Streptococcus pneumoniae, pneumococcus, is an important human pathogen. It causes a majority of bacterial infections in the upper respiratory tract, such as acute otitis media and acute sinusitis, and it is also one of the most common causes of bacterial pneumonia and bacterial meningitis. At the same time, it is also a common, harmless inhabitant of the human upper respiratory tract, especially during the first years of life. Capsular polysaccharide is the main virulence factor of pneumococci. Ninety serotypes of pneumococcal capsular polysaccharide are known at present. About twenty of these are common in disease, and selections of them have been used for immunization against pneumococcal disease. Pneumococci in the nasopharynx of a person are right on the spot and ready to cause an infection and illness when there is an opportunity, e.g. a viral infection, in the person or his/her family member. Some serotypes are more invasive than the others and act also as primary pathogens. (For review see 1-3)

In the previous issue of this Journal, Ndiaye and coworkers (4) described a mass immunization with the 23-valent pneumococcal polysaccharide vaccine to control an outbreak of severe pneumonia caused by Streptococcus pneumoniae serotype 1 in Nunavik, Arctic Canada, which began in August 2000. During the following period (1 yr 8 months), serotype 1 caused 11 of the 15 invasive pneumococcal disease (IPD) cases, whereas during the previous period (3 yrs 8 months), there were no serotype 1 isolates among 5 invasive pneumococcal infections. The incidence (per 100,000 per months) of IPD caused by serotype 1 fell from 8 before the immunization, to 1.3 afterwards. The frequency of hospitalizations because of clinical pneumococcal pneumonia increased during the outbreak, and decreased again after the immunization.

Outbreaks of pneumococcal disease (often caused by serotypes 1, 2, or 5) were more common in the first half of the 20th century than they are at present (for review, see 1, 2, 5). Outbreaks of IPD have also been reported in recent decades, often from men’s shelter, jails, or closed or socially-deprived communities. Among these, there have also been outbreaks of serotype 1 in men’s shelters in the USA and France (for references see 5), amongst aborigines in Australia (6), and in a closed community in Israel (7). Because of some special characteristics of serotype 1, and for clarity, I concentrate here on serotype 1.

Serotype 1 used to be more prevalent in the first half of the 20th century than it is at present in the industrialized countries such as the US (8) and many European countries (9). At present, serotype 1 is more prevalent in developing countries than in the industrialized countries (2). However, there are also differences in the prevalence
of serotype 1 between different states in the US (10,11), and even between the socially and economically similar Nordic countries. In Denmark, serotype 1 has been rather common in IPD for decades (12), whereas it has been uncommon in Finland and, until recently, also in Sweden.

Serotype 1 (together with serotype 7F) has a high invasive potential, i.e. when it colonizes the nasopharynx it, more often than other serotypes, causes a serious infection, i.e. pneumonia and/or bacteremia. On the other hand, the diseases caused by serotype 1 (or 7F) are less severe and less often fatal than similar diseases caused by other serotypes (3).

It has been suggested that “endemic” serotype 1 IPD could actually be an expression of unidentified outbreaks (5). At the turn of the century, the incidence and prevalence of serotype 1 IPD also increased in Sweden, a close neighbor of Denmark, as a result of the rather rapid spread of a virulent clone of serotype 1 (13). Serotype 1 was also the most common pneumococcal serotype causing IPD in Norway in 1995-2001 (Pedersen et al. 2004). In Finland, serotype 1 IPD is still uncommon (unpublished observations, Department of Public Health), even though serotype 1 could have spread to Finland both from west (Denmark, Sweden) and from east, where serotype 1 was the most common serotype encountered in invasive bacterial infections of children in St. Petersburg in 2001-2003 (14).

Serotype 1 IPD is common in ethnically and socio-economically special groups in Alaska (15), Canada (16), Greenland (17), Australia (6) and Israel (18). In Alaska, the incidence of all IPD and the proportion of serotype 1 are higher in indigenous groups than in non-indigenous groups of the society (15, 19). Unfortunately, very little if anything is known about the incidence and serotypes of serious pneumococcal infections in the wide Russian and Siberian Arctic, extending from Murmansk to Anadyr. It is probable that cases, or even outbreaks, of pneumonia are not diagnosed bacteriologically in this vast area.

According to Davidson and coworkers (19), “the explanation for high rates of pneumococcal disease in Alaska Natives may be found in a combination of unexplored social, genetic and environmental factors.” Are the same factors also important elsewhere in the arctic? Are pneumococcal infections generally prevalent and, thus, an important health problem in the Arctic? Arctic and subarctic populations, especially indigenous groups, are small, and international efforts are required to provide answers to these questions. The International Circumpolar Surveillance (ICS), has probably the best opportunities for carrying out this task.

REFERENCES

1. Crook DW. Capsular type and the pneumococcal human host-parasite relationship. Clin Infect Dis 2006; 42:460-2.
2. Hausdorff WP, Bryant J, Paradiso PR, Siber G. Which pneumococcal serogroups cause most invasive disease. Implications for conjugate vaccine formulation and use. Part I. Clin Infect Dis 2000; 30:100-121.
3. Sjöström K, Spindler C, Örtqvist A, Kalin M, Sandgren A, Kühlmann-Berenzon S, Henriques-Normark B. Clin Infect Dis 2006; 42:451-9.
4. Ndiaye AA, De Wals P, Proulx J-F, Ouakki M, Jette L, Dery S. Impact of a mass immunization campaign to control an outbreak of severe respiratory infections in Nunavik, Northern Canada. Int J Circumpolar Health 2006; 65:297-304.
5. Hausdorff WP, Feikin DR, Klugman KP. Epidemiological differences among pneumococcal serotypes. http://infection.thelancet.com Vol 5 2005; 83-93.

6. Gratten M, Torzillo P, Morey F, Dixon J, Erlich J, Hagger J, Henrichsen J. Distribution of capsular types and antibiotic susceptibility of invasive Streptococcus pneumoniae isolated from aborigines in Central Australia. J Clin Microbiol 1996; 34:338-341.

7. Dagan R, Gradstein S, Belmaker I, et al. An outbreak Streptococcus pneumoniae serotype 1 in a closed community in southern Israel. Clin Infect Dis 2000; 30:319-21.

8. Feikin DR, Klugman KP. Historical changes in pneumococcal serogroup distribution: Implications for the era of pneumococcal conjugate vaccines. Clin Infect Dis 2002; 35:547-555.

9. Lund E, Henrichsen J. Laboratory diagnosis, serology and epidemiology of Streptococcus pneumoniae. In TBergan and JR Norris (ed.) Methods in Microbiology, vol. 12, pp.241-262. Academic Press, London, 1978.

10. Robinson KA, Baughman W, Rothrock G, Barrett NL, Pass M, Lexau C, Damaske B, Stefonek K, Barnes B, Patterson J, Zell ER, Schuchat A, Whitney CG. Epidemiology of invasive Streptococcus pneumoniae infections in the United States, 1995-1998. JAMA 2001; 285:1729-35.

11. Mufson MA, Staneck RJ. Bacteremic pneumococcal pneumonia in an American city: A 20-year longitudinal study, 1978-1997. Am J Med 1999; 107:345-435.

12. Konradsen HB, Kaltoft MS. Invasive pneumococcal infections in Denmark from 1995 to 1999: epidemiology, serotypes, and resistance. Clin Diag Lab Immunol 2002; 9(2):358-65.

13. Henriches Normark B, Kalin M, Örtqvist A, Åkerlund T, Olsson Liljequist B, Hedlund J, Svensson SB, Zhou J, Spratt BG, Normark S, Kallenius G. Dynamics of penicillin-susceptible clones in invasive pneumococcal disease. J Infect Dis 2001; 184:861-9.

14. Kvetnaja AS, Kharic SM, Zhelezovia LJ, Cociareva TG, Sobolevskaia AA, Sirkii K, Herva E, Kaijaiainen T, Vaitinen S, Nohynek H. Invasive bacterial infections in children during 2001-3 in St.Petersburg, Russia. International congress on eradication and elimination of infectious diseases – Progress and problems. September 4-5, 2003. St.Petersburg Pasteur Institute, Russia.

15. Rudolph K, Parkinson AJ, Reasonover AL, Bulkow LR, Parks DJ, Butler JC. Serotype distribution and antimicrobial resistance patterns of invasive isolates of Streptococcus pneumoniae: Alaska 1991-1998. J Infect Dis 2000; 182:490-496.

16. Macey JF, Roberts A, Lior L, Tam TW, VanCaeseele P. Outbreak of community acquired pneumonia in Nunavut, October and November, 2000. Can Commun Dis Rep 2002; 28 (16):131-8.

17. Christiansen J, Paulsen P, Ladefoged K. Invasive pneumococcal disease in Greenland. Scand J Infect Dis 2004; 36:325-9.

18. Porat N, Trefler R, Dagan R. Persistence of two invasive Streptococcus pneumoniae clones of serotypes 1 and 5 in comparison to that of multiple clones of serotypes 6B and 23F among children in Southern Israel. J Clin Microbiol 2001; 39:1827-1832.

19. Davidson M, Parkinson A, Bulkow LR, Fitzgerald MA, Peters HV, Parks DJ. The epidemiology of invasive pneumococcal disease in Alaska, 1986-1990. Ethnic differences and opportunities for prevention. J Infect Dis 1994; 170:368-76.

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