Streptococcus milleri as a cause of pleural empyema

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ABSTRACT  Review of an annual series of cases of empyema seen at a regional cardiothoracic unit showed that six out of 25 were due to Streptococcus milleri. The details of the cases are summarised. This organism is now an important cause of empyema, occurring much more commonly in men than in women; but since it is highly sensitive to penicillins permanent resolution can be achieved with antibiotic treatment combined with open or closed drainage.

Pleural empyema, or pus in the pleural cavity, has been recognised since the time of Hippocrates. Streptococcus pneumoniae was once the predominant pathogen but antibiotics and chemotherapy changed the pattern and by the late 1950s it had been replaced by Staphylococcus aureus. The next decade showed an increase in enteric and other Gram negative organisms, particularly Pseudomonas, while recently the importance of anaerobes has been re-emphasised, confirming the work of Guillemot and others at the turn of the century. The failure to identify anaerobes with any frequency was probably due to failure to obtain adequate specimens, failure to optimise their transport and culture, and possibly the prior administration of antibiotics. In the series we discuss here one microaerophilic organism predominated—namely, Streptococcus milleri.

Patients and methods

Twenty five patients in an annual series of non-chronic, non-tuberculous empyema were included. These patients were seen at a regional cardiothoracic unit from August 1981 to August 1982. They were under the care of four surgeons. Many had been referred from other centres, and some had received antibiotics before admission. Specimens were obtained by thoracentesis, thoracoscopy, and thoracotomy and appropriate management was instituted.

The specimens were cultured anaerobically and aerobically on selective blood agar and in Robertson's medium, which was subcultured at 48 hours for both anaerobic and aerobic culture. In all cases acid fast bacilli and fungi were looked for. Shortly after case 9, the laboratory introduced the API 20 Strep (No 2060) system (API System, SA) for speciating streptococci encountered in medical practice, which incorporates 20 biochemical tests.

Results

The patients' sex and age, aetiology, causative organism or organisms, and management are indicated in the table.

In this series nine out of 25 infections (36%) were due to anaerobic organisms. Specimens from five of the 25 patients were sterile on culture. Fifteen different organisms were represented; the most common (6/25 cases) was Strep milleri (24%). Empyema due to Strep milleri was successfully treated by conventional methods, including closed intercostal drainage, rib resection, and decortication. In addition, appropriate antibiotics were prescribed. Penicillin was used alone in four cases, though in case 22 ampicillin was used initially for 24 hours. Patient 15 was treated with cephamandole followed by cephalaxin and patient 19 with ampicillin and metronidazole together with noxythioliol irrigation. There were no deaths. Five out of six of the cultures grew Strep milleri in pure culture. The sex ratio was 5:1 (M:F) with an age range of 24–66 years. For the series as a whole the sex ratio was close to 2:1 and the age range 19–73. Attention should be drawn to case 9, in which the organism was identified as a microaerophilic streptococcus before speciation became available and empyema was associated with a pyogenic liver abscess and subphrenic collection of pus. This association has previously been reported for group F streptococci and is important in the light of the observation by Bartlett and Finegold.

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Details of the patients, organisms isolated from the empyema, and the treatment given

<table>
<thead>
<tr>
<th>No</th>
<th>Sex</th>
<th>Age</th>
<th>Causal factors*</th>
<th>Organisms</th>
<th>Treatment†</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>39</td>
<td>Pneumonia</td>
<td>E coli</td>
<td>Thoracocentesis</td>
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<tr>
<td>2</td>
<td>F</td>
<td>45</td>
<td>Pneumonia in diabetic alcohol</td>
<td>H influenza</td>
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</tr>
<tr>
<td>3</td>
<td>M</td>
<td>44</td>
<td>Pneumonia with lung abscesses</td>
<td>H parainfluenzae</td>
<td>Decortication and linguelectomy</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>59</td>
<td>Dilatation of benign oesophageal stricture</td>
<td>E coli</td>
<td>Closed drainage</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>41</td>
<td>Thoracotomy and deep x-ray treatment for inoperable cancer</td>
<td>Klebsiella sp</td>
<td>Closed drainage</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>67</td>
<td>Pneumonia</td>
<td>Strept viridans (not speciated)</td>
<td>Thoracocopy, irrigation, and closed drainage</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>23</td>
<td>Pneumonia</td>
<td>Strept viridans</td>
<td>Rib resection</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>73</td>
<td>Pneumonia</td>
<td>Bacteroides sp</td>
<td>Rib resection</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>34</td>
<td>Pyogenic liver abscess and subphrenic abscess</td>
<td>Microaerophilic streptococci</td>
<td>Closed drainage of both cavities</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>40</td>
<td>Pneumonia</td>
<td>No growth</td>
<td>Decortication</td>
</tr>
<tr>
<td>11</td>
<td>F</td>
<td>43</td>
<td>Trauma</td>
<td>Staph epidermidis</td>
<td>Closed drainage</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>59</td>
<td>Pneumonia</td>
<td>Strept milleri</td>
<td>Rib resection</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>61</td>
<td>Drainage of malignant pleural effusion</td>
<td>No growth</td>
<td>Decortication</td>
</tr>
<tr>
<td>14</td>
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<td>Strept milleri</td>
<td>Closed drainage</td>
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<tr>
<td>15</td>
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<td>Laparotomy (endometriosis) in alcoholic</td>
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<td>Rib resection</td>
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<tr>
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<td>F</td>
<td>63</td>
<td>Pneumonia</td>
<td>Bacteroides sp</td>
<td>Closed drainage</td>
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<td>66</td>
<td>Pneumonia</td>
<td>Strept pneumoniae</td>
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<tr>
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<td>F</td>
<td>19</td>
<td>Pneumonia</td>
<td>No growth</td>
<td>Thoracocopy and aspiration</td>
</tr>
<tr>
<td>19</td>
<td>M</td>
<td>28</td>
<td>Pneumonia (Werdnig Hoffman muscular dystrophy)</td>
<td>Strept milleri</td>
<td>Closed drainage</td>
</tr>
<tr>
<td>20</td>
<td>M</td>
<td>60</td>
<td>Talc pleurodesis for pleural effusion of unknown cause</td>
<td>Staph aureus</td>
<td>Closed drainage</td>
</tr>
<tr>
<td>21</td>
<td>M</td>
<td>17</td>
<td>Pneumonia (mentally subnormal)</td>
<td>No growth</td>
<td>Thoracocopy and closed drainage</td>
</tr>
<tr>
<td>22</td>
<td>M</td>
<td>40</td>
<td>Spontaneous haemopneumothorax, intercostal drainage, and thoracoscopy</td>
<td>Staph epidermidis</td>
<td>Decortication</td>
</tr>
<tr>
<td>23</td>
<td>M</td>
<td>55</td>
<td>Pneumonia</td>
<td>Strept milleri</td>
<td>Rib resection</td>
</tr>
<tr>
<td>24</td>
<td>M</td>
<td>24</td>
<td>Pneumonia</td>
<td>Strept milleri</td>
<td>Decortication</td>
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<tr>
<td>25</td>
<td>M</td>
<td>37</td>
<td>Lobectomy for cancer</td>
<td>Klebsiella sp</td>
<td>Rib resection</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Staph aureus</td>
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</tr>
</tbody>
</table>

*"Pneumonia" indicates preceding pneumonia.
†Not including appropriate antibiotics.

that abdominal anaerobic infections accounted for over 17% of cases of anaerobic empyema. It is serologically heterogeneous, 14% in one series having the group F antigen.

Streptococcus milleri is part of the normal flora of the mouth and pharynx and in addition is part of the human intestinal flora. It seems likely that in common with other bacteria Strept milleri may arrive in the lung in several ways: (1) aspiration of oral secretions; (2) direct implantation—for example, by trauma or surgery; (3) by extension from a contiguous focus such as a subphrenic abscess; and (4) via the bloodstream from a distant focus.

There have been no previous reports specifically discussing the role of Streptococcus milleri in the aetiology of empyema; but in a recent report of infections caused by Lancefield group F and related streptococci two out of 28 infections were empyemas caused by Strept milleri, and in a report of serious infections notified to the Central Public
Streptococcus milleri was recognised as a cause of empyema.15

Streptococcus milleri is exquisitely sensitive to penicillin, ampicillin, and the β-lactamase stable penicillins, but is variably sensitive to other antibiotics often used to treat hospital-acquired infection. It is often isolated in pure culture—in the series of Shalaes et al14 in eight out of nine isolates and in our series in five out of six. This contrasts with the anaerobic organisms found in empyemas, which are often part of a polymicrobial process with an average of three different organisms per infection.13 The sex distribution in empyema caused by Strep milleri shows a striking male preponderance (5:1). This male preponderence is seen in all infections caused by Strep milleri.14

The cases in this series show that Streptococcus milleri was the causative organism in at least 24% (6/25) of consecutive patients with pleural empyema admitted to a regional unit and together with cases from published reports on Strep milleri indicate that this is an important aetiological agent in pleural empyema.

The tendency to form empyemas correlates well with the organism’s predilection for abscess formation and infected fluid cavities elsewhere in the body.15 It is frequently isolated in pure culture, much more commonly from males than females. The organism is likely to be reported with increasing frequency as more laboratories begin to speciate streptococci, and we wish to draw attention to its prevalence.

We are grateful to Mr IM Hill, Mr NS Hooton, and Mr FP Shabbo for allowing us to include patients under their care and to Dr JR Stephenson for his advice on the microbiological aspects.

References

9 Ball IC, Parker MT. The cultural and biochemical characters of Streptococcus milleri strains isolated from human sources. J Hyg (Camb) 1979;82:63–78.
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