Importance of *Streptococcus pneumoniae* in community-acquired pneumonia

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To understand the burden of *Streptococcus pneumoniae* in community-acquired pneumonia (CAP), one must first understand the burden of CAP in our communities. Jokinen et al (1) summarized the results of 10 population-based studies conducted between 1964 and 1982. The overall rate of pneumonia per 1000 persons per year ranged from eight to 15. The attack rates for pneumonia are highest at the extremes of age— for those younger than five years of age, the incidence is 34 to 36/1000/year, while for those 70 years of age and older it is 18 to 21/1000/year, and for those 75 years and older, it is 34.2/1000/year (1).

Koivula et al (2) studied all residents 60 years of age and older in a Finnish township, and found that 14/1000/year developed pneumonia and most, 10.2/1000/year, were community-acquired.

During influenza outbreaks pneumonia rates increase disproportionately in the elderly. In one study, the rates of pneumonia requiring hospitalization during an influenza epidemic were 35/100,000 for those aged 15 to 44 years, 95 and 310/100,000 for those aged 45 to 64 years, and 65 years and older, respectively (3).

The hospital admission rate for CAP is subject to considerable variations from one geographic area to the next because there are no uniformly accepted criteria for admission.

In two Ohio counties in 1991, the incidence of CAP requiring hospitalization was 266.8/100,000 (4). The rate was higher among Blacks than Caucasians: 337.3/100,000 versus 255.9/100,000; higher among males than females: 291.4 versus 244.3/100,000; and increased with age: 91.6/100,000 for those aged younger than 45 years, 277.2 for those aged 45 to 64 years and 1012.3/100,000 for persons aged 65 years and older (4).

The incidence of CAP requiring hospitalization in Halifax County in 1986 was 111.1/100,000 (5). It was also found that the rate was higher in men: 131/100,000 versus 99/100,000 for women. The overall rate of hospitalization for pneumonia in Halifax County increased with increasing age so that for those 75 years of age and older, it was 1160/100,000. The rate of pneumonia requiring hospitalization among nursing home residents was 3330/100,000/year (5).

Using a prevalence-based burden of illness approach, Guest and Morris (6) calculated the costs of the management of CAP during 1992/1993 in the United Kingdom. There were 261,000 episodes of CAP costing £440.7 million. Thirty-two per cent of all episodes (83,153) were treated in hospital accounting for 96% of the annual cost.

An even more important burden is the mortality rate due to pneumonia. Table 1 shows the mortality rates from pneumonia requiring hospitalization in a number of studies; it ranged from 8% to 21%. Table 1 also shows that if one relies on blood and sputum culture to diagnose pneumococcal pneumonia, only 9% to 17% of cases of CAP requiring hospitalization are found to be due to this pathogen. In contrast, Table 2 shows...
that 32% to 47% of cases of CAP are due to *S. pneumoniae* if serological techniques to detect pneumolysin antigen, antibodies to this antigen and its immune complexes (10-12) are used in addition to conventional diagnostic techniques of blood and sputum culture.

Outbreaks of pneumococcal pneumonia do occur. Over a four-week period, 45 men developed pneumococcal pneumonia in a crowded Houston jail (13). An outbreak of pneumococcal pneumonia in a shelter for homeless men resulted in 39 cases with a 61% bacteremia rate (14). Recently, outbreaks of pneumococcal pneumonia occurred in three nursing homes in Oklahoma, Maryland and Massachusetts (15). The attack rates ranged from 11.7% to 15%. In one nursing home, multidrug-resistant *S. pneumoniae* was isolated (15).

**GROUPS AT HIGH RISK FOR PNEUMOCOCCAL PNEUMONIA**

The rates of invasive pneumococcal disease are six to 34 times higher in Alaskan native people than in the rest of the American population (16). It is not known whether aboriginal Canadians have the same high rates of invasive pneumococcal disease.

Others with very high rates for invasive pneumococcal disease include those who are asplenic, and those who have sickle cell disease, nephrotic syndrome, Hodgkin's disease, multiple myeloma, chronic lymphocytic leukemia, nephrotic syndrome and complement deficiencies (17). Those with human immunodeficiency virus (HIV) infection have markedly increased rates of pneumonia with rates of 2.3/100 persons/year for those with CD4 counts of more than 500, of 6.8 for those with CD4 counts of 200 to 500 and of 10.8 for those with CD4 counts of less than 200 × 10^3/L (18). Pneumococcal pneumonia attack rates in HIV-positive persons are about 18 times higher than in HIV-negative persons (19).

**STRENGTHS AND WEAKNESSES OF THE CURRENT ESTIMATE OF BURDEN OF PNEUMOCOCCAL DISEASE**

There have been no population-based studies of pneumonia epidemiology in Canada. These are urgently need to determine pneumonia attack rates. An east, central and western site should yield data that can be extrapolated nationally. Special groups to be studied independently include the aboriginal peoples in the eastern Arctic, western Canada and Northwest Territories.

North American data on patients hospitalized with CAP are adequate. A national system for analysis of medical record databases could be a very economical method of monitoring pneumonia admission rates, outcomes and pneumococcal vaccination rates.

**REFERENCES**

1. Jokinen C, Heiskanen L, Juvonen H, et al. Incidence of community-acquired pneumonia in the population of four municipalities in Eastern Finland. Am J Epidemiol 1993:137:977-88.
2. Koivula I, Stem M, Makela PH. Risk factors for pneumonia in the elderly. Am J Med 1994;96:515-20.
3. Barker WH. Excess pneumonia and influenza associated hospitalization during influenza epidemics in the United States, 1970-78. Am J Public Health 1986;76:761-5.
4. Marston BJ, Flouffe JF, File TM Jr, et al. Incidence of community-acquired pneumonia requiring hospitalization. Arch Intern Med 1997;157:1709-18.
5. Marrie TJ. Epidemiology of community-acquired pneumonia in the elderly. Semin Respir Infect 1990;5:260-8.
6. Guest JF, Morris A. Community-acquired pneumonia: the annual
cost to the National Health Service in the UK. Eur Respir J 1997;10:1530-4.
7. Marrie TJ, Durant H, Yates L. Community-acquired pneumonia requiring hospitalization: 5-year prospective study. Rev Infect Dis 1989;11:586-99.
8. Mundy LM, Aurwaerter PG, Oldach D, et al. Community-acquired pneumonia: impact of immune status. Am J Respir Crit Care Med 1995;152:1309-15.
9. Fine MJ, Stone RA, Singer DE, et al. Processes and outcomes of care for patients with community-acquired pneumonia: Results from the pneumonia patient outcomes research team (PORT) cohort study. Arch Intern Med. (in press)
10. Burman LA, Trollfors B, Andersson B, et al. Diagnosis of pneumonia by cultures, bacterial and viral antigen detection tests, and serology with special reference to antibodies against pneumococcal antigens. J Infect Dis 1993;163:1087-93.
11. Kauppinen MT, Herva E, Kujala P, et al. The etiology of community-acquired pneumonia among hospitalized patients during a Chlamydia pneumoniae epidemic in Finland. J Infect Dis 1995;172:1330-5.
12. Porath A, Schlaeffer F, Lieberman D. The epidemiology of community-acquired pneumonia among hospitalized adults. J Infect Dis 1997;175:41-8.
13. Hoge CW, Reichler MR, Dominguez EA, et al. An epidemic of pneumococcal disease in an overcrowded inadequately ventilated jail. N Engl J Med 1994;331:643-6.
14. Mereat A, Nguyen J, Dautzenberg B. An outbreak of pneumococcal pneumonia in two men’s shelters. Chest 1991;99:147-51.
15. Kludit P, Lett SM, DeMaria A, et al. Outbreaks of pneumococcal pneumonia among unvaccinated residents in chronic care facilities. Massachusetts, October 1995, Oklahoma, February, 1996 and Maryland, May-June 1996. Morb Mortal Wkly Rep 1997;46:60-2.
16. Davidson M, Schraer CD, Parkinson AJ, et al. Invasive pneumococcal disease in an Alaska native population 1980 through 1986. JAMA 1989;261:715-8.
17. Janoff EN, Rubins JB. Invasive pneumococcal disease in the immunocompromised host. Microbiol Drug Resist 1997;3:215-32.
18. Hirschick RE, Glassroth J, Jordan MC, et al. Bacterial pneumonia in persons infected with the human immunodeficiency virus. N Engl J Med 1995;333:845-51.
19. Garcia-Leoni ME, Moreno S, Rodeno P, et al. Pneumococcal pneumonia in adult hospitalized patients infected with human immunodeficiency virus. Arch Intern Med 1992;152:1808-12.
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