Reappraisal of Empyema Thoracis*
Surgical Intervention When the Duration of Illness Is Unknown

Eddie L. Hoover, M.D.,† Hwei-Kang Hsu, M.D., F.C.C.P.;‡
Margery J. Ross, Ph.D.;§ Andrew M. Gross, M.D.;§
Hueiline Webb, M.D., t Anuokare Ketosugbo, M.D.;§
and Peter Finch, M.D., F.C.C.P.‖

The timing of surgical treatment of empyema remains controversial. Traditionally, thoracotomy is performed either within three weeks of diagnosis or delayed until presumed pleurodesis occurs. Often, these patients are moribund and the duration of illness impossible to determine. We report our surgical results in seven patients with a deteriorating clinical course and multiple loculations which persisted after tube thoracostomy and would not have responded to multiple thoracostomies. Five patients required decortication. One required lobectomy for an abscess which developed on the contralateral side six weeks after discharge. There were no deaths or recurrences of empyema. Average times from surgery to tube removal and to discharge were six to 12 days, respectively. We conclude that one can safely and cost-effectively treat these patients surgically even when the duration of illness and presence of pleurodesis are unknown, and that the postoperative course will be uncomplicated.

The timing of surgical intervention for pyogenic empyema thoracis continues to be controversial despite the fact that Hippocrates described its diagnosis and clinical course 2,400 years ago. The efficacy of decortication was presented by Fowler in 18931 and supported by Lilienthal in 1915.2 These reports probably led to the policy of routine open drainage, a practice followed both during the 1918 influenza pandemic and World War I. However, the high morality rate of early decortication soon relegated it to a secondary role to be used only after failure of thoracostesis and intercostal tube drainage. This policy was supported by the findings of Evarts Graham through the Empyema Commission of the United States Army that mortality after the more conservative closed drainage was only 10 percent.3 The author reasoned that mortality would decrease when the empyema cavity was allowed to seal itself from the remainder of the pleural space.

Interest in the surgical approaches to empyema was renewed during World War II. In 1946, Samson and Burbford4 studied early decortication with respect to the clinical course, degree of lung compression and the etiology, i.e., postpneumonic vs traumatic and were among the first to mention the time factor as a consideration for surgery. They recommended decortication within two to three weeks of diagnosis, before the ingrowth of myofibrils between the parietal pleura and the visceral and underlying pulmonary parenchyma. It has subsequently become standard practice to delay open treatment until pleurodesis is assured if surgery cannot be performed within the first three weeks following diagnosis. Although this approach has substantially decreased mortality, the morbidity has remained significant because of prolonged hospitalization, indwelling chest tubes which are serially shortened over a period of weeks or months, the presence of open draining wounds requiring meticulous care, and the occasional need for a second procedure for wound closure.

We support the principle of early surgical intervention in empyema. However, we frequently do not know the duration of illness in patients who are, for example, substance abusers, derelicts, or immunosuppressed patients. Recently, we successfully intervened surgically in a moribund patient who was unresponsive to tube drainage, and in whom the duration of illness could not be established. Six additional patients were treated similarly with equally satisfactory results. Based on this clinical experience which we report here, we propose that surgical intervention in empyema can be safe and effective despite uncertainty as to duration of illness or the occurrence of pleurodesis.

METHODS

During the period of this report (August 1980 through March 1985), 36 patients were treated for empyema at the Brooklyn Veterans Administration Medical Center. All patients were men. The average age was 42 years with a range of 30 to 73 years. Our
FIGURE 1. A typical chest x-ray film prior to thoracostomy.

The diagnostic and therapeutic protocol consisted of early bronchoscopy, upright and decubitus chest x-ray films (Fig 1), thoracentesis with cultures (aerobic, anaerobic, fungus, and AFB) and smears, chest tube insertion by the thoracic service, and repeat chest x-ray films including decubitus views after 24 hours. If the drainage was incomplete and the remaining pocket appeared to be localized, a second chest tube was inserted and x-ray films repeated. If subsequent roentgenograms show persistent loculations or an ill-defined diffuse haziness (Fig 2 and 3), a computerized tomography study was obtained to ascertain whether pleural thickening might account for the roentgenographic findings (Fig 4). If it appeared that the empyema was of the loculated type, surgery was scheduled as soon as any associated medical problems were corrected. Ampicillin was begun immediately after thoracentesis and Gram stains were done and infection was suspected. Antibiotic coverage was changed, if necessary, based on culture and sensitivity data. Antibiotics were continued intravenously for one week postoperatively.

RESULTS

Seven of the 36 patients treated for empyema during the period of this report failed to respond to conventional therapy. None of the 29 patients responding to tube thoracostomy subsequently required open drainage of any type. Six patients were chronic alcohol abusers: four of these were also intravenous drug abusers. The remaining patient was an intravenous drug abuser. One patient had chronic renal failure requiring dialysis, and another had portal hypertension with a prior episode of variceal bleeding. Their
data are presented in Table 1. All patients were operated upon within 48 hours after conventional therapy failed. There were no deaths and no significant postoperative complications. The patients were explored through a posterolateral thoracotomy with rib resection when appropriate. All patients had numerous fibrinopurulent pockets throughout the hemithorax and in the major fissures, which would not have cleared even with repeated chest tube insertions. The fibrinopurulent debris was easily removed by debridement with forceps and sponge stick. On intraoperative examination, five of seven patients required decortication. The peels were easily removed, and the underlying lung expanded fully in all patients. Although the requirement for decortication implied chronic empyema, even intraoperative examination could not establish the duration of the disease process. The bronchus of patient 1, who required a right lower lobectomy for an unsuspected abscess which encompassed the entire lobe, was closed with a stapler without sequelae. After the surgical procedure, all patients were irrigated copiously with saline solution. Two chest tubes were placed in the standard manner, and the chest was closed with No. 0 monofilament suture for the muscle layers and absorbable sutures for the subcutaneous tissue and skin.

Chest tubes remained in place an average of six days with a range of four to 12 days. The average postoperative length of stay was ten days with a range of seven to 21 days. The patient with cirrhosis required prolonged hospitalization for control of ascites. Bacteriologic results are shown in Figure 5. In every patient, the same culture result was obtained from pleural aspirate and intraoperative culture. Three patients (No. 1, 3, and 4) had Gram-negative organisms and one (No. 5) had *Staphylococcus aureus*. Three patients (No. 2, 6, and 7) had negative pleural aspirate

### Table 1—Summary of Data in Patients Undergoing Surgery

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Associated Medical Problems</th>
<th>Duration of Illness (Preop Days)</th>
<th>Operative Procedure</th>
<th>Chest Tubes Out (Postop Day)</th>
<th>Ready for Discharge (Postop Day)</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>Alcoholism, IV drug abuse, 35 pk/yr smoker</td>
<td>?</td>
<td>Debridement</td>
<td>7</td>
<td>13</td>
<td>Contralateral lung abscess 6 weeks after discharge requiring lobectomy</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
<td>Alcoholism, IV drug abuse, 40 pk/yr smoker, RUL pneumonia</td>
<td>?</td>
<td>Debridement, decortication</td>
<td>8</td>
<td>10</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>Alcoholism, IV drug abuse, 25 pk/yr smoker, RLL pneumonia</td>
<td>7</td>
<td>Debridement, decortication</td>
<td>10</td>
<td>14</td>
<td>None</td>
</tr>
<tr>
<td>4</td>
<td>53</td>
<td>Alcoholism, 70 pk/yr smoker, cirrhosis with UGI bleed</td>
<td>?</td>
<td>Debridement, decortication</td>
<td>4</td>
<td>7</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>73</td>
<td>Alcoholism, CHF, COPD</td>
<td>?</td>
<td>Debridement</td>
<td>7</td>
<td>11</td>
<td>None</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
<td>Alcoholism, IV drug abuse, chronic renal failure</td>
<td>14</td>
<td>Debridement, decortication</td>
<td>12</td>
<td>22</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>31</td>
<td>IV drug abuse, smoker</td>
<td>14</td>
<td>Debridement, decortication</td>
<td>6</td>
<td>8</td>
<td>None</td>
</tr>
</tbody>
</table>
and intraoperative cultures despite grossly visible pus. We found agreement between positive blood and sputum cultures with cultures taken at the time of surgery. All patients defervesced within 48 to 72 hours of surgery, and there were no instances of wound infections.

**DISCUSSION**

After the report in 1946 by Samson and Burford, open procedures for empyema thoracis were often delayed until pleurodesis was assured if surgery could not be performed within the first three weeks. Eloxessr subsequently developed an ingenious flap technique to drain the empyema cavity after it was allowed to mature to the point of ensuring complete pleurodesis. Although this technique reduced morbidity, returned adequate pulmonary function and provided a cosmetically acceptable result, it prolonged postoperative hospitalization increased the burden of costly wound care and frequently necessitated secondary procedures for wound closure.

Early thoracotomy for empyema has been reported by a number of authors with appropriate emphasis on tailoring therapy to the individual patient. Morin and co-workers in 1972 reported their results in 23 patients who underwent early surgical intervention with excellent results. Except for one death in an elderly patient, which was unrelated to surgery, there were no complications, and the average postoperative hospital stay was two weeks. This result was similar to our average postoperative stay of ten days. The lower average age of our patients (five of seven patients less than 33 years old) probably accounts for the differences in the length of stay between the two reports.

Morin et al. identified unsuspected lung pathology including one lung abscess and one bronchopleural fistula in 12 patients. These authors stressed the importance of the "D" shaped configuration of posteriorly placed loculations described roentgenographically by Le Roux and Dobbs as an indication of suitability for surgical intervention. We did not find this sign to be helpful, even retrospectively, although we would agree that its presence should make one more comfortable with a decision to operate.

Results similar to ours have been reported in cases which were secondary to trauma. Coon and Shuck in 1975 reported successful early intervention within 14 days in all seven of their trauma patients undergoing early surgery in the setting of clinical deterioration and failure of tube thoracostomy to establish full lung re-expansion.

In a 1977 report by Sherman et al., the presence of serious associated diseases was stressed as a complicating factor in the selection of a treatment modality for many of these patients. Seventy-six of their 102 patients, (75 percent) had significant associated diseases. Their treatment approach was more traditional in that they relied heavily upon prolonged chest tube drainage and the instillation of lytic enzymes to decrease the cavity size before making a decision about surgical intervention. They reserved early surgery for the younger patients with small residual cavities after prolonged tube drainage, although they offered that younger patients with larger cavities might be candidates for early surgical intervention.

In 1977, Fishman and Ellerton reported their results of early intervention in eight immunosuppressed patients. The authors recommended an ag-

**Figure 5. Source and results of bacteriologic studies.**

<table>
<thead>
<tr>
<th>Source</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleural aspirate</td>
<td>♢</td>
<td></td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
</tr>
<tr>
<td>Intraoperative culture</td>
<td>♢</td>
<td></td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
<td>♣</td>
</tr>
<tr>
<td>Blood</td>
<td></td>
<td></td>
<td>♣</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sputum</td>
<td>♦</td>
<td>♦</td>
<td>♦</td>
<td>♦</td>
<td>♦</td>
<td>♦</td>
<td>♦</td>
</tr>
</tbody>
</table>

Key:
- **Bacteroides asaccharolyticus**
- **Bacteroides distasonis**
- **Bacteroides melanogenicus**
- **Candida albicans**
- **Candida tropicalis**
- **Clostridium perfringens**
- **Hemophilus influenza**
- **Hemophilus parainfluenza**
- **Klebsiella pneumoniae**
- **Normal flora**
- **Staphylococcus aureus**
- **Streptococcus, beta hemolytic**
- **Streptococcus faecalis**
- **Streptococcus viridans**

---

Downloaded From: http://journal.publications.chestnet.org/pdaccess.ashx?url=/data/journals/chest/21542/ on 06/26/2017
gressive approach because of excellent results in six of these patients who were rapidly deteriorating with conservative tube drainage. These authors were among the first to note that the duration of illness is often impossible to determine, and therefore, the conventional wisdom of relating surgery to the probability of pleurodesis could not be relied upon. We also stress this point as we were unable to establish the duration of illness in five of our seven patients.

In 1981, Mavroudis et al. reported their series of 100 patients from San Francisco General Hospital. Nineteen patients failed tube thoracostomy treatment. Ten of the 19 had open debridement done within two weeks after admission, and the remaining nine had an Eloesser flap created primarily. Of the ten patients undergoing open debridement, one died, and two were treatment failures who subsequently were treated with an Eloesser flap. Their stated treatment goal for the ten patients undergoing open drainage was simply debridement and disruption of loculations. They avoided extensive debridement and did not remove the parietal pleura. We also avoided parietal pleurectomy because we were able to achieve full lung expansion and felt it unnecessary. Contrary to their approach, we did perform extensive debridement in five of our seven patients as it was necessary to achieve full lung expansion thereby obliterating dead space. With respect to timing, they too advocated early open drainage which they defined as “within two weeks of admission.” All patients in our series were operated on within five days after admission which included 24 to 48 hours of closed drainage. Our bacteriologic findings require two comments. First, Staphylococcus is reported by others to predominate in empyema. We recovered three Gram-negative organisms and only one case of Staphylococcus aureus. This difference in results may have been caused by a difference in presenting culture reports. Most series in which Staphylococcus predominated included culture reports of all patients admitted with empyema, not just those patients who underwent surgery. Neither we nor other investigators have been able to relate the timing of surgery to the organism recovered. We do not suggest that Gram-negative organisms are more likely to produce loculated empyemas. Second, negative cultures do not imply sterilization of the abscess cavity. Our findings, which are more likely to produce loculated empyemas. Second, negative cultures do not imply sterilization of the abscess cavity. Our findings, which are consistent with the literature, illustrate this point. Three of our patients had negative intraoperative cultures despite gross purulence and a deteriorating clinical course. These patients may have had anaerobic infections which were not recovered because of improper handling of the specimens.

To summarize, we believe that one can safely intervene surgically in empyema thoracis in patients failing tube thoracostomy, even when the duration of illness and occurrence of pleurodesis are unknown, with the expectation of an uncomplicated and cost-effective postoperative course.

ACKNOWLEDGMENTS: The authors would like to express their sincere gratitude to Ms. Barbara Miniero for her secretarial assistance in preparing this manuscript.

REFERENCES
1 Fowler GR. A case of thoracoplasty for the removal of a large cicatricial fibrous growth from the interior of the chest, the result of an old empyema. M Rec 1893; 44:83
3 Graham EA. Some fundamental considerations in the treatment of empyema thoracis. St Louis: CV Mosby, 1925