P
tients with empyema that are incompletely drained by tube thoracostomy are often consi-
dered for thoracotomy and decortication.1 However, because many of these same patients have significant comorbid conditions, a variety of interventions have been described to avoid the morbidity associated with thoracotomy. These have included a variety of open drainage methods, intrapleural administration of fibrinolytic agents, and thorascopic techniques.2-6 Video-assisted thorascopic (video-assisted thoracic surgery [VATS]) decortications have been described, but may not be possible if there is too dense a pleural symphysis or if the patient cannot tolerate the single-lung ventilation required.7,8 We have used rigid thorascopic debridement, with continuous postoper-

ative irrigation, to successfully treat 14 empyemas in 13 patients. Complete resolution was obtained in 12 patients (92%), including seven patients who were ventilated in the ICU. Specific advantages of this approach include the ability to perform pleural debridement without double-lumen intubation or the need to place the patient in a formal thoracotomy position.

**Materials and Methods**

*Statistical Analysis*

Results are expressed as mean±SEM.

*Patient Population*

From October 17, 1995 to April 30, 1996, 13 consecutive patients (11 men and two women) (average age, 33.4±5 years) with empyema underwent thorascopic debridement. Data concerning their respective perioperative courses were collected.

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**Study objective:** To determine the role of rigid thoracoscopy and continuous pleural irrigation as an alternative to thoracotomy in critically ill patients.  
**Design/setting/patients/interventions:** Thirteen patients with empyema (one bilateral) underwent thorascopic decortications and continuous postoperative irrigation with normal saline solution. Seven patients required preoperative ventilator support.  
**Measurements and results:** Double-lumen intubation was utilized in only two cases. Empyemas were drained effectively in all patients, including nine patients in whom dense adhesions were encountered. Mean duration of irrigation was 3.5±0.5 days. There were no deaths. One patient developed a recurrent empyema 1 week after resolution of symptoms and underwent thoracotomy.  
**Conclusions:** Rigid thorascopic decortication is an effective method for treating empyemas and can be considered before thoracotomy. It can be performed in patients who might not be candidates for video-assisted thorascopic approaches owing to inability to tolerate one-lung anesthesia or who have dense adhesions preventing lung collapse.  

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**Key words:** empyema; irrigation; thoracoscopy

**Abbreviations:** VATS=video-assisted thoracic surgery
prospectively. One patient had evidence of bilateral empyemas. Nine patients were being treated for concomitant pneumonia. Patients were admitted to the hospital for the following reasons: penetrating chest trauma (six); penetrating abdominal trauma (one); blunt chest and abdominal trauma (two); following right lower lobectomy for bronchogenic cancer (one); following esophagectomy for adenocarcinoma (one); respiratory failure and pneumonia (one); and rheumatoid arthritis and effusion (one). The patients had been in the hospital for an average of 12.4±2.6 days. Seven patients were in the ICU and had required mechanical ventilation (15.0±2.6 days). Four patients were in a step-down ICU because of their febrile course and comorbid conditions, while two patients were being treated on regular surgical wards. All patients had undergone tube thoracotomy and were receiving antibiotics as initial management. All patients had evidence of the following: (1) incomplete evacuation of fluid with loculation demonstrated by chest CT scans (Fig 1); (2) continued clinical toxic reactions with elevated leukocyte count despite antibiotics; and (3) pleural fluid with at least one of the following: pH <7.20, lactate dehydrogenase >500 IU/L, grossly purulent appearance of the fluid drained, and positive Gram's stain or culture of the pleural fluid. The average leukocyte count on the day of surgery was 18.2±2.1/μL and body temperature was 39.2±0.16°C.

**Technical Details**

Single-lumen endotracheal tubes were used in 11 patients where double-lumen tubes were believed to be contraindicated for one or more of the following reasons: inability to withstand one-lung ventilation (nine); need for supportive ventilation so great that it was believed that the patient would not tolerate a period of extubation (two); technically difficult to place a double-lumen tube owing to body habitus (two); and unstable cervical and thoracic spine injuries (two). In the patients who were ventilated with a single-lumen tube, after initial exploration, if lung inflation inhibited exposure, the endotracheal tube was advanced temporarily into the opposite mainstem bronchus (two cases) or short periods of apnea/hypoventilation were used after appropriate hyperventilation (four cases). In the remaining five cases, lung expansion during ventilation was not problematic.

Patients were positioned supine with the affected hemithorax elevated with rolls in five cases (due to body habitus in one instance and due to complex orthopedic/neurosurgical hardware in four cases). The remaining eight patients were positioned as for posterolateral thoracotomy.

The chest tubes were pulled and after preparing the patient, gentle finger dissection was carried out through the chest tube site to create a space. A rigid 52F mediastinoscope was then introduced through the same site and further dissection was carried out using the tip of the mediastinoscope, suction catheters, and/or endoscopic kitners (OR Concepts, Inc; Burnsville, Minn). When further dissection was required beyond the reach of the mediastinoscope, a second and sometimes a third planned incision was made under direct vision. The thorax was irrigated copiously to clear out debris. Dense parietal and visceral peels were debrided using biopsy forceps. At the end of the procedure, a new chest tube was placed under vision through one of the new ports. A Jackson-Pratt drain was placed through a separate stab wound and connected to a three-way stopcock. All wounds were then completely closed, except the original chest tube site where only the fascia was closed.

Irrigation was carried out with normal saline solution at 50 mL/h until the effluent remained clear, the patient was afebrile, and one set of cultures from the chest tube was negative.

**Operative Findings**

The right side was operated on in 11 cases, the left in three. The empyema was loculated in one-third of the hemithorax in six cases, two-thirds in five cases, and involved the entire hemithorax in three cases. Dense adhesions were found in nine cases and decortication of visceral and parietal peel was required in eight cases. Improved lung expansion and filling of the thoracic space could be appreciated after decortication.

**Results**

The operative time averaged 49.6±4.6 min. Estimated blood loss was <150 mL in all cases and no patients required blood transfusions. Apart from the original chest tube site, a single additional port was utilized in eight procedures, while in six cases two additional ports were required. Our group always uses an additional port, if only to place a new chest tube through a noncontaminated tract. Predominant organisms that were identified by operative cultures included the following: *Staphylococcus aureus* (four); *Streptococcus epidermidis* (one); pneumococcus (two); *Enterococcus faecalis* (two); and *Haemophilus influenzae* (one). The cultures were sterile in four instances.

On the second postoperative day, the average body temperature was 38.0±0.14°C and the average leukocyte count was 11.7±0.8/μL. Irrigation was continued for an average of 3.5±0.5 days and the chest tubes were pulled after an average of 6.1±1.2 days, after there was no radiologic evidence of undrained fluid collections. Of the seven patients who had needed preoperative ventilation, six were weaned in 6.8±2.5 days. One patient with a T1 spinal injury required tracheostomy and was transferred to a long-term care ventilator facility. The average postoperative stay for the ICU patients was 13±3.0 days and the average postoperative length of hospitalization for all the patients was 12.5±2.2 days.

**Figure 1.** CT scan revealing multiple loculations.
There were no deaths. One patient, after initial resolution, developed a recurrence of empyema and required thoracotomy. No air leaks were encountered.

**DISCUSSION**

Empyema encompasses a spectrum of pleural infection, ranging from an early exudative stage associated with thin, easily drained fluid, through a fibropurulent stage characterized by a thickening of the exudate and denser fibrin deposition, and finally the organizing stage in which a thick fibrous “peel” encases some or all of the lung.2,5,9 The principles of therapy include treating the underlying cause, appropriate antibiotics, and ensuring complete pleural drainage with lung expansion to obliterate the pleural space.1 This can be accomplished in the early stage with tube thoracostomy, but failure with continued pleural sepsis can occur if the fluid is too thick to be drained and/or if loculation prevents adequate drainage and lung expansion.2,5 Should this occur, more aggressive methods must be utilized. Thoracotomy with decortication is the most definitive approach, but it is associated with significant morbidity.2 In addition, many patients with empyema are debilitated and may present a prohibitive risk. Alternative approaches described have included rib resection with open drainage or instillation of fibrinolytic agents.2-4 Video-assisted thoroscopic (VATS) decortication, with or without cyclical irrigation, has more recently been suggested as an effective means of providing complete drainage and breakdown of loculations, and allowing lung expansion.5,8,10 However, requirements include the ability to have a double-lumen endotracheal tube placed and to tolerate “one-lung” anesthesia.7 Furthermore, extremely dense pleural symphysis may prevent the lung from collapsing enough to allow adequate visualization with the camera.8

The use of rigid thoracoscopy for lysis of pleural adhesions was first described by Jacobaeus11 at the beginning of the century and subsequently in a variety of clinical series.6 Although rigid scopes do not provide the same panoramic view that video-assisted techniques do, they still remain effective tools for pleural exploration. The combination of rigid thoracoscopy for pleural debridement with continuous postoperative irrigation resulted in a cure of empyema in 12 of 13 (92%) cases without thoracotomy. While the addition of antibiotic solution to the irrigation may be beneficial, we believe that the chief benefit is to mechanically break down residual or recurrent inflammatory exudate or blood clots.5 This approach should be considered in patients who are not candidates for VATS decortication, before proceeding with thoracotomy.

**REFERENCES**


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