Five-year surveillance of antimicrobial resistance of *Streptococcus pneumoniae* in a large southwestern German community hospital

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Pneumococcal resistance to antimicrobial agents has shown a steady worldwide increase over recent decades [1]. Penicillin-resistant pneumococci were first reported from Australia in 1967 [2] and became widespread over the 1980s and 1990s [3–5]. The rapid increase of pneumococcal resistance raises concerns about options for adequate therapy of patients with systemic pneumococcal infections. Treatment failures in patients with penicillin-resistant or cephalosporin-resistant strains have been described [6–9]. We have performed a prospective 5-year surveillance study of pneumococcal resistance in a large southwestern German community hospital. Minimal inhibitory concentrations (MICs) were determined by the Etest which has proven to be a reliable alternative to conventional methods for antimicrobial susceptibility testing of pneumococci [10–13].

Five hundred and fifty-four primary clinical isolates of pneumococci collected from hospitalized patients between September 1992 and March 1998 were used for the study. Four hundred and thirty of the pneumococcal strains were isolated from adults, and 124 from children. The susceptibilities of pneumococcal strains to penicillin, ceftriaxone, erythromycin and rifampicin were determined by the Etest. MIC values were converted to categories of susceptibility by using the NCCLS standard M 100-S8 [14]. Table 1 summarizes the data on MIC determinations in pneumococcal strains isolated from adults and children. The prevalence of isolates with intermediate or high-level resistance to penicillin (4.3%) or erythromycin (6.3%) in adults was lower than the corresponding prevalence of isolates resistant to penicillin (8.1%) or erythromycin (9.7%) in children. Pneumococcal strains with intermediate or high-level resistance to ceftriaxone were found only rarely. Strains resistant to rifampicin were not observed. Only one pneumococcal isolate from an adult patient demonstrated multiresistance (high-level resistance to penicillin and ceftriaxone and intermediate resistance to erythromycin). Resistance rates to penicillin remained remarkably constant over the 5-year surveillance period. Resistance rates to erythromycin, however, showed a more than threefold increase from 4.2% during winter 1992–1993 to 14.8% during winter 1997–98.

Previous studies of the antibiotic susceptibility of pneumococci in Germany demonstrated that resistance rates to penicillin were 0.8% (strains collected between 1980 and 1986) [15], 7.6% (strains collected between 1988 and 1991) [16], and 1.8% (strains collected between 1992 and 1994 [17], respectively. The corresponding figures for resistance to erythromycin were 0% [15], 3.8% [16], and 3.8% [17]. A comparison of the reported data and our results shows that the prevalence of penicillin-resistant pneumococci had increased nearly 10-fold from the mid-1980s to the early 1990s; however, no further increase of resistance rates has been observed during recent years. Resistance of pneumococci to erythromycin, however, which was absent in 1986 [14], showed a steady increase throughout the 1990s with a peak prevalence of about 15% during winter 1997–98. Thus our results demonstrate that, compared to other European and non-European regions, the situation regarding pneumococcal resistance to penicillin in Germany is still favorable. The occurrence of highly penicillin-resistant strains is extremely rare, and pneumococcal strains with multiple resistance to several antibiotics have been observed only occasionally. The recent increase of pneumococcal resistance to erythromycin, however, underlines the need for continuous surveillance of antimicrobial

### Table 1 Prevalence of antibiotic resistance in 554 clinical isolates of *Streptococcus pneumoniae*

<table>
<thead>
<tr>
<th>Population group</th>
<th>Antimicrobial agent</th>
<th>Susceptible strains (%)</th>
<th>Intermediately resistant strains (%)</th>
<th>Highly resistant strains (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults</td>
<td>Penicillin G</td>
<td>412/430 (95.8)</td>
<td>17/430 (4.0)</td>
<td>1/430 (0.2)</td>
</tr>
<tr>
<td>Children</td>
<td>Penicillin G</td>
<td>114/124 (91.9)</td>
<td>10/124 (8.1)</td>
<td>0/124 (0)</td>
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<tr>
<td>Adults</td>
<td>Ceftriaxone</td>
<td>428/430 (99.6)</td>
<td>1/430 (0.2)</td>
<td>1/430 (0.2)</td>
</tr>
<tr>
<td>Children</td>
<td>Ceftriaxone</td>
<td>124/124 (100)</td>
<td>0/124 (0)</td>
<td>0/124 (0)</td>
</tr>
<tr>
<td>Adults</td>
<td>Erythromycin</td>
<td>403/430 (93.7)</td>
<td>6/430 (1.4)</td>
<td>21/430 (4.9)</td>
</tr>
<tr>
<td>Children</td>
<td>Erythromycin</td>
<td>112/124 (90.3)</td>
<td>0/124 (0)</td>
<td>12/124 (9.7)</td>
</tr>
</tbody>
</table>
susceptibility of *Streptococcus pneumoniae* as a guide to appropriate treatment of pneumococcal infections.

**Jochen Abb**, *Mechthild Kommerell*

and **Herta Breuninger**

Institute of Microbiology,

Klinikum Ludwigsburg, Posilpostraße 4,

D-71640 Ludwigsburg,

Germany

*Tel: 07141 99 666 3 Fax: 07141 99 727 3

**References**


