Streptococcus pneumoniae infection in children: vaccine implications

Background and epidemiology: The spectrum of disease caused by *Streptococcus pneumoniae* in infants and children ranges from focal respiratory tract infection to invasive diseases such as meningitis and bacteremia. Studies suggest that about 28% to 55% of cases of acute otitis media (AOM) may be attributable to *S. pneumoniae*.[1] The risk of invasive pneumococcal disease is highest during the first 2 years of life, with an estimated incidence rate of 83 to 161.2 per 100 000 in Canada.[2] This estimate is comparable to the one for pertussis among nonvaccinated children (153 per 100 000)[3] and raises important questions about the need and advisability of vaccinating children younger than 2 years against *S. pneumoniae*.

At least 90 serotypes based on *S. pneumoniae* capsular antigens have been identified, and 23 of them account for at least 85% to 90% of the serotypes that cause invasive infections in adults and children. A 23-valent pneumococcal polysaccharide vaccine is available for use in people older than 2 who are at risk of pneumococcal infections, such as elderly people, people who are chronically ill and immunocompromised individuals.[3] The vaccine is not indicated for use in children younger than 2 because the antibody response to polysaccharide antigens does not invoke T cells and thus cannot be sustained. In contrast, protein antigens induce antibody responses that have an absolute requirement for T cells. This observation has led to the development of conjugated vaccines to enhance the immunogenicity of the polysaccharides.

Penicillin has long been the drug of choice for *S. pneumoniae* infections. However, the incidence of infection with penicillin-resistant strains has risen over the past decade. In one study 586 (44%) of 1322 healthy children attending day-care centres in Toronto carried a total of 599 *S. pneumoniae* isolates. Decreased susceptibility to penicillin was found in 102 (17%) of the isolates, and 82 (14%) were resistant to multiple antibiotics. One-third of the children surveyed were either taking antibiotics or had taken them within the month before the study.[4]

Clinical management — AOM: In a recent review,[5] 80% of children with AOM recovered spontaneously within 2 to 7 days after presentation; the number needed to treat to prevent 1 child from experiencing pain at 2–7 days was about 17. Thus, routine use of antibiotics to treat AOM may not be indicated. However, the Canadian Paediatric Society (CPS) argues that, because it is not possible to determine a priori which cases of AOM will result in suppurative complications (e.g., mastoiditis), all cases of AOM should be considered candidates for antimicrobial therapy. The society recommends a 10-day course of amoxicillin, dosed according to weight.[6]

Clinical management — invasive pneumococcal infection: The site of the infection and the specific nature of the susceptibility pattern determine the therapy for antimicrobial-resistant pneumococci. The CPS has provided a set of principles to help doctors choose an appropriate regimen.[7] For empirical therapy of confirmed or highly suspected pneumococcal meningitis, a combination of vancomycin and either a third-generation cephalosporin (cefotaxime or ceftriaxone) or rifampin is recommended. Therapy should be adjusted based on minimal inhibitory concentration testing.

Prevention: A 7-valent pneumococcal polysaccharide–protein conjugate vaccine has recently been licensed in Canada and the United States for use in infants and young children. A large randomized controlled trial has shown that the vaccine is 97% effective and reduced the number of clinical visits because of AOM by about 9%.[8] The US Centers for Disease Control and Prevention recommends that all children aged 2 to 23 months be vaccinated, along with those aged 24 to 59 months at risk of pneumococcal disease.[9]

The 7 valences in the conjugated vaccine account for about 87% of *S. pneumoniae* isolates identified in Canadian children aged 6 to 23 months who had invasive disease, and about 65% of the isolates identified in Canadian children less than 6 months who had invasive disease.[10] The National Advisory Committee on Immunization has yet to make recommendations on the use of this vaccine in Canada.

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