

## Thoracoscopic-assisted management of postpneumonic empyema in children refractory to medical response

H.-P. Liu, M.-J. Hsieh, H.-I. Lu, Y.-H. Liu, Y.-C. Wu, P. J. Lin

Department of Thoracic and Cardiovascular Surgery, Chang Gung Memorial Hospital, Chang Gung University, 199 Tun-Hwa N Road, Taipei, 105 Taiwan

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### Abstract

**Background:** Empyema frequently complicates the hospitalization of children; and in advanced stages, it often requires surgical intervention. In this study, we investigated the use of video-assisted thoracic surgery (VATS) for the management of postpneumonic empyema in children who have had an unsatisfactory medical response.

**Methods:** We did a retrospective review of the medical records of 51 consecutive patients with loculated empyema (mean age, 5 years; range, 2 months to 15 years) hospitalized at Chang Gung Memorial Hospital between 1995 and 2000. All patients underwent debridement of the necrotic lung tissue and evacuation of the loculated empyema cavity using a VATS approach.

**Results:** The mean operating time for the 51 patients was 90 min (range, 50–210); mean blood loss was 70 cc. Fever subsided within 72 h postoperatively in all patients. On average, chest tubing was removed on the 7th postoperative day (range, 4–18 days). However, in one patient who suffered from a prolonged air leak, the chest tube was not removed until day 18. The mean postoperative stay for all patients was 13.7 days (range, 9–23). No deaths occurred, and all of the children made a good recovery. A follow-up revealed that one of the 51 children patient suffered a left upper lung abscess 7 months after discharge. Left upper lobectomy was performed in this case, and the patient was discharged uneventfully 10 days after the operation.

**Conclusions:** VATS is a safe and effective treatment for pediatric empyema. Thoracoscopic-assisted surgery facilitates visualization, evacuation, and debridement of the necrotizing lung tissue. Early surgical intervention can avoid lengthy hospitalization and prolonged intravenous antibiotic therapy, and it can accelerate clinical recovery.

**Key words:** Empyema — Children — Pediatric empyema — Video-assisted thoracic surgery (VATS)

Because the appropriate treatment for thoracic empyema is still controversial, the approach varies among individuals [1–7]. Nor has a consensus yet been reached on the appropriate treatment for children with empyema [2–4]. Children with an unsatisfactory clinical response are commonly given prolonged antibiotic treatment. Surgical treatment via conventional decortication remains controversial and is currently limited to patients who present with failed chest tube drainage or multiloculated empyema. The advent of video-assisted thoracic surgery (VATS) has recently changed the treatment of patients with complicated empyema refractory to medical treatment. This study reviews the safety and efficacy of VATS for the treatment of postpneumonic empyema in pediatric patients with an unsatisfactory clinical response.

### Materials and methods

The medical records of 51 consecutive pediatric empyema patients (mean age, 5 years; range, 2 months to 15 years) were reviewed retrospectively. The sample contained 29 male and 22 female patients. Empyema was considered in all parapneumonic effusion patients, mainly through chest radiography and chest computed tomography (CT). Empyema was diagnosed in cases where there was a positive Gram stain or frank pus was aspirated from the pleural cavity. All children referred for surgery had unsatisfactory medical responses, with persistent fever and multiloculated empyema.

Surgery was performed under general anesthesia. A single-lumen endotracheal tube was used for most operations, with selective one-lung bronchial intubation. Patients were placed in the lateral decubitus position with the involved side facing up, and incisions were made for the VATS approach (Fig. 1).

Trocar placement was dictated by the location of the loculated empyema cavity, as seen on the chest radiograph or CT scan. A 5- or 10-mm 0° telescope was used for the procedure; it was placed around the eighth intercostal space in the midaxillary line. A digital breakdown of the pleural adhesion was generally performed before insertion



**Fig. 1.** Incisions for the VATS approach.

of the trocar or instruments. The second incision (2–4-cm) was always made in the fifth intercostal space (midaxillary line) to allow the placement of conventional instruments directly into the thoracic cavity. This skin incision (muscle-sparing) was located so that it could be incorporated in a formal thoracotomy incision if necessary.

Various curved sponge forceps and a conventional suction tube were used to break down the necrotizing debris under video vision. All purulent tissue and fibrin peel within the pleural cavity and the lung parenchyma were evacuated thoracoscopically, and the infected necrotic lung tissue was excised and removed. Subsequently, total pneumonolysis was done to ensure complete expansion of the entire lung parenchyma. If the lung was coated in fibrin peel and did not expand, a plane was generally created between the lung parenchyma and the pleural peel using a peanut. Thoracoscopic decortication was subsequently performed.

Following normal saline irrigation and meticulous hemostasis, a chest tube was inserted through the trocar incision. It was removed when air leakage stopped and chest radiography revealed full lung expansion. Patients were discharged following removal of the chest tube.

## Results

Fifty-one children with loculated empyema were treated successfully with VATS. Operating times ranged from 50 to 210 min, (mean, 90). None of the patients required conversion to open thoracotomy, and there was no procedure-related morbidity or mortality. Necrotizing lung tissue was present in 44 (86.3%) of the 51 patients. Fever subsided in all patients within 72 h of the operation. The mean duration of postoperative air leakage was 4.5 days, and most of the chest tubes were removed on the 7th postoperative day (range, 4–18 days). However, in one patient who suffered a prolonged air leak, the chest tube was not removed until day 18. The average postoperative hospital stay was 13.7 days (range, 9–23).

Follow-up was conducted for all 51 children. Empyema did not recur in any of the cases. Chest radiography for all patients during the 3-month follow-up revealed full lung expansion. One patient suffered a recurrent left upper lung abscess 7 months after discharge. A left upper lobectomy was performed in this case, and the patient was discharged without complications 10 days after the operation.

## Discussion

Pediatric empyema generally occurs secondary to the direct spread of lung infection from a parapneumonic effusion. Approximately 0.6% of cases of pneumonia in children are complicated by empyema, and the incidence of postpneumonic empyema in children ranges from 0.4 to six cases per 1000 admissions [3].

The treatment of thoracic empyema varies according to the following considerations: stage of the disease, specific bacteria isolated, response to treatment, and degree of lung trapping [8–13]. Most children with early or fibrinopurulent-stage empyema respond favorably to antibiotics or a combination of antibiotics and thoracic drainage. Delayed diagnosis or referral without aggressive management during the early stages of empyema invariably led to prolonged suffering and complications. Patients with advanced-stage or multiloculated empyema frequently respond poorly to antibiotics and have an increased risk of formal decortication.

Most of the patients in the present series had been treated by their general practitioner, primarily with antibiotics and for a mean duration of 17 days (range, 6–33). By the time of surgical consultation, the disease had reached an advanced stage in many of the cases, requiring extensive debridement and the evacuation of the loculated empyema cavity.

Thanks to recent advances in the video-assisted thoracoscopic (VATS) technique, patients with pleural and thoracic disorders can now be managed less invasively [7, 11, 12]. However the role of VATS in treating pediatric empyema has received relatively little attention. In these cases, aggressive VATS intervention is necessary to expedite recovery and decrease hospital stay [4, 6]. Surgical intervention should be encouraged in cases where medical treatment has failed and where fever persists and imaging studies confirm loculations. Children with unsatisfactory medical responses and progressive, prominent symptoms of infection should be referred for surgical intervention as early as possible to avoid a prolonged hospital stay and subsequent potentially fatal complications. Early surgical intervention in pediatric empyema accelerates recovery and reduces morbidity [4, 6].

Our experience of patients with advanced-stage empyema has shown that the adhesions and loculation of empyema can be completely broken down with a minimal-access incision and assistance by video vision. Evacuation of necrotic lung debris and peels was performed without significantly increasing morbidity. Our patients' postoperative clinical response improved dramatically, with fever subsiding within 72 h. Our result mirrors the success of others who have used VATS to treat pediatric empyema [4, 6].

This study confirms that surgical intervention accelerates recovery and reduces morbidity. To reduce postoperative pain and discomfort, the patients' chest tubes were removed as soon as air leakage had subsided and drainage fell below 50 ml/day. Clearly, successful pediatric empyema management depends largely on an appropriate and aggressive initial course of action. Although this fact has been long recognized, the impor-

tance of early surgical intervention in pediatric empyema has not been sufficiently emphasized.

The measured results herein demonstrate that VATS provides safe and effective treatment for pediatric empyema when the response to medication is unsatisfactory. Earlier surgical intervention should be encouraged in children with empyema complicated by persistent fever, progressive leukocytosis, or evidence of loculated empyema with a trapped lung as revealed by chest CT scan or ultrasonography. Complete lung reexpansion through early thoracoscopic pneumonolysis may reduce hospital stay and promote a rapid postoperative recovery in symptomatic children.

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