Comparison of *Streptococcus pneumoniae* serotypes causing acute otitis media & invasive disease in young children in the Czech Republic

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**Background & objectives:** The availability of a type-specific pneumococcal vaccine for children is a worldwide problem. It is necessary to study the serotypes prevalent in a country before introducing a type-specific vaccine. The objective of the present study was to analyse the prevalence of *Streptococcus pneumoniae* serotypes in children suffering from acute otitis media or invasive pneumococcal disease and to compare a coverage of serotypes by individual pneumococcal vaccines.

**Methods:** Children suffering from acute otitis media and invasive pneumococcal disease were analysed in the Czech Republic from October 1999 to November 2000. Serotyping was performed by the quellung technique using antisera from Statens Serum Institute (Denmark).

**Results:** The most frequent serotypes in patients with acute otitis media were 3, 19F, 23F, 14, 9V, 1, 6B, 11A and 28F. Vaccine coverage for the identified serotypes in acute otitis media patients was 52.1 per cent for the 7-valent vaccine, 57.8 per cent for the 9-valent vaccine and 75.7 per cent for the 11-valent form of the vaccine. In 108 patients with invasive pneumococcal disease, the most frequent serotypes were 6B, 9V, 14, 19F, 3 and 23F. Vaccine coverage for the identified serotypes in patients with invasive pneumococcal disease was 62 per cent for the 7-valent vaccine, 66.4 per cent for the 9-valent vaccine and 77.5 per cent for the 11-valent form of the vaccine.

**Interpretation & conclusion:** Vaccine coverage for the identified serotypes for the 11-valent pneumococcal vaccine was better than the other two vaccines.

**Key words** Acute invasive disease - acute otitis media - serotypes - *Streptococcus pneumoniae* - vaccine

Acute otitis media (AOM) is the most common disease diagnosed during early childhood in the developed countries. Based on various reports 50-60 per cent of children have at least one episode of acute otitis media during their childhood. Approximately 88 per cent cases/episodes of acute otitis media are bacterial and 25-50 per cent of them are caused by *Streptococcus pneumoniae*. Invasive pneumococcal disease (IPD) is less frequent (incidence 160 per 100,000) but is more serious compared to AOM.

The availability of a type-specific pneumococcal vaccine for children is a worldwide problem. Geographical differences in the distribution of serotypes as well as a large number of *S. pneumoniae* type antigens described emphasize the need why a study on the distribution of serotypes should be done prior to introduction of a type-specific pneumococcal vaccine in a country.

The present study was carried out to analyse the prevalence of *S. pneumoniae* serotypes in children suffering from acute otitis media or invasive pneumococcal disease in Czech Republic and to compare a coverage of serotypes by individual pneumococcal vaccines.
Table. Serotypes (%) of isolates obtained from patients with acute otitis media (n=141) and invasive pneumococcal disease (n=108) in Czech Republic (October 1999 - November 2000)

| Serotype | 1 | 3 | 4 | 5 | 6A | 6B | 7F | 8 | 9A | 9N | 9V | 10A | 11A | 12F | 14 | 15A | 15C | 17A | 18C | 19A | 19F | 20 | 23F | 24F | 28F | 29 | 31 | 33F | 35F | 37 | 38 | 40 |
|----------|---|---|---|---|----|----|----|---|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|----|----|----|---|---|----|----|----|----|----|----|----|----|----|
| AOM      | 5.7 | 15 | 1.4 | 2.9 | 5.0 | 2.9 | 0.7 | 6.4 | 5.0 | 0.7 | 9.3 | 1.4 | 0.7 | 0.7 | 6.4 | 1.4 | 14.3 | 1.4 | 9.3 | 5.0 | 0.7 | 0.7 | 0.7 | 1.4 |
| IPD      | 3.7 | 7.4 | 3.7 | 0.9 | 4.6 | 14.8 | 3.7 | 2.8 | 0.9 | 1.8 | 14.8 | 2.8 | 11.1 | 1.8 | 3.7 | 10.2 | 0.9 | 5.6 | 0.9 | 1.8 | 0.9 | 0.9 |

AOM, acute otitis media; IPD, invasive pneumococcal disease
Material & Methods

Young children (< 2 yr of age) suffering from acute otitis media were analysed prospectively in a multicentre study in the Czech Republic from October 1999 to November 2000. Children with invasive pneumococcal disease were also studied and isolates obtained from these patients were sent for typing to the National Reference Laboratory for Streptococci and Enterococci in Prague. Data on coverage of vaccine (7-valent, 9-valent and 11-valent vaccine) were collected during the same time as for the prospective study. Typing was performed by the quellung technique using antisera from Statens Serum Institute (Denmark).

Results & Discussion

Of the 143 patients with acute otitis media due to \textit{S. pneumoniae}, 141 isolates were serotyped and 140 confirmed. The most frequent serotypes in these patients were 3 (15.0%), 19F (14.3%), 23F and 14 (9.3% each), 9V (6.4%), 1 (5.7%), 6B, 11A and 28F (5.0% each) (Table). Vaccine coverage for the identified serotypes in acute otitis media patients was 52.1 per cent for the 7-valent vaccine, 57.8 per cent for the 9-valent vaccine and 75.7 per cent for the 11-valent form of the vaccine.

A total of 108 isolates were obtained from children (< 2 yr of age) with invasive pneumococcal disease. There were 40 cases of meningitis, 16 of bacteremia, 8 of sepsis/septicaemia/shock syndrome, 30 of lower respiratory tract infections and 14 other serious pneumococcal infections. In these patients the most frequent serotypes were 6B and 9V (14.8% each), 14 (11.1%), 19F (10.2%), 3 (7.4%) and 23F (5.6%) (Table). Vaccine coverage for the identified serotypes in these patients was 62 per cent for the 7-valent vaccine, 66.4 per cent for the 9-valent vaccine and 77.5 per cent for the 11-valent form of the vaccine.

Our finding on serotype distribution and vaccine coverage in children younger than 2 yr of age in Czech Republic are in good agreement with other studies. Both the acute otitis media and invasive pneumococcal disease serotypes showed the importance of using an 11-valent vaccine formulation. In fact, the serotypes 1 and 3 not present in the 7-valent formulation accounted for 25 per cent of overall cases. Moreover, there is not a major difference in the serotypes represented in the vaccines as cause of acute otitis media or invasive pneumococcal disease respectively but there is, instead, a different percentage of cases being attributed to each vaccine-serotype.

References


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