The Treatment of Pleural Effusion Complicating Pneumonia*

Joseph M. Van De Water, M.D.

Since the advent of antibiotics, pleural effusion has become a rare complication of pneumonia, but it remains a serious one that can result in prolonged hospitalization. A five-year (1963-1968) retrospective and prospective study of this problem in young men free of other disease was undertaken. The case material consists of the 49 patients requiring thoracenteses from the entire 6,000 cases of pneumonia treated during that same period. The two most important aspects of therapy, it is concluded, were prompt treatment with intercostal tube drainage and early chest physiotherapy. These measures enabled early return to full duty for the military personnel under study. The need for open drainage and decortication was eliminated and the average hospitalization time was reduced by 50 percent.

Pleural effusion is a complication of pneumonia that can result in prolonged hospitalization and pulmonary disability. Most important in its treatment are prompt and adequate drainage and early chest wall physiotherapy. The present study covers a five-year period during which the hospitalization and residual disability were significantly reduced by such measures.

CLINICAL MATERIAL

The patients, men ranging in age from 17 to 25 years, were in the United States Army Infantry training program and were therefore in generally good health prior to their pneumonia. They were all subject to similarly strenuous activities and similar environmental conditions. Only those patients whose effusions required one or more thoracenteses were included. Roentgenographic diagnosis alone of a pleural effusion did not qualify a patient for entrance into the study. Over the five-year period beginning July 1, 1963 and ending June 30, 1968 there were 49 such patients.

FINDINGS

The number of pleural effusions, while varying from year to year, was closely related to the incidence of pneumonia. There was approximately one case of pleural effusion for every 100 cases of pneumonia. The worst month was February with 30 percent incidence which was twice as high as the months of January, April and March with incidences of 14 percent, 14 percent and 12 percent respectively. There was no apparent relationship to the rate of admission for upper respiratory infection nor to the total population of trainees (Fig 1).

The early course of the illness in these patients was identical with that of the 99 percent of pneumonia patients who did not develop a pleural effusion. The average interval for the development of effusion was five days from the time that pneumonia was diagnosed. The pleural effusion was associated with a parenchymal infiltrate which was invariably in the lower lobe—one and a half times more frequently on the left than on the right.

There were eight cases of Group A beta-hemolytic Streptococcus from which came three of the four patients who eventually required decortication. Twelve cases were diagnosed as *D. pneumoniae*. The responsible organism was difficult to identify despite culture of pleural fluid, blood, throat, and sputum in every one of the 49 patients (plus the determination of antistreptolysin O titers in many). The presence of an organism in a sputum sample was not accepted as diagnostic as these samples were often saliva rather than sputum (Table 1).

During the last three years, acute and convalescent sera were drawn for viral studies in patients.
Five-year comparison of the numbers of cases of pleural effusion, pneumonia, upper respiratory infections, and trainee strength. The effusions most closely followed the pneumonias with an incidence of 7/1045, 5/1375, 19/1940, 7/955, and 11/890 for the respective years.

Eight were positive for adenovirus: four were of type 4 and four of type 7. Six of these represented diagnoses in cases whose etiologic agent would have otherwise remained unknown. Two of the type 4 cases had been diagnosed as D. pneumoniae on the basis of a positive throat culture in one and blood culture in the other.

In all cases, the pleural effusions were initially serous and straw-colored. The protein content ranged from 3.4 to 5.3 gm percent with a mean of 4.8 gm percent. The mean specific gravity was 1.019. Lactate dehydrogenase and glucose values varied widely without discernible correlation with other factors. White blood cell count of the pleural fluid ranged from 50 cells/mm³ to 42,000/mm³ without dependence on bacterial agent, nor were correlations possible with the differential white cell counts.

Treatment

When D. pneumoniae or Group A streptococci were suspected, seen, or cultured, penicillin was given. When the agent could not be identified, erythromycin was often used, because of its effectiveness against both the pyogenic cocci and the Eaton agent (Mycoplasma). The patients also received symptomatic medication, steam inhalation, and intermittent positive pressure breathing.

In the first two years of this study, treatment of the effusion consisted of repeated thoracenteses. Four of these patients who had five, four, six, and nine thoracenteses respectively, eventually had decortications. One other patient also had nine thoracenteses, and his hospitalization amounted to 104 days.

From the third year on, early intercostal tube drainage was used. Largely due to this single measure, but also to early chest physiotherapy, there was a 50 percent reduction in hospital time, a reduction in morbidity, and elimination of the need for decortication (Table 2).

Discussion

There are numerous reports of pleural effusions in the literature, but typically their discussions center on effusions associated with tuberculosis and malignancies. The pleural effusion once so frequently with pneumonia in the preantibiotic days is now relatively uncommon, particularly in otherwise healthy young adults. The present study points out the seriousness of this complication and the necessity for prompt recognition and proper treatment.

Detection of the etiologic agent and often diagnosis of the effusion itself is difficult. Although a bacterial agent was identified in only 20 of these 49 cases, six of 16 of the remaining 29 tested harbored an adenovirus, supporting the belief that

<table>
<thead>
<tr>
<th>Group A</th>
<th>Diplococcus</th>
<th>Adenovirus</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-Hemolytic streptococcus</td>
<td>Pneumonia</td>
<td>4</td>
</tr>
<tr>
<td>Sputum</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Throat</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Blood</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Pleural Fluid</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>ASO &gt; 250</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Established-DX</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>

Basis on which positive diagnoses were made. Positive sputum cultures alone were not accepted. Note that the pleural fluid was sterile in all but six cases. Where more than one organism was found, the diagnosis was established on the basis of the most prevalent one.
PLEURAL EFFUSION COMPLICATING PNEUMONIA

Table 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Pleural Effusions</th>
<th>Thoracenteses</th>
<th>Inter- Hospitalization (days)</th>
<th>Costal Decorti- cations</th>
</tr>
</thead>
<tbody>
<tr>
<td>63-64</td>
<td>7</td>
<td>23</td>
<td>3.3</td>
<td>2-6</td>
</tr>
<tr>
<td>64-65</td>
<td>6</td>
<td>22</td>
<td>4.4</td>
<td>1-9</td>
</tr>
<tr>
<td>65-66</td>
<td>19</td>
<td>32</td>
<td>1.7</td>
<td>1-4</td>
</tr>
<tr>
<td>66-67</td>
<td>7</td>
<td>9</td>
<td>1.3</td>
<td>1-3</td>
</tr>
<tr>
<td>67-68</td>
<td>11</td>
<td>22</td>
<td>2.0</td>
<td>1-3</td>
</tr>
</tbody>
</table>

Comparison of the average number of hospital days with the number of thoracenteses, intercostal tubes, and decorti- cations. Hospital days includes a period of convalescence not necessarily spent in the hospital and as such is a measure of the total working or duty days lost.

Viral pneumonia can lead to a pleural effusion. Isolation of a bacterial agent, particularly beta streptococcus should warn of subsequent effusion or necrotizing pneumonia, but the lack of this identification does not lessen the probability of this complication. Beyond this, there is no physical sign or laboratory study that will pinpoint those cases of pneumonia that will develop effusion. Rather, the detection of the smaller, early effusion is frequently made first by the radiologist instead of the clinician, whose percussive and auscultatory tools are all too crude.

Treatment must achieve effective and persistent drainage of the pleural space, and begins with thoracentesis, performed immediately upon suspicion or diagnosis of an effusion. If there is reaccumulation, a second thoracentesis or intercostal tube drainage should be instituted. If there is need for a third thoracentesis, intercostal tube drainage is usually imperative. Repeated thoracenteses, recommended by some, often lead to fluid loculation, incomplete pleural space drainage, prolonged hospitalization, and even, occasionally, decortication. There is rarely an indication for repeated thoracenteses coupled with intrapleural instillation of antibiotics.

When applied early, intercostal tube drainage is very effective, particularly if polyvinyl tubes are used. A roentgenogram in the lateral decubitus position is most helpful for this diagnosis.

Figure 2. Sequence of six roentgenograms of a typical case illustrating: 17 Mar—the initial appearance of the pleural effusion; 1 Apr—and removal of 3800 ml of which 1700 ml were removed by intercostal tube drainage over a ten day period: 18 Apr—progressive clearing. Patient is back at full duty on 21 May.
used. The tube should be at least a size 28 F, and should be connected to an underwater seal and high suction. The patient will often experience immediate relief of pain if the pleural space decompression is effective. If the tube ceases to function and there is evidence of persistent pleural fluid, the tube should be replaced. When there is no longer any fluid accumulation or drainage and the patient’s clinical course is stable, the tube should be removed. In addition, the usual measures of pneumonia therapy, including antibiotics, should be employed.

There is rarely an indication for decortication, early or late. These effusions are, by definition, empyemas, because they contain polymorphonuclear leukocytes. Grossly, however, the fluid is initially not the thick creamy pus that is usually found in cases of empyemas developing from the intrapleural rupture of a parenchymal abscess as in tuberculosis or bronchiectasis. When prompt adequate intercostal tube drainage is instituted the stage of frank empyema can be avoided. However, when it occurs, the pus, which is often sterile, can be removed successfully with strong suction. Open pleural drainage or decortication can be avoided.

Early mobilization of the patient was very important. When the febrile phase of the illness, which usually precedes the development of the effusion, has passed, active chest wall physiotherapy was begun. This aided removal of the pleural fluid and improved pulmonary function. The patients were returned to duty when there was still haziness present on the chest roentgenogram. They were encouraged to participate in all activities where chest motion and expansion were demanded to improve chest wall compliance. This “natural” physiotherapy hastens the resolution of the roentgenographic shadow, which is apparently no more than a reactive pleurisy or “pleural edema,” and not a peel (Fig 2).

ACKNOWLEDGMENT: I am indebted to Col. Arthur A. Terrill, Chief of Surgery, Beaumont General Hospital, El Paso, Texas for his guidance and encouragement.

REFERENCES

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