Most frequent pathogens in Bacteremic Pneumonia and Impact on Morbidity and Mortality

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ABSTRACT

Introduction: In response to bacteria multiplying in the lung, alveolar macrophages generate an inflammatory response with arrival of neutrophils to the alveoli. The goal of the inflammatory response is to seal and control bacteria multiplication. If the bacteria are highly virulent or the inflammatory response is not adequate, bacterial multiplication will continue and patients will be at risk for bacteremia and poor outcomes. Data on the etiology of bacteremia and the influence of bacteremia on outcomes are scarce.

Objective: The objective of this study was to characterize the most frequent bacteria causing bacteremia in hospitalized patients with CAP and to define the impact of bacteremia on clinical outcomes.

Methods: This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. Patients with positive blood cultures were included in the study. The frequency of organisms was calculated and clinical outcomes were compared between bacteremic and non-bacteremic CAP patients.

Results: A total of 595 patients were included in the analysis. The most common organism identified was *Streptococcus pneumoniae* in 443 patients, followed by *Staphylococcus aureus* in 74 patients (MSSA 42, MRSA, 32). In-hospital mortality was 14% for bacteremic patients and 8% for non-bacteremic patients.

Conclusions: This study indicates that *S. pneumoniae* is the primary pathogen causing bacteremia CAP in hospitalized patients. The increased mortality documented in hospitalized patients with bacteremic CAP is likely due to a combination of increased pathogen virulence and inappropriate lung inflammatory response.

INTRODUCTION

- Community-acquired pneumonia (CAP) is a major cause of morbidity and mortality worldwide. Approximately 4 million cases of Pneumonia occur each year in United States of which Streptococcus Pneumonia is the main culprit.
- The pneumococcus is acquired in the nasopharynx and is carried asymptomatically in approximately 40 to 50 percent of individuals at any point in time. Invasive disease, most commonly occurs upon acquisition of a new serotype, typically after an incubation period of one to three days.
- Pneumococci are presumably aerosolized from the nasopharynx to the alveolus where they enter alveolar type II cells by bacterial binding to the receptor for platelet activating factor (PAF) which occurs through bacterial display of surface localized choline, a chemical constituent shared between the bacteria and the human chemokine PAF.
- Bacteremic CAP is associated with higher morbidity than in non-bacteremic CAP. This is especially true for pneumococcal pneumonia, where higher rates of bacteremia of 10%–20% were identified[1] and longer time to clinical stability and higher mortality[2] were described.
- Inflammatory markers have been studied and Increasing age was found to have elevated levels. Smoking, alcoholism, Nursing home exposure were also noted to influence the bacteremia.

OBJECTIVE

The objective of this study was to characterize the most frequent bacteria causing bacteremia in hospitalized patients with CAP and to define the impact of bacteremia on clinical outcomes.

MATERIALS AND METHODS

STUDY DESIGN AND STUDY POPULATION

This was a secondary data analysis of the Community-Acquired Pneumonia Organization (CAPO) International Cohort Study database. Data was collected between 2001 and 2015. In each participating center, non-consecutive medical records of hospitalized patients with the diagnosis of CAP were reviewed. A sample of the data collection form is available at the study website (www.caposite.com). Validation of data quality was performed at the study center before the case was entered in to the CAPO database. Institutional Review Board approval was obtained by each participating center.

STUDY DEFINITIONS

Community Acquired Pneumonia:
Diagnosis of CAP required the presence of :
•New pulmonary infiltrate on imaging (CT scan or chest x-ray) at the time of admission to the hospital.
•Signs and Symptoms of CAP (at least one of the following)
•New or increased cough (per the patient)
•Fever >37.8° C (100.0° F) or hypothermia <35.6° C (96.0° F).
•Changes in WBC (leukocytosis >11,000 cells/mm^3, left shift > 10% band forms/microliter, or leukopenia < 4,000 cells/mm^3
•Working diagnosis of CAP at the time of hospital admission with antimicrobial therapy given within 24 hours of admission. Patients with positive blood cultures were included in the study

RESULTS

- A total of 595 patients with median age of 60 years were enrolled
- Patient characteristics are included in Table 1.

Table 1: Patient characteristic table

Time to Clinical Stability, Median(IQR)	6 (5)
Pleural effusion, n(%)	170 (28.6)
Age , Median(IQR)	60 (35)
Sex, n(%)	340 (57.1)
Heart rate, Median(IQR)	110 (26.5)
Altered mental status on admission, n(%)	112 (18.8)
Respiratory Rate, Median(IQR)	24 (12)
Systolic blood pressure, Median(IQR)	117 (34)
Temperature (degrees Celsius), Median(IQR)	38 (1.9)
ICU admission, n(%)	151 (25.4)
Congestive Heart Failure, n(%)	91 (15.3)
COPD, n(%)	98 (16.5)
Diabetes, n(%)	106 (17.8)
HIV, n(%)	117 (19.7)
Liver Disease, n(%)	51 (8.6)
Neoplastic Disease, n(%)	55 (9.2)
Chronic Renal Failure, n(%)	52 (8.7)
PaO2, Median(IQR)	61.3 (22.8)
pH, Median(IQR)	7.4 (0.1)
Blood Urea Nitrogen, Median(IQR)	31 (35.8)
Serum glucose, Median(IQR)	114 (47)
Hematocrit, Median(IQR)	36.9 (8)
Serum sodium, Median(IQR)	135 (7)
Length of Hospital Stay, Median(IQR)	9 (11)
30-day Mortality, n(%)	109 (18.3)
In-Hospital Mortality, n(%)	84 (14.1)
Pneumonia Severity Index, Median(IQR)	101 (52)
Nursing home resident, n(%)	35 (5.9)

RESULTS

Table 2: Various bacteria isolated in blood cultures (n)

ORGANISM 1 in Blood	(n)
E. coli	20
Moraxella Catarrhalis	8
Mycoplasma Pneumoniae	1
Staphylococcus Aureus	10
Hemophilus Influenzae	19
MRSA	28
Proteus spp	3
Streptococcus Pnemoniae	437
Klebseilla Pneumonia	4
MSSA	27
Pseudomonas Aeruginosa	11
Streptococcus Pyogenes	4

ORGANISM 1 in Blood	(n)
None	573
Enterobacter spp	1
Klebsiella Pneumoniae	1
MSSA	5
Pseudomonas Aeruginosa	1
Acinetobacter spp	2
Hemophillus Influenzae	1
MRSA	4
Non Tuberculuous Mycobacteria	1
Streptococcus Pnemoniae	6

CONCLUSIONS

Community-acquired pneumonia (CAP) is a significant cause of morbidity and mortality worldwide; the most etiologic pathogen is thought to be *Streptococcus pneumoniae*. Bacteremic CAP is associated with worse clinical outcomes than non-bacteremic CAP.

Therefore, it is crucial to reveal an accurate clinical picture of pneumococcal pneumonia to determine an appropriate treatment strategy for CAP. Clinical predictors for pneumococcal pneumonia will aid and adjunct in therapy(3).

Increased pneumococcal vaccination in at risk populations will likely reduce bacteremic incidence and thus morbidity and mortality (4).

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