Rapid detection of pneumococcal antigen in pleural fluid of patients with community acquired pneumonia

W G Boersma, A Löwenberg, Y Holloway, H Kutschüter, J A M Snijder, G H Koeter

Abstract

**Background** Detection of pneumococcal antigen may help to increase the rate of diagnosis of pneumococcal pneumonia. This study was designed to determine the value of rapid detection of pneumococcal antigen in pleural fluid from patients with community acquired pneumonia.

**Methods** Thoracentesis was performed in patients suspected of having empyema and in patients with pneumonia of unknown aetiology. Pneumococcal capsular antigen was detected by latex agglutination and this method was compared with Gram staining and culture, specimens of pleural fluid being examined in parallel by the three methods.

**Results** Pleural fluid was radiographically identified in 63 of 135 patients with community acquired pneumonia. In nine of 45 patients with pneumococcal pneumonia and pleural fluid pneumococci were identified by Gram stain in two and by culture in one specimen of pleural fluid, whereas antigen was detected in eight of these specimens. In 12 of 33 patients with pneumonia of other known aetiology only one pleural fluid specimen was antigen positive, providing a specificity of 92% for this test. Pleural fluid obtained from 12 of 58 patients with pneumonia of unknown aetiology yielded detectable antigen in seven cases.

**Conclusions** Detection of pneumococcal antigen by latex agglutination in pleural fluid may yield important and rapid information in patients with community acquired pneumonia.

(Thorax 1993;48:160–162)
Results of diagnostic tests for pneumococci in pleural fluid from patients with community acquired pneumonia

<table>
<thead>
<tr>
<th>Diagnosis (n)</th>
<th>Pleural fluid radiographically present (%)</th>
<th>No of positive cases/ No tested (%)</th>
<th>Pleural fluid Gram stain</th>
<th>Culture</th>
<th>Antigen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumococcal pneumonia (45)</td>
<td>22 (49)</td>
<td>2/9 (22)</td>
<td>1/9 (11)</td>
<td>8/9 (89)</td>
<td></td>
</tr>
<tr>
<td>Pneumonia of other known aetiology (32)*</td>
<td>16 (50)</td>
<td>0/12</td>
<td>0/12</td>
<td>1/12 (8)</td>
<td></td>
</tr>
<tr>
<td>Pneumonia of unknown aetiology (38)</td>
<td>25 (45)</td>
<td>0/12</td>
<td>0/12</td>
<td>7/12 (58)</td>
<td></td>
</tr>
</tbody>
</table>

*Chlamydia psittaci (2 cases), Haemophilus influenzae (2), Chlamydia psittaci and Mycobacterium tuberculosis (1), M tuberculosis (1), β haemolytic streptococcus group G (1), Gram negative rods—2 spp (1), Escherichia coli and Streptococcus milleri (1), Bacteroides spp and anaerobic Gram positive rods (1), Fusobacterium spp (1), mixed aerobic and anaerobic bacteria (1).

Results

Pleural fluid was radiographically visible in 63 (47%) of the 135 patients admitted with community acquired pneumonia and was obtained in 33 cases.

Samples of pleural fluid were collected from nine of the 45 patients with pneumococcal pneumonia, 12 of the 32 patients with pneumonia of other known aetiology, and 12 of the 58 patients with pneumonia of unknown aetiology.

*S pneumoniae* was detected in pleural fluid by Gram staining or culture in only two of the nine patients with pneumococcal pneumonia we studied, whereas pneumococcal capsular antigen was detected by latex agglutination in eight of the eight patients, yielding a sensitivity of 89% (table).

Detection of pneumococcal antigen in pleural fluid from patients with pneumonia caused by other known aetiological agents was highly specific (92%) for pneumococcal disease, only one of the 12 patients being antigen positive. This patient, with a chlamydial infection, had been treated with antibiotics before admission, suggesting that a mixed infection including *S pneumoniae* could not be excluded.

In patients who were classified as having pneumonia of unknown aetiology antigen was detected in seven of 12 pleural fluid samples, all of which were negative according to Gram staining and culture.

Only one patient developed a pneumothorax as a complication of the thoracentesis, and a chest tube was required. No other complications were noted.

Discussion

Pleural fluid is detected by chest radiography in 16–57% of patients with community acquired pneumonia.5,7 Although radiographically present in 63 (47%) of the patients in this study, pleural fluid was examined in only 33.

Bacterial pneumonia has a higher incidence of parapneumonic effusion than "atypical" or viral pneumonia.5,8 Parapneumonic effusion develops in about half of all patients with pneumococcal pneumonia, the highest rate being seen in patients with bacteremia.5,7

Although more cases of bacterial pneumonia are caused by *S pneumoniae* than by any other bacterium, pneumococcal empyema is rare.6 In the study by Bartlett and associates9 pneumococci were identified by culture in only five of 83 pleural fluid specimens from patients with empyema, whereas in the present study pneumococci could be identified in two of nine specimens.

Once patients have received antibiotics the clinical manifestations and the bacteriology of the pleural fluid may be altered.10 In pneumococcal pneumonia antibiotic treatment has an enormous impact on the results of Gram staining and culture of clinical specimens, such as sputum and pleural fluid.11–15 Soluble bacterial antigens may persist in clinical specimens, including pleural fluid, even when bacteria can no longer be found. Previous studies have investigated pleural fluid for pneumococcal antigen by counterimmunoelectrophoresis.14,16 There is no published assessment of the value of more rapid and simpler methods, such as latex agglutination and coagglutination, for detecting capsular antigen.

In our study detection of pneumococcal antigen in pleural fluid was far more sensitive (89%) than Gram staining and culture. The same sensitivity of latex agglutination has been reported in sputum specimens.3,11,18 Tugwell et al19 reported that antigen could be detected by counterimmunoelectrophoresis in pleural fluid in 10 of 12 adults with lobar pneumonia, whereas routine bacteriological methods identified pneumococci in only five of these specimens. In a study among children counterimmunoelectrophoresis detected pneumococcal antigen in all 19 pleural fluid specimens in which *S pneumoniae* was identified.14 No false positive results were reported in children with non-pneumococcal pneumonia. In culture negative pleural fluid pneumo-
coccocal antigen was detected in 15 of the 45 cases.
Antigen detection in pleural fluid may provide a definite aetiological diagnosis, as shown in seven of the 12 patients with pneumonia of “unknown” aetiology in the present study.

We observed that despite adequate antibiotic treatment antigen sometimes persisted in pleural fluid for at least one week, while Gram staining and culture gave negative results. This is in accordance with the findings of others.14

Our results suggest that antigen detection in pleural fluid in patients with community acquired pneumonia is a reliable method for establishing that S pneumoniae is definitely the cause. In contrast to pneumococci in sputum specimens, detectable antigen in pleural fluid is highly specific for the presence of pneumococcal pneumonia. The results of latex agglutination are available within one hour and antibiotic treatment can be directed at the pneumococcus.

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