for empyema management were compared: Chest tube insertion combined with antibiotic therapy, and thoracoscopic drainage as an initial intervention. General anesthesia was utilized in both groups to minimize discomfort and psychological trauma, which is particularly important in the pediatric population. The use of local anesthesia alone was considered suboptimal due to its association with pain and anxiety in children.

The group managed with thoracoscopy demonstrated a significantly shorter hospital stay compared to those treated with conventional chest tube insertion. This was likely due to more effective evacuation of purulent material, mechanical disruption of fibrous septations, and optimal chest tube placement under direct visualization. These findings are consistent with previously published data supporting the superiority of thoracoscopic drainage in achieving complete pleural clearance [9].

Postoperative rehabilitation poses an additional challenge in the pediatric population, particularly in socioeconomically disadvantaged regions such as Upper Egypt. Compliance with physiotherapy is often poor, and parental engagement may be limited. This further emphasizes the need for treatment modalities that promote rapid recovery and minimal reliance on postoperative care.

Moreover, the thoracoscopic group in our study exhibited a significantly reduced duration of chest tube drainage. This can be attributed to effective lysis of adhesions and thorough pleural decontamination achieved during the procedure. These outcomes are in agreement with findings from **Wait *et al.*** [10] and **Doski *et al.*** [11] who reported similar reductions in drainage time following thoracoscopic intervention.

Importantly, the need for secondary surgical intervention in the form of open decortication was notably lower in the thoracoscopic group (4%) compared to the conventional group (30%). This difference likely reflects the enhanced drainage efficacy and optimal tube positioning achieved under thoracoscopic guidance. Our results align with prior studies that support thoracoscopy as a superior modality in preventing disease progression and reducing the necessity for more invasive procedures [10, 11].

CONCLUSIONS

This study highlighted the clinical advantages of thoracoscopic intervention over conventional chest tube drainage in the management of pediatric empyema thoracis. Thoracoscopy was associated with shorter hospital stay, reduced duration of chest tube placement, and a significantly lower rate of secondary surgical interventions. These outcomes suggest that early thoracoscopic drainage provides more effective clearance of the pleural space and contributes to faster recovery, particularly in settings where adherence to postoperative care may be limited. Given these findings, thoracoscopy should be considered as a first-line therapeutic approach in children presenting with advanced or loculated parapneumonic effusions.

No funding.
No conflict of interest.

REFERENCES

1. **Marhuenda C, Barceló C, Fuentes I *et al.* (2014):** Urokinase versus VATS for treatment of empyema: A randomized multicentre clinical trial. Pediatrics, 134: 1301–1307.
2. **Grijalva C, Nuorti J, Zhu Y *et al.* (2010):** Increasing incidence of empyema complicating childhood community-acquired pneumonia in the United States. Clin Infect Dis., 50 (6): 805–813.
3. **Hafen G, Grenzbach A, Moeller A *et al.* (2014):** Lack of concordance in parapneumonic effusion management in children in central Europe. Pediatr Pulmonol., 51: 411–417.
4. **Le Roux B, Mohlala M, Odell J *et al.* (1986):** Suppurative disease of the lung and pleural space. Part 1: Empyema thoracis and lung abscess. Curr Probl Surg., 23: 1. doi: 10.1016/0011-3840(86)90031-6.
5. **Atwater E (1972):** Morrill Wyman and the aspiration of acute pleural effusions, 1850. A letter from New England. Bull Hist Med., 46 (3): 235-56.
6. **Playfair G (1875):** Case of empyema treated by aspiration and subsequently by drainage. Br Med J., 1: 45-46.
7. **Wakabayashi A (1991):** Expanded applications of diagnostic and therapeutic thoracoscopy. J Thorac Cardiovasc Surg., 102: 721-23.
8. **Cassina P, Hauser M, Hillejan L *et al.* (1999):** Video-assisted thoracoscopy in the treatment of pleural empyema: stage-based management and outcome. J Thorac Cardiovasc Surg., 117: 234-38.
9. **Hürtgen M, Witte B, Friedel G *et al.* (1999):** Video-assisted thoracoscopic access in pleural empyema compared with chest tube drainage. Chirurg., 70 (4): 464–468.
10. **Wait M, Sharma S, Hohn J *et al.* (1997):** A randomized trial of empyema therapy. Chest, 111: 1548–1551.
11. **Doski J, Lou D, Hicks B *et al.* (2000):** Management of Para pneumonic collections in infants and children. J Pediatr Surg., 35 (2): 265–268.