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Pneumococcal Pneumonia: Experience in a Community Hospital

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Cases of patients admitted to hospital with community-acquired pneumonia over a three-year period were reviewed to determine whether pneumococcal pneumonia and pneumococcal bacteremia occurred as frequently as reported in urban and university-based studies. Pneumococcus was isolated in only 25 of 202 patients (12 percent) in whom adequate attempts at culture were made, only one patient had documented pneumococcal bacteremia and no patients died of pneumococcal pneumonia proved by culture. Prospective studies in community hospitals should be considered to define more clearly the epidemiology of pneumococcal pneumonia in the nonurban United States population. These studies would also contribute to a rational policy for use of pneumococcal vaccine in this country.

Streptococcus pneumoniae (pneumococcal) pneumonia is generally considered a major cause of community-acquired bacterial pneumonia requiring admission of the patient to hospital. For example, in a study from Grady Hospital in Atlanta¹ a specific bacterial pathogen was identified in 57 percent of cases, and the pneumococcus was judged responsible for 62 percent of these bacterial pneumonias. The Grady study documented a 19 percent mortality among patients with pneumococcal pneumonia; of those with bacteremic pneumococcal pneumonia, the mortality was 32 percent, compared with 6 percent

for nonbacteremic patients. According to a standard medical textbook, bacteremia occurs in 20 percent to 30 percent of pneumococcal pneumonia cases.² In the PraCon study, it was estimated that in 1976 pneumococcal pneumonia accounted for 82 percent of hospital admissions for pneumonia,³ and the incidence of pneumococcal pneumonia has been estimated to range from 21 to 230 cases per 100,000 population each year.⁴ These and similar statistics emphasize the importance of pneumococcal pneumonia and have been used in making decisions about the potential benefits of immunization with pneumococcal vaccine, which was licensed in November 1977.

In the past, studies of the cause and prognosis of pneumonia have generally been done in large urban hospitals. We questioned whether data

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derived from urban areas would accurately reflect the pneumococcal pneumonia experience in a small community or rural hospital setting. We reviewed the records of all patients with pneumonia admitted to Los Alamos Medical Center during a three-year period (January 1, 1976, through December 31, 1978) to identify the cause of pneumonia and its associated mortality.

Patients and Methods

Los Alamos is located in the Jemez Mountains of northern New Mexico, at an altitude of 7,500 feet (2,300 m). The mid-1977 county population was 17,100. The community is relatively isolated geographically, the nearest towns being 20 and 40 miles away, so that few residents seek medical care elsewhere for acute illnesses. In addition, residents of the nearby Rio Grande Valley who work in Los Alamos often seek care in Los Alamos; 40 percent of all patients admitted to hospital live outside Los Alamos County. Therefore, the lower bound of the study population is estimated at 17,000 and the upper bound at 25,000. This population stems from several racial and ethnic backgrounds from all over the United States, with a predominance of non-Hispanic whites and many Hispanic New Mexicans. Native Americans, who receive care at Indian Health Service hospitals, are rarely admitted to the Los Alamos Medical Center.

The community is served by a single 88-bed hospital. In 1977 the medical population of Los Alamos included 28 physicians, all board-certified. Seven internists, one family practitioner and six pediatricians provided most primary care to the community.

The Los Alamos Medical Center laboratory is directed by a board-certified pathologist and the bacteriology procedures are done by certified medical techniques (MT-ASCP). Standard culture techniques are carried out according to a procedure manual, with internal quality control standards. The laboratory participates in the quarterly review of the College of American Pathologists Laboratory Survey Program to Extent 4.

Coding in the hospital medical records department includes listing of both primary and secondary diagnoses. All records in which pneumonia, bronchopneumonia, pneumonitis or related terms were listed as an admission or discharge primary

or secondary diagnosis were identified for study. Each record was reviewed and those meeting the criteria for pneumonia were included in the study.

Criteria for pneumonia were as follows: (1) an abnormal chest roentgenogram diagnostic of pneumonia—for example, acute parenchymal infiltrate or segmental or lobar consolidation; (2) clinical abnormalities consistent with pneumonia, such as fever, rales, physical finding of consolidation in the lung; (3) exclusion of other causes of these abnormalities in the judgment of the attending physician. For each patient, data were obtained on age, sex, race, dates of admission and discharge from hospital, onset of pneumonia, chest roentgenograms, preceding antibiotic therapy, underlying conditions and outcome. Sputum Gram stain, sputum culture, transtracheal aspirate, lung biopsy or blood cultures obtained before antibiotic therapy were reviewed for microbiologic data.

After reviewing all records, patients younger than 5 years old at the time of illness were excluded because few microbiologic studies had been done to identify a causal agent in those patients. Patients who were admitted to hospital without pneumonia and in whom pneumonia then developed after three days or longer were considered to have a nosocomial infection. Because this study was undertaken to review pneumonia acquired in the community, these patients were also excluded.

The case definition for pneumococcal pneumonia required identification of *S pneumoniae* in blood specimens or transtracheal aspirate or isolation of heavy growth in sputum culture.

Results

A total of 325 patients in hospital met the criteria for pneumonia. Of this number, 91 patients were younger than 5 years old and four patients had nosocomial infections. Of the remaining 230 patients, ages ranged from 6 to 98 years, with a mean of 54 years and a median of 57 years of age. Of these, 117 of the patients were male and 113 were female. The mean duration of the hospital stay was 9.3 days (median 8 days), with a range of 2 to 36 days. Thirteen of these patients (6 percent) died.

A reasonable attempt had been made to identify a causative organism in 202 patients (88 percent of total). Sputum culture had been done in 165

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patients, blood specimens were cultured in 95 patients, transtracheal aspiration was done on 13 patients and bronchoscopy in 6 patients. An open-lung biopsy procedure was done in one patient. The quality of the sputum specimens submitted for culture was difficult to evaluate, since Gram stains were not always done. Organisms associated with pneumonia in the 202 patients are shown in Table 1.

Peripheral blood leukocyte count and differen-

tial were reviewed but varied widely and were not helpful in distinguishing community-acquired viral from bacterial pneumonia.

S pneumoniae was isolated in 25 patients (12 percent of 202 pneumonia cases). One patient had blood cultures positive for pneumococcus, one patient had pneumococcus isolated from a transtracheal aspirate and 23 patients had a sputum culture with heavy growth of pneumococcus. In the patient with pneumococcal bacteremia,

TABLE 1.—Culture Data in 202 Pneumonia Patients, 1976 Through 1978, Los Alamos, New Mexico

Organism	Type of Clinical Specimen				Total N (%)
	Sputum N (%)	Trans- tracheal Aspirate	Bronchos- copy	Blood	
<i>Streptococcus pneumoniae</i>	23 (11)*	1	..	1	25 (12)
<i>Klebsiella</i>	12 (6)	..	..	..	12 (6)
<i>Escherichia coli</i>	6 (3)	..	..	..	6 (3)
<i>Proteus</i>	3 (1)	..	1	..	4 (2)
<i>Staphylococcus aureus</i>	3 (1)	..	1	1	5 (2)
<i>Enterobacter</i>	2 (1)	..	..	..	2 (1)
<i>Hemophilus influenzae</i>	1	1	..	..	2 (1)
<i>Bacteroides corrodens</i>	1	..	..	1	2 (1)
<i>Aspergillus</i>	1†	..	..	..	1
<i>Coccidioides immitis</i> . . . . .	..	..	1	..	1
No growth	113 (56)	11 (5)	3 (1)	92 (46)	219
Total positive versus Total specimens	52/165	2/13	3/6	3/95	60/279

*Number of specimens positive for the organism (percentage of all 202 patients with specimen positive for that organism).
†Patient with lung biopsy procedure.

TABLE 2.—Comparison of Patients With Pneumococcal Pneumonia and Patients With Nonpneumococcal Pneumonia (Total of 202 Patients), Los Alamos, New Mexico

Characteristic	Pneumococcal Pneumonia Group (N = 25)	Nonpneumococcal Pneumonia Group (N = 177)
Age	Mean = 58.3 years Median = 55 years	Mean = 55.9 years Median = 57 years
Sex Male	15	84
Female	10	93
Length of hospital stay	Mean = 9.7 days Median = 9 days Range = 3-23 days	Mean = 9.8 days Median = 8 days Range = 2-36 days
Underlying disease:		
None	8	66
Heart disease	6	48
Asthma	2	11
Chronic obstructive pulmonary disease	4	27
Alcoholism	3	9
Malnutrition	1	4
Cancer	1	8
Dementia . . . . .	..	6
Other neurological disease	1	8
Diabetes	1	14
Trauma	1	8
Preceding upper respiratory infection	1	20
Renal failure . . . . .	..	4
Miscellaneous . . . . .	..	12

sputum cultures did not grow pneumococcus. Four patients with pneumococcus identified on sputum culture were found to have an additional organism in notable quantity.

Ages among the patients considered to have pneumococcal pneumonia ranged from 24 to 87 years, with a mean of 58.3 years and a median of 55 years. Eight of these patients had no known underlying disease. Table 2 correlates patients with pneumococcal pneumonia and patients with all other types of pneumonia. Although pneumonia was considered the cause of death in 13 patients, no patient with identified pneumococcal pneumonia died while in hospital.

Based on a population of 20,000 for the three-year observation period, the 25 cases of pneumococcal pneumonia represent an incidence rate of 42 cases per 10⁵ person-years.

Discussion

The difficulty of identifying the etiologic organism in cases of pneumonia is well known. For pneumococcal pneumonia technical difficulties in isolating pneumococcus from the sputum may occur, and, alternatively, the pneumococcus may colonize the nasopharynx, leaving unsuspected the organism actually causing pneumonia. In 1971 a study from San Diego⁵ showed that in 23 of 51 patients (45 percent) with bacteremic pneumococcal pneumonia, no pneumococci were identified in cultures of sputum or nasopharynx. Sensitive techniques for collecting sputum (for example, trans-tracheal aspiration or bronchoscopy) may be less available in a community hospital than in a university hospital. Because no pathologic organism was identified in 68 percent of all patients from whom sputum was obtained, the adequacy of sputum culture can certainly be questioned in our study. However, while only 11 percent of sputum specimens were positive for *S pneumoniae* by culture, the pneumococcus was still the most commonly isolated bacterial pathogen in the pneumonia patients enrolled in this study.

Bacteremia is said to occur in 20 percent to 30 percent of cases of pneumococcal pneumonia.² If bacteremia had occurred in 20 percent to 30 percent of the cases in this study, a total of 11 pneumococcal pneumonia cases would be the expected number among 202 patients. In 25 patients in whom pneumococcal pneumonia was confirmed, 11 patients had blood cultures, only one of which yielded *S pneumoniae*. Therefore, the rate of bacteremia, that is, 9 percent, is lower

than the 20 percent to 30 percent rate that is generally cited.

The proportion of pneumonia cases caused by *S pneumoniae* in this study is much lower than the PraCon estimates or the prospective study results from Grady Hospital. More important, none of the patients from whom pneumococcus was isolated died. We are unable to determine the extent to which patients with pneumococcal pneumonia may not have been admitted to Los Alamos Hospital Medical Center or were admitted elsewhere; while this would alter the incidence rate of all pneumococcal pneumonia in the community, it is unlikely that a bias in favor of admitting patients with less severe cases, with less bacteremia and resultant lower mortality, would have occurred.

The licensure of pneumococcal vaccine in late November 1977 could have resulted in widespread use of this vaccine with lower rates of pneumococcal pneumonia in the community in 1978 compared with 1976 through 1977. However, there was no evidence of a decline in hospital cases of pneumococcal pneumonia; seven cases occurred in 1976, nine cases in 1977 and nine cases in 1978. Pneumococcal vaccine was used by Los Alamos physicians in 1978, but in the absence of information on pneumococcal vaccination rates in Los Alamos, we cannot assess the effect of vaccine on serotypes responsible for pneumonia. In any case, none of the patients with pneumococcal pneumonia in this study had received pneumococcal vaccine before the onset of illness.

Pneumococcal vaccine has been advocated for the prevention of pneumococcal pneumonia in patients at high risk of acquiring pneumonia or of dying if pneumonia should occur. The use of pneumococcal vaccine for persons at increased risk of pneumococcal pneumonia (for example, asplenic patients) seems appropriate. Further, the use of vaccine in populations epidemiologically at higher risk for disease may be reasonable in populations similar to those served by large urban or university hospitals, based on rates of incidence and mortality as reported from Grady Hospital in 1972. However, our data suggest a lower incidence of patients admitted with pneumococcal pneumonia to hospital. This study of community hospital experience can be useful in defining major policy issues in pneumococcal vaccination, as there is insufficient information about the epidemiology of pneumococcal pneumonia in nonurban populations.⁶ Studies of larger populations may

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be needed to document and clarify differences between urban university hospital and small community hospital experience with pneumococcal pneumonia.

Recommendations

The following recommendations are offered:
(1) Several larger community hospitals should review their pneumonia data for comparison with urban and university hospital data. (2) From these studies, an attempt should be made to define high-risk patients in order to provide practical

guidance for identification of persons most likely to benefit from pneumococcal vaccination.

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