Empyema and Bronchopleural Fistula*
Experience with Open Window Thoracostomy

Dov Weissberg, M.D., F.C.C.P.

Open window thoracostomy (OWT) was created in 12 patients with empyema and sepsis after conventional therapy with antibiotics and drainage had failed. After creation of OWT all infections subsided within ten days to four months and all fistulae closed within one to four months. Complete obliteration of the empyema cavity by granulation tissue occurred in 11 of 12 patients within one to eight months, depending upon the size of the space. All patients tolerated the procedure well. Creation of OWT has not caused lung collapse in any of the patients due to fibrosis caused by the preceding infection. There was no complication or death. OWT is a safe procedure recommended in all patients with empyema resistant to conventional therapy. It does not need to be restricted to post-pneumonectomy cases. Operative closure of bronchopleural fistulae, a major surgical undertaking with an uncertain outcome, is usually unnecessary.

Treatment with antibiotics and tube drainage is adequate for the majority of patients with empyema. However, in chronic empyema, effective drainage of the pleural space may be difficult, and frequent failures ensue as a result of undue persistence of closed-drainage procedures and other well-intended half-measures. On the other hand, obliteration of the space by extensive thoracoplasty is a mutilating procedure, correctly avoided by surgeons who have not had adequate experience with thoracoplasty procedures. Presence of a bronchopleural fistula in some of these patients further complicates the problem. Some authors favor its operative closure in addition to either drainage or obliteration of the pleural space.1-3 We have managed these patients by creating an open window thoracostomy (OWT), without attempting to close the fistula. This report summarizes our experience with 12 patients.

Clinical Material

Between 1971 and 1981, 112 patients with empyema due to various causes were treated in our hospital. Twelve patients have not responded to conventional therapy with drainage and antibiotics and were treated by open window thoracostomy. In ten of these patients, the empyema was preceded by some operative procedure: five had pneumonectomy, while in five the infection occurred in residual pleural space. Bronchopleural fistula was present in seven patients: in four it was small and peripheral, while three developed a large fistula originating in the main bronchus following pneumonectomy. Five patients were moribund because of sepsis. There were 11 men and one woman, ranging in age from 36 to 66 years.

Technique

The OWT is done under general endotracheal anesthesia. The incision is made over the area of the greatest collection of pus, usually lateral or posterolateral. Three or four ribs and the intercostal soft tissues are resected for a length of 15 to 20 cm. The edges of the skin are brought to the parietal pleura and fixed with a few absorbable sutures (Fig 1). After aspiration of all pus and necrotic debris, the cavity is filled with gauze soaked in Eusol (Dakin’s solution). The dressing is changed daily, until complete obliteration of the cavity by granulation tissue occurs. When bronchopleural fistula is present, the process of its gradual closure can be observed. All patients receive antibiotics preoperatively and until clearance of infection has occurred, according to results of culture and sensitivity studies.

The following two patients illustrate our method and the results.

Case Reports

Case 8

A 49-year-old man with epidermoid carcinoma of the left bronchus underwent left pneumonectomy on October 9, 1977. His postoperative course was complicated by a large bronchopleural fistula and empyema. Despite treatment with antibiotics, intercostal tube drainage (November 7) and a five rib thoracoplasty (November 28), the high fever continued. The thoracoplasty wound became grossly infected, discharging copious amounts of pus. There was no response to therapy with antibiotics. The patient became...
septic and confused. On December 7, the thoracoplasty was converted to an OWT by resection of additional segments of ribs and all remaining intercostal tissues. The wound was packed with gauze soaked in Eusol. Within a few days his clinical condition improved dramatically. The wound began clearing and the fistula decreased in size to complete closure within four months. The cavity filled gradually with granulation tissue, until its complete obliteration six months after the OWT (Fig 2). There were no further problems related to the chest. One month later the patient died from a brain metastasis.

**CASE 10**

A 36-year-old man had a right middle and lower bilobectomy because of bronchiectasis. The postoperative course was complicated by bronchopleural fistula and empyema. Cultures grew *Pseudomonas aeruginosa*. Despite treatment with antibiotics and intercostal tube drainage, his condition deteriorated and he became moribund. One month after the bilobectomy, an OWT was made, with immediate improvement in his general condition. From the second postoperative day, he was afebrile and fully cooperative. The wound became clean within one month, and at the same time, the fistula closed off by growth of granulation tissue. There followed rapid obliteration of the remaining space, which was complete two months after the OWT. At this time, small nonepithelialized area was covered with split thickness skin graft (Fig 3). After discharge from the hospital he returned to full-time employment as a waiter. Seven years later he remains well. Chest films show full expansion of the remaining right upper lobe (Fig 4).

**RESULTS**

The empyema was controlled by OWT in all patients. Their general condition began to improve immediately after the procedure, and sepsis subsided within a few days. The local infection cleared completely within a period ranging from ten days to four months (Table 1) and all fistulae closed within four months. The empyema cavity filled with granulation tissue to complete obliteration in all patients. Depending upon the size of space, this process lasted from one to six months in ten patients, eight months in one, and 24 months in one. There were no complications related to the procedure. One patient (No 8) died from brain metas-

**DISCUSSION**

In 1935, Eloesser* described an operation for open drainage of tuberculous empyema in cases where the lung had not been resected. Clagett and Geraci* reported a method of open drainage of empyema following pneumonectomy. They resected a rib and left the wound open for daily irrigations with 0.25 percent neomycin solution until sterilization of the cavity occurred. Closure of the thoracostomy was performed at a later date. Virkkula and Kostiainen* described a similar method, but created a considerably larger window, resecting two or
Table 1—Empyema and OWT: Clinical Course

<table>
<thead>
<tr>
<th>Case Number, Age (years), Sex</th>
<th>Underlying Disorder and Treatment</th>
<th>Delay from Onset of Empyema to OWT (months)</th>
<th>Infection Cleared (months)</th>
<th>Postoperative Course Fistula Closed (months)</th>
<th>OWT Obliterated (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 M</td>
<td>Pulmonary TB, lt; Lucite ball plombage</td>
<td>None</td>
<td>20</td>
<td>½</td>
<td>2</td>
</tr>
<tr>
<td>2 M</td>
<td>Pulmonary TB, lt; Lucite ball plombage</td>
<td>Small</td>
<td>20</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3 M</td>
<td>Pulmonary TB, rt; Pneumonectomy</td>
<td>Large br. pleurocutaneous</td>
<td>12</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>4 M</td>
<td>Pulmonary TB, rt; Therapeutic pneumothorax</td>
<td>None</td>
<td>“Several” years</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>5 M</td>
<td>Pulmonary TB, lt; Pneumonectomy</td>
<td>None</td>
<td>10</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6 M</td>
<td>Pulmonary TB, lt; empyema necessitatis; Drainage</td>
<td>Small pleurocutaneous</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7 F</td>
<td>Pulmonary TB, rt; bleeding. Emergency pneumonectomy</td>
<td>Large</td>
<td>1 month</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>8 M</td>
<td>Bronchogenic ca, lt; Pneumonec. 5-rib thoracoplasty—failure</td>
<td>Large</td>
<td>2 months</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9 M</td>
<td>Malig. mesothelioma, pleural effusion, lt; Nonresectable. Biopsy</td>
<td>None</td>
<td>1 month</td>
<td>½</td>
<td>1</td>
</tr>
<tr>
<td>10 M</td>
<td>Bronchiectasis, rt middle &amp; lower lobes. Bilobectomy</td>
<td>Small</td>
<td>1 month</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11 M</td>
<td>Bronchogenic ca, rt; Pneumonectomy</td>
<td>Small</td>
<td>1 month</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12 M</td>
<td>Lung abscess, lt</td>
<td>None</td>
<td>2 months</td>
<td>½</td>
<td>2</td>
</tr>
<tr>
<td>13 M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Late death from brain metastasis

three ribs. In several of their patients, the window was left permanently open because of persistent bronchopleural fistula or other factors not permitting its closure. Our method is similar to theirs and has been used with great success. This procedure is indicated in patients who have empyema, with or without bronchopleural fistula that did not respond to vigorous therapy with antibiotics and tube drainage. It is applicable both in empyema that occurred after pneumonectomy or that developed in a residual pleural space, regardless of the size of the bronchopleural fistula. In these therapy-resistant cases, addition of a simple rib resection rarely cures the empyema. The OWT offers a solution, as the wide opening enables thorough daily cleaning of the pleural cavity either by irrigation or by the change of dressing. Although the majority of investigators²,₅,₁₇ have used the open thoracostomy only for treatment of empyema following pneumonectomy, we have created the window regardless of any previous resection. Following the OWT, the remaining lung tissue did not collapse because of fibrosis caused by the infection. In these patients, decortication may have seemed more appropriate; however, their moribund septic condition did not permit a more extensive procedure. We were con-
vinced that they would not tolerate decortication. OWT is an intervention of a much lesser magnitude, enabling complete evacuation of pus and debris and bringing about immediate dramatic improvement in every case.

A theoretic drawback of leaving the pleural space open is the possibility of mediastinal flutter. This was described by Eerola, but was not seen in any of our patients. We believe that any significant flutter is prevented effectively by the fibrosis resulting from the longstanding infection.

Operative closure of the bronchopleural fistula using muscle pedicles has been reported from time to time. Although the prospects of immediate closure seem attractive, such attempts are technically difficult, dissection of the bronchial stump hazardous, and the results unpredictable. Monod and Weyl described a method of suturing the bronchial fistula in connection with extensive thoracoplasty. Use of hypothermia in some of their patients testifies to the magnitude of this operation. In one patient, mobilization of the aorta needed for exposure of the bronchus resulted in necrosis of the aorta and death. Dahlbäck and Schüller, in addition to reamputation and resuture of the bronchus, covered the sutured stump with pericardium, pleura, azygos vein or intercostal pedicle. Of 22 patients treated, seven died in the postoperative period and three later. Four fistulae occurred. Björk closed bronchopleural fistulae using stainless steel wire in two patients. Both fistulae re-opened promptly and both patients died. Other authors also stressed the difficult approach to the fistula and high risk in its dissection and closure. On the other hand, after establishing adequate drainage through the OWT, the great majority of fistulae, including the large ones, close spontaneously, albeit slowly, as did all in this series. The few remaining ones can be blocked off effectively by a gauze pack, avoiding a major operation with a doubtful outcome. My experience has been confirmed by Virkkula who wrote that:

The chief aim in the treatment of an empyema is obliteration of the cavity because when that is achieved, suppuration ceases and the fistula closes. Thus, in principle, the treatment of the empyema and the bronchial fistula are the same in patients in whom the cavity can be obliterated surgically. The treatment of suppuration by antimicrobial medication alone neither clears the cavity nor closes the fistula.

Secondary operative closure of the thoracic window is likewise a matter of controversy. Once sterilization of the cavity occurred, its secondary closure has been attempted by several authors, but the results have not been uniformly good. In the series of Stafford and Claggett, following secondary closure of thoracostomy, empyema recurred in seven of 18 patients, while Virkkula and Eerola reported three recurrences among 13 patients. We believe that operative closure of the window should not be attempted routinely, as it only improves the appearance of the chest, a consideration of relatively minor importance in most patients. Of course, secondary closure for cosmetic reasons may be occasionally indicated in young people, particularly women. The wide opening into the pleural cavity was very well tolerated by all our patients and all were satisfied. The OWT with the resulting scar is indeed a small price to pay for getting rid of the incapacitating and life-threatening empyema.

References

2. Eerola S. Treatment of postpneumonectomy empyema and associated mediastinal fistulae: A clinical study. Academic Dissertation, Medical Faculty of the University of Helsinki, Painioavain Oy, Helsinki, 1977