Rare *emm* types were associated with more severe disease and increased mortality rates. Skin and soft tissue infections were more frequent clinical signs among cases caused by common *emm* types.

**The Study**

We conducted a retrospective population-based study of 140 episodes of *Streptococcus dysgalactiae* subsp. *equisimilis* bacteremia occurring in Finland during 1995–2004. Rare *emm* types were associated with more severe disease and increased mortality rates. Skin and soft tissue infections were more frequent clinical signs among cases caused by common *emm* types.

Lancefield groups C and G β-hemolytic streptococci (GCS and GGS) may colonize the pharynx, skin, gastrointestinal tract, and female genitourinary tracts (1). According to recent taxonomic studies, large colony-forming groups C and G streptococci that infect humans are classified as *Streptococcus dysgalactiae* subsp. *equisimilis* (2). *S. dysgalactiae* subsp. *equisimilis* and *S. pyogenes* share virulence factors (3,4). The M protein is an important virulence factor because it confers resistance to phagocytosis (5). As with *emm* genes of *S. pyogenes*, the *emm* homologs of groups C and G *S. dysgalactiae* subsp. *equisimilis* are used for sequence-based typing (4,6,7), with >50 sequence types currently described (www.cdc.gov/ncidod/biotech/strep/strepblast.htm). The aim of our study was to determine the clinical signs, epidemiologic characteristics, and *emm* types of *S. dysgalactiae* subsp. *equisimilis* bacteremia during the 10-year observation period in Finland.

**Streptococcus dysgalactiae subsp. equisimilis**

Bacteremia, Finland, 1995–2004

Sari Rantala, Susanna Vähäkuopus, Jaana Vuopio-Varkila, Risto Vuento, and Jaana Syrjänen

We conducted a retrospective population-based study of 140 episodes of *Streptococcus dysgalactiae* subsp. *equisimilis* bacteremia occurring in Finland during 1995–2004. Rare *emm* types were associated with more severe disease and increased mortality rates. Skin and soft tissue infections were more frequent clinical signs among cases caused by common *emm* types.
We divided bacteremia episodes into 2 groups: those caused by the 5 most common emm types and each representing >5% of all episodes (97 episodes, common emm types) and those caused by the less common or nontypable emm types (41 episodes, rare emm types). We could not find an association between emm type and clinical features such as age or underlying disease. Severe disease was caused more often by rare emm types than by common emm types. Mortality rates were higher in patients with bacteremia caused by rare emm types than that caused by common emm types (Table 1). Four patients had recurrent S. dysgalactiae subsp. equisimilis bacteremia (Table 2). PFGE profiles showed that strains isolated from the same patient in recurring infections were identical (Figure 2).

Common emm types were more frequently manifested as skin and soft tissue infections than were rare emm types, 75% vs. 54%, respectively (p = 0.012). The most frequent source of bacteremia was cellulitis (51%). We also found an association between a common emm type and cellulitis. Cellulitis was a more frequent clinical sign among patients with infections caused by common emm types than by rare emm types (p = 0.007); 64% of patients infected by common emm types had cellulitis as an initial clinical manifestation versus 39% of patients infected by rare emm types.

Conclusions

Our study showed that mortality rates were higher in patients with S. dysgalactiae subsp. equisimilis bacteremia caused by rare emm types than in those with bacteremia caused by common emm types. The reason for this finding is unclear. One explanation for this might be that patients contract certain prevailing bacterial strains (so-called common types) more often, and a prior antigen challenge and subsequent humoral response may play a role. Severe disease (death or intensive care unit treatment) was also caused more often by rare emm types than by common emm types. We found also an association between a common emm type and cellulitis as a clinical manifestation; the common emm types were also associated with skin and soft tissue infections.

In our comprehensive study with molecular typing data for 138 invasive S. dysgalactiae subsp. equisimilis isolates from human infections, we found 18 emm types, which is consistent with previous reports by Cohen-Poradosu et al. (12) and Broyles et al. (13). These 2 studies reported stG485.0, or StG6, StG245, and StG2078 as the most common emm types, respectively. Thus, emm typing provides a useful tool for comparative epidemiologic analysis of GGS isolates from various geographic regions. Our results also suggest that certain emm types may prevail among bacteria.

Table 1. Disease severity among 138 episodes of Streptococcal dysgalactiae subsp. equisimilis bacteremia, Finland, 1995–2004*  

<table>
<thead>
<tr>
<th>Disease severity</th>
<th>No. (%) common emm types, n = 97</th>
<th>No. (%) rare emm types, n = 41</th>
<th>Odds ratio (95% CI)</th>
<th>p value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality rate</td>
<td>11 (11)</td>
<td>12 (29)</td>
<td>3.2 (1.3–8.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Patient admitted to ICU</td>
<td>5 (5)</td>
<td>6 (15)</td>
<td>3.2 (0.9–11)</td>
<td>0.084</td>
</tr>
<tr>
<td>Patient death or ICU treatment</td>
<td>12 (12)</td>
<td>15 (37)</td>
<td>4.1 (1.7–9.8)</td>
<td>0.001</td>
</tr>
<tr>
<td>Hypotension‡</td>
<td>13 (13)</td>
<td>10 (24)</td>
<td>2.1 (0.8–5.2)</td>
<td>0.113</td>
</tr>
<tr>
<td>DIC§</td>
<td>2 (2)</td>
<td>6 (15)</td>
<td>8.1 (1.6–42.3)</td>
<td>0.009</td>
</tr>
<tr>
<td>Multiorgan failure</td>
<td>2 (2)</td>
<td>4 (10)</td>
<td>5.1 (0.9–29.2)</td>
<td>0.084</td>
</tr>
<tr>
<td>STSS¶</td>
<td>5 (2)</td>
<td>4 (10)</td>
<td>5.1 (0.9–29.2)</td>
<td>0.084</td>
</tr>
</tbody>
</table>

*CI, confidence interval; ICU, intensive care unit; DIC, disseminated intravascular coagulation; STSS, streptococcal toxic shock syndrome. Patients who had both clinical data and isolates available.
†χ² test or Fisher exact test as appropriate.
‡Hypotensive (BP <90 mm Hg) at least once 0–2 days after positive blood culture.
§Thrombocyte count <100 x 10^9/L.
¶The definition of STSS was based on a consensus definition, including identification of β-hemolytic streptococci from a normally sterile site, septic shock, and multiorgan failure.
that cause human infections. Our study did not show any obvious time shifts in the occurrence of certain emm types.

A noteworthy finding in our series was the high frequency of recurrent group G S. dysgalactiae subsp. equisimilis bacteremia as reported earlier (12,14). Clinicians should be alert to this phenomenon, which seems to be more common than recurrent group A streptococcal bacteremia.

The dynamics of interspecies transfer of virulence loci between group A streptococci, GGS, and GCS (3), as well as potential genetic transfer or intragenomic events causing interconversion of group antigen types, remains to be resolved. Further characterization of the strains by multilocus sequence typing would be of interest (15).

We conclude that severity of disease and mortality rates were higher in persons with S. dysgalactiae subsp. equisimilis bacteremia caused by rare emm types than that caused by common emm types. Skin and soft tissue infections such as cellulitis were significantly more frequent clinical signs among episodes caused by common emm types.

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Table 2. Characteristics of recurrent episodes of group G Streptococcal dysgalactiae subsp. equisimilis bacteremia, Finland, 1995–2004

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Episode 1</th>
<th>Episode 2</th>
<th>Episode 3</th>
<th>Time to recurrence, mo</th>
<th>Clinical signs</th>
<th>PFGE pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>stG6</td>
<td>stG6</td>
<td>stG6</td>
<td>15; 3</td>
<td>Cellulitis</td>
<td>Unique, identical in episodes 1–3</td>
</tr>
<tr>
<td>2</td>
<td>stG6</td>
<td>stG6</td>
<td></td>
<td>68</td>
<td>Cellulitis</td>
<td>Unique, identical in episodes 1 and 2</td>
</tr>
<tr>
<td>3</td>
<td>stG480†</td>
<td>stG480</td>
<td></td>
<td>28</td>
<td>Spondylitis</td>
<td>Unique, identical in episodes 1 and 2</td>
</tr>
<tr>
<td>4</td>
<td>stG480</td>
<td></td>
<td></td>
<td>21</td>
<td>Cellulitis</td>
<td>Unique</td>
</tr>
</tbody>
</table>

*PFGE, pulsed-field gel electrophoresis.
†Blood culture taken outside Pirkanmaa Health District, isolate available.
‡Blood culture taken outside Pirkanmaa Health District, no isolate available.

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References


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