

# Video - Assisted Thoracoscopic Surgery as a Primary and Effective Treatment for Empyema: A Case Report

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DOI Number: 10.22541/au.169200038.81557392/v1

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## Highlights:

Currently the primary treatment of empyema is the use of antibiotics and Intercostal drainage tubes. Our case signifies how the early initiation of surgical treatment that is video assisted thoracoscopic surgery and decortication can prevent further complications that may be cause due to intercostal drainage tube insertion

Video - assisted thoracoscopic surgery can also decrease the duration of treatment and hospital stay. Currently 86% of empyemas are treated with ICD tube and antibiotics which can lead to complications like progression of primary empyema into tertiary stage empyema, recurrent pneumothorax, tension pneumothorax or at the worst organ rupture. Hence VATS can be proved as one of the primary and effective as well as safe methods to manage empyema for 1st and 2nd stage of empyema.

**Abstract:** *Background: Empyema Thoracis is a serious life - threatening condition. . Although it is rare in pediatric patients, the possibility for rapid progression makes its treatment challenging. This case report describes the presentation, clinical course, diagnostic challenges, management measures, and outcome of a 4 - year - old female child with empyema thoracis. Case: The initial presenting complaint in this 4 - year - old patient included fever, abdominal pain, and cough. Physical examination revealed mild subcostal retraction with decreased air entry in the right lung and tachypnea. Chest radiography showed right sided pleural effusion prompting the initiation of non - invasive mode of ventilation. Ultrasonography (USG) thorax showed mild to moderate right sided pleural effusion with consolidation and collapse. Pleural tapping showed no growth and was genexpert negative. High resolution computed tomography (HRCT) indicated Empyema. Video assisted thoracoscopic surgery was performed with decortication under appropriate management. Post procedure, the patient was intubated with Intercostal chest drainage (ICD) tube. Repeated HRCT and Chest X - Rays were done to monitor response to treatment and guide further management decisions. Following removal of the chest tube, the patient was discharged with reassuring vital signs, laboratory results, and a chest x - ray. Conclusion: In conclusion, this case report demonstrates the challenges faced in diagnosing and managing rare empyema thoracis in pediatric patients. It highlights the significance of early surgical interventions by video assisted thoracoscopic surgery and the need to manage potential complications in order to ensure successful outcomes.*

**Keywords:** Thoracic Empyema, Video Assisted Thoracoscopic Surgery, Pediatrics

## 1. Introduction

Thoracic empyema is defined as accumulation of frank pus in the pleural cavity. Conditions predisposing one to empyema include unresolved pneumonia, aspiration of pleural effusion, and trauma. Three stages of empyema can be distinguished: Exudative (Stage 1), Fibropurulent (Stage 2), and organizing (Stage 3).

In 0.6% of all pediatric pneumonias, empyema occurs, with a higher rate associated with malnourished and immunocompromised children.<sup>2</sup> There has been a global increase in the frequency of empyema in children. Therefore in order to promote quick recovery and maintain lung

expansion, early intravenous antibiotic and Intercostal Chest Drainage treatment are conducted in up to 86% of cases. In cases of Intercostal Chest Drainage failure, video assisted thoracoscopic surgery (VATS) and thoracotomy with decortication are used.<sup>3</sup> The main issue with the standard treatment of Intercostal Chest Drainage and antibiotics is that loculations and septa cannot be detected until empyema has progressed to stage two. As a result, VATS is the best management option for both Stage 1 and Stage 2 empyema as it guarantees short hospital stay and fewer recurrence rate.<sup>1</sup>

In this case, a 4 - year - old patient diagnosed with pleural effusion which progressed to empyema was surgically

Volume 12 Issue 9, September 2023

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managed using video assisted thoracoscopic surgery, thus decreasing the length of hospital stay compared to conventional treatment.

## 2. The Case

A 4 year 6 months 15 days female patient was brought to the outpatient department with the presenting complaint of fever, abdominal pain, and cough. The parents describe an otherwise healthy child until initial onset of symptoms occurring 15 days prior with symptoms of a cold in the form of a blocked nose. She developed complaints of intermittent epigastric pain 10 days prior to admission, which was described as dull aching in character.<sup>4</sup> days prior to admission she developed intermittent fever with associated chills. The patient denies any associated rigors or rash. A cough developed 2 days prior to admission with associated postural variation i. e. more when lying down and not associated with expectoration. The patient had one episode of vomiting the night prior to admission. The patient and parents deny any history of loose stools. Past medical history is significant for pneumonia at the age of 16 months associated with malarial fever. There is no history of Tuberculosis or Asthma. There is No significant family or birth history present.

Anthropometry findings: Reveals malnourished child

Observed Expected

Height 96 105.6cm

Weight 13.3kg 17kg

Head Circumference 42cm 49.6cm

A physical examination revealed tachypnea with mild subcostal retraction with an oxygen saturation of 93%. Auscultation revealed air entry was decreased in the right lower zone of the right lung. Routine blood investigations showed Hb=10.2gm/dl, WBC=2500 cells/cumm, PLT=1.4 lakh/cumm, CRP >25 mg/dl, SGOT=29 IU/L, SGPT=18 IU/L, Serum Creatinine=0.7 mg/dl. Respiratory biofire showed no organism. She was started on intravenous Ceftriaxone and intravenous Vancomycin, oral Azithromycin and oral Fluvir. Arterial blood gas analysis showed pH = 7.4, pCO<sub>2</sub>=29.8, pO<sub>2</sub>=107.2, HCO<sub>3</sub>= 19.5, O<sub>2</sub> saturation= 98.1%. Chest X - ray was performed in Supine position and showed right sided pleural effusion (Image - 1). Ultrasonography showed mild pleural effusion of 30ml. The patient was started on a non - invasive mode of ventilation.

On the third day of admission as fever spikes persisted, repeat laboratory investigations were done which showed CRP >25 mg/dl, Hb=8.3gm/dl, WBC=9540 cells/cumm and Platelets had fallen to 38000/cumm. Thus antibiotics were upgraded to intravenous Meropenem.

On the sixth day of admission CXR repeat showed no improvement so intravenous Clindamycin was added. Ultrasonography (USG) thorax was repeated which showed mild to moderate right sided pleural effusion of around 80 ml with changes of consolidation and collapse.

On the ninth day of admission, laboratory investigations showed Hb=11.6gm/dl, WBC=15950 cells/cumm, PLT=6.05 lakh/cumm, CRP=17.33mg/dl. A pleural tap was

performed under all aseptic precautions; approximately 15 ml of pleural fluid were drained. Pleural fluid analysis showed cells=165, neutrophils=65, lymphocytes= 35, proteins=4, sugar=59, coagulum= positive. Pleural fluid culture showed no growth and genexpert was negative. As the pleural tap was ineffective at draining much of the pleural fluid, the patient was taken for high resolution computed tomography. HRCT showed large to moderate loculated septate right lateral chest wall pleural effusion with enhancing thickening between parietal and visceral pleura and split pleura sign, consistent with Empyema Stage 2

The patient was referred to pediatric surgery and video assisted thoracoscopic surgery was performed on the 14th day of admission. Decortication was done with 60 - 70 ml blood loss. Intraoperatively packed cell volume (PCV) transfusion was given. Pus culture showed no growth. The patient was intubated with intercostal chest drainage (Intercostal Chest Drainage) tube in situ on the right side post - operatively. The patient was intubated for a total of 5 days. As her distress settled, she was extubated and put on NIV. The patient was on NIV for 4 days and was later put on O<sub>2</sub> by nasal prongs for 2 days. As the patient was maintaining saturation well, she was slowly weaned off oxygen and is presently maintaining saturation well on room air without distress. As there were no column movements, HRCT was repeated on the fifth day after surgery, which showed few air fluid levels in the right hemithorax consistent with the sign of hydropneumothorax along with collapse and consolidation of underlying right lung parenchyma. Thus, the Intercostal Chest Drainage was repositioned. Column movements were appearing again associated with bubbling which later reduced and disappeared. Chest X - rays were repeated at regular intervals, which showed improvement. HRCT was repeated again 10 days post - surgery that showed mild hydropneumothorax on the right side and complete collapse on the right lower lobe. Antibiotics were continued. As column movements decreased and chest X - rays showed improvement and also laboratory reports showed fall in CRP=2.14mg/dl, Intercostal Chest Drainage was thus clamped and removed on 22nd day post - surgery. The patient was discharged with reassuring vital signs, laboratory results, and a chest x - ray (Image - 2).

## 3. Discussion

Thoracic empyema is defined as "pus in the chest" or presence of microorganism in the pleural fluid. Overall, 0.6% of childhood pneumonias are complicated by parapneumonic effusion which may progress to Thoracic Empyema. It predominantly involves the right lung and 7.1% of all cases are bilateral.<sup>2,4</sup> In developing countries like India more than 25% of hospital - admitted patients with pneumonia develop parapneumonic effusion or empyema because of delay in receiving effective treatment.<sup>3</sup>

Empyema Thoracis (ET) progresses in 3 stages. First, the exudative stage where infection causes immune responses and the fluid crosses the visceral pleura and accumulates in the pleural space and pleura gets inflamed. Second, the fibrinopurulent stage where the immune response causes migration of neutrophils and activation of coagulation

cascade. The fibrin deposits will form septa on the pleural cavity. The inflammatory process will begin to be filled by bacteria and phagocytic cells that have died. Third, the organizing stage where fibroblast starts moving which progresses to development of pleural peel.<sup>1, 2</sup> The fibrinopurulent stage changes into an organizing phase within 7 - 10 days of symptom initiation.<sup>1</sup>

An early diagnosis of thoracic empyema is crucial due to the urgency of treatment, particularly in younger children.<sup>2</sup> Even if the actual diagnosis is obtained by aspiration of purulent material from the affected pleural cavity, proper radiological examinations such as X - Ray, CT scan and USG may help determine the presence of loculated empyema and exclude other differential diagnosis such as lung abscess and lung lesion.<sup>2</sup> The aim of treating ET is to restore lung function. Several studies gave a conclusion that the exudative and fibrinopurulent stage can be treated by antibiotics and Intercostal Chest Drainage insertion while the organizing stage requires surgical intervention.<sup>1, 3, 9</sup> Video assisted thoroscopic surgery (VATS) is used in confirmed cases of empyema as it is an effective method for treating thoracic empyema and requires only small incisions.<sup>1, 6, 8, 9</sup> VATS debridement and VATS decortication are two methods available to treat empyema.<sup>1, 5, 6, 7</sup> VATS can help clear pleural cavity and lung re - expansion through pulmonary surface debridement and breakdown of loculation. Several studies show that VATS drainage and decortication offers better results than treatment with fibrinolytics or thoracostomy alone.<sup>1</sup> Some studies also show that VATS is better than Intercostal Chest Drainage for treatment of thoracic empyema as the duration of hospital stay was less in patients being treated with VATS than Intercostal Chest Drainage.<sup>1, 4 - 10</sup> The average cost of treatment was also less in VATS. Some studies also show that complications were more common in patients treated with Intercostal Chest Drainage as compared to VATS.<sup>10</sup>

The crucial turning point in this case was the HRCT findings that strongly indicated the presence of Empyema. Given the severity of the condition and the lack of improvement with conservative measures, Video - assisted thoroscopic surgery (VATS) was deemed necessary. The VATS procedure included decortication to address the empyema effectively.

This specific case underscores the importance of early consideration of VATS in the treatment of Empyema, especially when the patient's condition is not responding to initial interventions. VATS allowed for a direct examination of the pleural space, precise diagnosis, and targeted treatment, leading to a favorable outcome. This highlights the significance of timely and appropriate interventions in managing complex respiratory conditions, such as Empyema, and supports the assertion that VATS should be considered early in the treatment plan when indicated by clinical findings.

#### 4. Conclusion

Empyema Thoracis (ET) is an accumulation of pus in the pleural cavity. Here we discuss the presentation and management of ET in a pediatric patient, initially presenting

with pleural effusion. The patient was initially treated with antibiotics and a pleural tap was performed; as the patient failed to improve following this initial management, an HRCT was performed. Findings from the HRCT included loculated septate right lateral chest wall pleural effusion with thickening between parietal and visceral pleura and presence of split pleura, consistent with a diagnosis of. The patient was then immediately taken for Video Assisted Thoroscopic Surgery (VATS) decortication. Patient soon started responding to treatment and her respiratory distress settled. Thus, implementation of VATS as a primary treatment is very helpful especially in stage 1 and 2 empyema. It also reduces the length of hospital stay, less complications and an economic way of treatment.

**Financing:** No financial support received

**Conflict of interest statement by authors:** None declared

**Compliance with ethical standards:** Written informed consent was obtained from patients kin to publish this report in accordance with the journal's patient consent policy.

**Author's Contribution Statement:** Conceptualization: N. C. Data Curation: D. B. Investigation: N. C, I. S, D. B, D. P. Methodology: N. C, I. S. Project Administration: N. C, D. P. Resources: N. C, I. S, D. B, D. P. Supervision: N. C. Validation: N. C. Writing - Original Draft: N. C. Writing - Review Editing: I. S, D. B, D. P.

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### Author Profile

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### Images



**Image 1:** Chest X - ray done in supine position before the surgery showing right sided pleural effusion.



**Image 2:** Chest X - ray done in supine position after Video assisted thoracoscopic surgery showing improvement.