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, 93 and 310/100,000 for those aged 45 to 64 years, and 65 years and older, respectively (3).

RATE OF PNEUMONIA REQUIRING HOSPITALIZATION

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 requir-

ing hospitalization was 266.8/100,000 (4). The rate was higher among Blacks than Caucasians: 337.3/100,000 versus 253.9/100,000; 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

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TABLE 1

Frequency of *Streptococcus pneumoniae* as a cause of community-acquired pneumoniae as determined blood and sputum cultures

Author (reference)	Years	Location	N	Sputum culture (%)	<i>S pneumoniae</i> (%)	Unknown etiology (%)	Mortality (%)
Marrie et al (7)	1981 to 1987	Halifax, Nova Scotia	719	36	8.5	49.8	21.2
Mundy et al* (8)	1990 to 1991	Baltimore, Maryland	385	40	17.9	31.1	9.1
Marston et al (4)	1991	Two counties, Ohio	2776	51	12.5	55.7	8.8
Fine et al (9)	October 1991 to March 1997	Halifax, Boston, Massachusetts, Pittsburgh, Pennsylvania	1339	58	9.1	70.4	8.0

*180 patients had human immunodeficiency virus

TABLE 2

Streptococcus pneumoniae as a cause of community-acquired pneumonia using pneumolysin antigen, antibody and/or immune complexes as the diagnostic standard, in addition to blood and sputum culture

Author (reference)	Location	Year	N	<i>S pneumoniae</i>
Burman et al (10)*	Uma, Sweden	December 1982 to November 1984	196	63* (32%)
Kauppinen et al (11)	Oula, Finland	May 1986 to May 1987	125	58/122 (47%)
Porath et al (12)	Soroko, Israel	November 1991 to October 1992	346	148 (43%)

*13 of 196 (6.6%) *S pneumoniae* in blood, 25 of 148 (52%) sputum; 18 of 25 (72%) in transtracheal aspirate specimen; 28 of 59 (47%) positive pneumolysin antibody; 55 of 62 (89%) positive C-polysaccharide antibody; 40 of 41 (98%) positive capsular polysaccharide antibody; 14 of 61 (23%) positive phosphorylcholine antibody

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 $200 \times 10^9/L$ (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.

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