Clinical Features And Correlates Of Bacteremia Among Urban Minority New Yorkers Hospitalized With Community Acquired Pneumonia

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Citation


Abstract

Background: Pneumonia mortality, incidence and rates of bacteremia related to CAP varies among US minority compared to White Americans. However, information on clinical features, risk for bacteremia and hospitalization costs due to CAP among minority subjects is lacking.

Methods: We studied clinical features of CAP, factors associated with bacteremia due to CAP, length of stay among adult hospitalized inner city Hispanic and African American New Yorkers.

Results: Among 697 study subjects of whom 92% were of Hispanic and African American origin, 69 (9.9%) were found to have a positive blood culture. Bacteremia related to CAP was noted only in 35 (5%) subjects. Nine subjects (1.3 %) had bacteremia unrelated to CAP during hospitalization. 25 positive blood cultures (3.6%) were considered as skin contaminants by the treating clinicians.

None of the co-morbidity or outcome variables were associated with CAP bacteremia except HIV positive status (OR 2.97 95% CI 1.2 – 7.3). CAP bacteremia group were at higher odds for abnormal vital signs, serum chemistry and hematological parameters. The length of stay (LOS) was increased due to positive blood cultures, especially in those with non-CAP pathogens (median 14 days) and contaminants (9 days) compared to CAP pathogens (5 days) (p < 0.05). In the sub-group analysis, Hispanics with CAP were noted to be older and have higher odds of lung disease compared to non-Hispanics. HIV infected subjects were noted to be younger and HIV positive subjects with CAP bacteremia were at higher odds to present with consolidation on chest x-ray compared to other HIV positive controls.

Conclusions: As noted in other populations, routine blood cultures among hospitalized inner city minority CAP patients are associated with low yield for CAP pathogens from routine blood cultures drawn during initial evaluation and management of CAP. Also, bacteremia with CAP pathogens is unrelated to any co-morbidity or outcome except HIV positive status, abnormal clinical sings and selected lab abnormalities in this population. Minority patients who are HIV positive and have radiographic consolidation, may be at higher odds to have positive cultures with CAP organisms. Further, contaminant blood cultures from routine blood drawing may increase length of stay and therefore impact health care expenditure in CAP patients significantly. Therefore, minority subjects with clinical risks only as described may benefit from blood culture tests upon hospitalization for CAP.

ABBREVIATIONS

ROBINCAP Routine blood cultures in community acquired pneumonia
CAP Community acquired pneumonia
HIV Human Immunodeficiency virus
US United States
PSI Pneumonia Severity Index
ARDS Adult Respiratory Distress Syndrome
MICU Medical Intensive Care unit
MSOF Multi-System Organ Failure
CI Confidence Interval
COPD Chronic Obstructive Pulmonary Disease
CVD Cardiovascular Disease
CHF Congestive Heart Failure
PORT Pneumonia Outcomes Research Team
AIDS Acquired Immunodeficiency syndrome
Los Length of stay

**INTRODUCTION**

Pneumonia and Influenza are among the ten leading causes of death in the United States (US). Mortality is highest among Whites (2.7%) and lower among Hispanic Americans (2.4%) and African Americans (2.0%). The death rates per 100,000 US population for pneumonia and influenza in 2001 was 21.6 overall, 25.3 in Whites, 16.0 among African Americans and 7.4 in Hispanic Americans. Given the decreased access to primary care, lower rates of vaccinations and poorer quality of hospital care, the reason for lower pneumonia mortality among US minority is unclear.

Among Hispanic Americans, there is age and gender related disparity in pneumonia mortality. About 82% of pneumonia deaths occur among Hispanic individuals over 65 years of age, making it the sixth leading cause of death in this age group. Hispanic women are more likely to die from pneumonia than men.

Among New Yorkers, mortality from influenza and pneumonia in 2002 by race is: 4.4% among Puerto Rican Hispanics, 3.5% in other Hispanics, 4.3 in Whites and 3.9% in African Americans. But, the data on New Yorkers less than 65 years of age shows that Puerto Rican Hispanics have higher mortality due to pneumonia than other ethnic groups.

Contrary to data on mortality, incidence of pneumonia has been reported to be higher among African Americans and other minority subjects. Hospitalizations due to CAP remains a major public health problem with as many as 1.1 million of these cases require hospitalization. The overall rate of hospitalization due to CAP in 2003 is reported to be 48.1 cases per 10,000 persons. Hospitalization from pneumonia has increased by 42% between 1988 and 2002. African Americans have a higher incidence of CAP requiring hospitalization than whites.

The Infectious Disease Society of America and American Thoracic Society 2007 guidelines on CAP recommends that two sets of blood cultures be drawn before initiation of antibiotic therapy only in certain high risk patients, such as those with severe CAP requiring ICU admission, immunocompromised conditions, acute alcohol use, chronic liver disease and pleural effusion. However, studies have also shown that minority individuals have a higher prevalence of bacteremia from CAP than Whites.

Given the disparities in pneumonia mortality, incidence and CAP related bacteremia noted among the minority population we studied the clinical features and the risks for bacteremia among inner city Hispanic or African American subjects with CAP.

**METHODS AND MATERIALS**

This study is a retrospective analysis of a consecutive sample of adult minority patients of predominantly Hispanic and African American origin hospitalized with community acquired pneumonia in the Department of Medicine, Lincoln Hospital between August 2002 and December 2004. Lincoln hospital is a community-based university affiliated teaching hospital with 347 in-patient beds serving a diverse inner city minority population in New York City, USA.

The total number of admissions to our adult medical service during this study period was 27264 cases. From this database, a total of 899 (3.3%) patients 18 years of age and above with diagnosis of pneumonia were identified through a computerized query and chart review performed by two independent trained investigators.

Diagnosis of community acquired pneumonia was based on acute symptoms of cough, fever, dyspnea documented in the medical record by an admitting team and verified by a board certified hospitalist physician and an obvious focal or diffuse infiltrate on chest roentgenogram that was ascertained by a board certified radiologist. Patients who had both clinical and radiological evidence of CAP were included in the study. All blood cultures were drawn on admission prior to empirical administration of antibiotic therapy for CAP as per recommended guidelines.

Of the 899 eligible patients, 202 were excluded due to one of the following conditions: a) No blood cultures on admission b) lack of a clear opacity on chest X-ray c) recently hospitalized within 2 weeks d) nursing home residents e) mechanical ventilation initiated before diagnosis of pneumonia f) inadequate medical information g) alternate diagnoses of respiratory illness after initial enrollment in the study. (Figure 1)

**DATA COLLECTION**

The study protocol was reviewed and approved by the institutional review board. The following data were collected through detailed chart review by two independent investigators from fully computerized electronic medical records: Age, sex, insurance status, self reported ethnic
background, co-morbid conditions, personal habits such as smoking and drug use, physical examination findings and lab data, chest X-ray report, blood culture & sensitivity results, additional tests, antibiotic coverage and final diagnoses.

Data on clinical outcomes namely need for medical intensive care and or mechanical ventilation, acquired respiratory distress syndrome, multiple system organ failure, death, discharge status were also obtained. Pneumonia severity index scores were calculated for all subjects using data from the time of admission.

Two independent investigators blinded to final study objectives & data analysis reviewed inclusion criteria, co-morbidity, blood culture and radiographic reports to limit misclassification of study data. They also ascertained the clinical outcomes data using standard criteria. A third investigator blinded to chart review information entered coded variable responses into a password protected computer database to ensure privacy and security of patient health information and performed the analysis.

STATISTICAL METHODS

The primary objectives of this observational study were as follows: a) analyze and compare the clinical features of CAP in minority subjects namely African Americans and Hispanics, b) compute the proportion of bacteremia with CAP pathogens in these patients, c) study the association of clinical features and clinical outcomes to bacteremic CAP and d) estimate hospitalization costs due to CAP in our minority subjects.

In order to study clinical features and clinical outcomes associated with bacteremia due to CAP, patients were divided into 2 groups. The study group consisted of subjects who had bacteremia with organisms known to cause pneumonia or CAP pathogens in these patients, c) study the association of clinical features and clinical outcomes to bacteremic CAP and d) estimate hospitalization costs due to CAP in our minority subjects.

A comparative analysis of following selected clinical features between the study and control groups was performed: demographic variables such as age, sex and ethnicity status; co-morbid illnesses namely cardiovascular, renal, liver, lung and HIV disease; clinical data namely vitals on admission, initial laboratory tests of serum sodium, blood urea nitrogen, random glucose, hematocrit, and pneumonia severity index (PSI) scores.

A composite endpoint was defined using adverse clinical outcomes including need for medical intensive unit (MICU) care or mechanical ventilation, sepsis/shock, acquired respiratory distress syndrome (ARDS), multi-system organ failure (MSOF) and all-cause death. The odds of bacteremia related to CAP was compared between subjects with and without the composite endpoint.

We also analyzed the median length of stay in different blood culture groups using non-parametric test for medians, and estimated cost due to any extended stay from contaminated blood cultures in the study.

With a 2-sided alpha error of 0.05, our final study sample size of 697 had a power of 80% to detect an odds ratio of at least 3.0 between the blood culture positive and control groups with respect to clinical features or outcomes that were measured as dichotomous variables, assuming that 15% of our controls would present with any one of clinical features or composite outcome.

Statistical analyses was performed using non-parametric Fischer's exact test for categorical data and Mann Whitney test for continuous variables. A stepwise multi-nomial logistic regression analysis using categorical endpoints based on blood culture results was also performed to assess the influence of all potential confounder independent variables.
on CAP related blood culture positive status noted during univariate analysis. Odds ratios are reported along with 95% CI. A p value of 0.05 was considered as significant.

RESULTS

I. CLINICAL FEATURES BASED ON ETHNICITY

A total of 697 patients qualified for the study. About two-thirds of patients (n = 463) were reported as Hispanics, 25% (n = 178) were African American, a small proportion of 4.0% (n = 28) came from other ethnic backgrounds and ethnicity could not be verified in an additional 28 subjects.

A. DEMOGRAPHIC DATA

Median age of all study subjects was 54.1 years. Hispanics were older than African Americans (median age 53 versus 48 years, p value = 0.0004). There more men than women (55% versus 45% respectively). No differences were noted in gender distribution among the ethnic groups. (Table 1)

Figure 2

Table 1: Demographic characteristics

<table>
<thead>
<tr>
<th>Gender</th>
<th>All subjects (n = 697)</th>
<th>Hispanics (n = 463)</th>
<th>African Americans (n = 178)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>65% (446)</td>
<td>64% (299)</td>
<td>36% (64)</td>
<td>0.0004</td>
</tr>
<tr>
<td>Female</td>
<td>35% (251)</td>
<td>36% (164)</td>
<td>64% (114)</td>
<td></td>
</tr>
</tbody>
</table>

** Other Ethnicity distribution: White 9 (1.2%); Others 19 (2.7%); Unavailable 28(4%)

* using Mann Whitney U test comparing age in Hispanics versus African American versus subjects

B. COMORBID ILLNESS

Chronic obstructive pulmonary disease (COPD), Asthma, cardiovascular disease (CVD), congestive heart failure (CHF), chronic liver and renal disease were noted among a significant proportion of our subjects. However, HIV positive status was the most notable co-morbidity found in 26.8% of the 597 study patients who were tested. A higher proportion of Hispanic patients compared to African Americans had CVD (20.5% vs 13.5%, p value < 0.05) and chronic liver disease (22.6% vs 14.6%, p value < 0.05) (Table 2)

Figure 3

Table 2: Co-morbid illness and risks

<table>
<thead>
<tr>
<th>Co-morbidity</th>
<th>All subjects (n = 697)</th>
<th>Hispanics (n = 463)</th>
<th>African Americans (n = 178)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart disease</td>
<td>29.2 (204)</td>
<td>30.2 (140)</td>
<td>27.5 (49)</td>
<td>0.39</td>
</tr>
<tr>
<td>Cardiac/Coronary Disease</td>
<td>19.8 (139)</td>
<td>20.5 (95)</td>
<td>19.3 (36)</td>
<td>0.79</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>7.1 (110)</td>
<td>7.1 (35)</td>
<td>7.1 (13)</td>
<td>0.99</td>
</tr>
<tr>
<td>Chronic lung disease</td>
<td>19.7 (137)</td>
<td>22.6 (105)</td>
<td>14.6 (28)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Chronic renal disease</td>
<td>29.2 (204)</td>
<td>31.9 (157)</td>
<td>26.3 (48)</td>
<td>0.43</td>
</tr>
<tr>
<td>Cancer</td>
<td>6.5 (45)</td>
<td>5.6 (26)</td>
<td>9.5 (17)</td>
<td>0.25</td>
</tr>
<tr>
<td>HIV positive</td>
<td>27 (185)</td>
<td>29.1 (139)</td>
<td>27.9 (50)</td>
<td>0.98</td>
</tr>
<tr>
<td>Current smokers</td>
<td>27.6 (193)</td>
<td>27.3 (135)</td>
<td>31.1 (56)</td>
<td>0.71</td>
</tr>
<tr>
<td>Ever drank alcohol</td>
<td>24.2 (169)</td>
<td>24.9 (115)</td>
<td>25.9 (46)</td>
<td>0.91</td>
</tr>
</tbody>
</table>

C. INVESTIGATIONS

As shown in Table 4, all laboratory results were similar among Hispanics and African Americans except a higher serum hematocrit among Hispanics (36.5% vs 34.1%, p < 0.05). About 76.8% of subjects were found to have focal infiltration or consolidation on chest radiograph, whereas 23.2% presented with diffuse infiltrates. Pleural effusion was found in 11% of all cases. No differences were noted in radiological findings between the two ethnic groups.

Figure 4

Table 3: Clinical, Lab Data & Chest x ray findings

** Other Ethnicity distribution: White 9 (1.2%); Others 19 (2.7%); Unavailable 28(4%)

* using Mann Whitney U test comparing age in Hispanics versus African Americans versus subjects
D. CLINICAL OUTCOMES

128 patients (18.3%) were admitted to MICU, and 93 (13.3%) required mechanical ventilation. Approximately 5% of subjects had a complicated MICU course with ARDS and MSOF. A total of thirty five deaths occurred within the study (5%). 20.5% of all subjects had at least one adverse clinical outcome or the composite endpoint. There were no statistically significant differences noted in any clinical outcomes including death among the two ethnic groups.

E. PNEUMONIA SEVERITY

PSI was calculated upon admission using the Pneumonia Outcomes Research Team (PORT) scoring system. Data was available in all but 5 patients for PSI score estimation. As in the original PORT study by Fine et al (8) those with HIV positive status (n=188) were excluded from PSI estimation.

Table 5: PSI/PORT scores *

<table>
<thead>
<tr>
<th>PSI Class (Score)</th>
<th>All patients</th>
<th>Hispanics</th>
<th>African American</th>
<th>Groups HA compared to AA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (&lt; 50)</td>
<td>25.6 (129)</td>
<td>24.7 (94)</td>
<td>26.9 (32)</td>
<td>NS (-)</td>
</tr>
<tr>
<td>2 (51-70)</td>
<td>19 (96)</td>
<td>16.2 (55)</td>
<td>27.7 (33)</td>
<td>NS (-)</td>
</tr>
<tr>
<td>3 (71-90)</td>
<td>18 (91)</td>
<td>18.5 (63)</td>
<td>14.3 (17)</td>
<td>&lt; 0.05 (-)</td>
</tr>
<tr>
<td>4 (91-120)</td>
<td>25.6 (129)</td>
<td>27.4 (93)</td>
<td>22.7 (27)</td>
<td>&lt; 0.05 (-)</td>
</tr>
<tr>
<td>5 (&gt;120)</td>
<td>11.7 (59)</td>
<td>13.2 (45)</td>
<td>9.4 (10)</td>
<td>&lt; 0.05 (-)</td>
</tr>
</tbody>
</table>

Severity of pneumonia was greater in Hispanics compared to African Americans. A statistically significant higher proportion of Hispanics had PSI Class 3, 4 or 5 scores. (p < 0.05) (Table 5)
Clinical Features And Correlates Of Bacteremia Among Urban Minority New Yorkers Hospitalized With Community Acquired Pneumonia

III. BACTEREMIA AND CLINICAL FEATURES

A. BACTEREMIA STUDY GROUPS

To study the clinical features associated with bacteremia in our diverse minority population, subjects regardless of ethnic background with bacteremia with organisms causing CAP (n= 35) were classified as study group (CAP bacteremia group) whereas all others served as controls (n= 662). (Table 8) The proportion of study subjects and controls were similar in Hispanics and African Americans. (5.0 % vs 5.6%, p = NS) Clinical features and outcomes were compared between the study and control groups.

B. DEMOGRAPHIC DATA

Among the demographic features, we found the CAP bacteremia group (49+/- 14 yrs) to be relatively younger than the controls (54+/-17 yrs) (difference 5.2 years; p < 0.05; 95% CI 0.29-10.27). The two groups were similar with respect to gender, ethnic distribution and reported insurance status. (Table 9)

C. COMORBID ILLNESS

The CAP bacteremia cases had higher odds of HIV positive individuals (58%) compared to the control group (30%) (OR 3.2, 95% CI 1.55 to 6.73, p =0.002). None of the other co-morbid illnesses were different between the groups. (Table 9)

D. CLINICAL SIGNS

CAP bacteremia group compared to others were noted to follow the following clinical signs: higher respiratory rate (median 20, range 14-37 vs. 20, 11 -34, p < 0.05); lower systolic blood pressure ( mean+/-sd 118+/- 25.9 vs. 126.8 +/- 24.6, p < 0.05); higher pulse rate (median 100, range 58- 136 vs. 92,
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95.141, p < 0.05); higher temperature (median 99.2, range 97-103 vs. 98.8, 96-103, p < 0.05) (Table 10)

**Figure 11**

Table 10: Univariate analysis of clinical features and outcomes using in all subjects

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>All patients (n = 697)</th>
<th>Study group</th>
<th>Control group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Mental Status (%)</td>
<td>11.4 ± 4</td>
<td>13.4 (92)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Respiratory rate, median(range)</td>
<td>11.9 ± 4.0</td>
<td>20 (11-38)</td>
<td>20 (11-36)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Systolic blood pressure mmHg</td>
<td>118 ± 22.9</td>
<td>126 ± 24.6</td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Diastolic blood pressure mmHg</td>
<td>65.1 ± 11.9</td>
<td>69 ± 14.2</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Pulse rate, median(range) per min</td>
<td>100 (78-136)</td>
<td>92 (54-141)</td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Peripheral temperature, median (range) °C</td>
<td>95.2 (97-103)</td>
<td>98.9 (96-103)</td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Lab results</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serum Sodium levels, mmol/L</td>
<td>126±10(147)</td>
<td>136±24(147)</td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Serum random glucose, mmol/L</td>
<td>90 (62-175)</td>
<td>121 (55-605)</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood urea nitrogen, mg/dL</td>
<td>30.0 (14-131)</td>
<td>45.5 (10-48.5)</td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>PORT score severity = a+b+c+d+e</td>
<td>27.1±3.12</td>
<td>20.2±3.96</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Precordial Effusion (%)</td>
<td>32 (6%)</td>
<td>75 (11.10%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Total CRE bacteriumus</td>
<td>30 (43.70%)</td>
<td>29 (43.40%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Diffuse CRE bacteriumus</td>
<td>21 (31.89%)</td>
<td>15 (23.00%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Hospital Outcomes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sepsis on and/or check</td>
<td>20 (6%)</td>
<td>46 (70%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>ARDS</td>
<td>3 (2%)</td>
<td>3 (4.70%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>3 (8%)</td>
<td>89 (13.10%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>MEET case</td>
<td>5 (14.29%)</td>
<td>120 (18.40%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>MEET P</td>
<td>2 (5.70%)</td>
<td>20 (3.70%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Death (all causes)</td>
<td>2 (5.70%)</td>
<td>20 (3.70%)</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Composite outcomes</td>
<td>6 (17.10%)</td>
<td>137 (20.70%)</td>
<td></td>
<td>NS</td>
</tr>
</tbody>
</table>

**G. SUB-GROUP ANALYSIS**

We also analyzed the HIV subgroup with CAP versus the non-HIV subjects. HIV subjects with pneumonia were noted to be of younger age than non-HIV individual with CAP (OR 1.02 95%CI 1.008 – 1.03) and also at lesser odds to have a consolidation on chest x-ray (OR 0.43 95%CI 0.27–0.69).

We also analyzed the subgroup of Hispanics versus all other ethnic groups with respect to all clinical features and outcomes related to CAP. Except age and lung disease, none of the clinical features or outcomes including bacteremia were significantly associated with Hispanic ethnicity on multi-variate logistic regression analyses. Hispanics were noted to be at higher odds to be of older age (OR 1.02 95%CI 1.008 – 1.03) and for lung disease ((OR 1.35 95%CI 1.05 – 1.75).

**IV) HOSPITALIZATION COSTS**

We did not find a statistically significant difference between the median length of stay between the groups (CAP bacteremia study group’s median los: 4.2 days, range 0-17 days, Control group’s median los: 13.2 days; range 0-185 days). However on sub-group analysis, there was a statistically significant increase in length of stay above the median stay among subjects with non-CAP pathogens (14 days) & the contaminant blood culture group (9 days) compared to those who had CAP pathogens (5 days) & negative blood cultures (4 days) (p < 0.05). (Table 11)

**Figure 12**

Table 11: Comparison of PSI/PORT score grading in all subjects

<table>
<thead>
<tr>
<th>PSI/PORT SCORES</th>
<th>All patients* N=594</th>
<th>Study group</th>
<th>Control group</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1 (&lt; 51)</td>
<td>129</td>
<td>3</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>Grade 2 (51-70)</td>
<td>104</td>
<td>3</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Grade 3 (71-90)</td>
<td>87</td>
<td>2</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Grade 4 (91-130)</td>
<td>129</td>
<td>6</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>Grade 5 (&gt; 131)</td>
<td>55</td>
<td>2</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

*HIV positive status patients were not included in calculating PSI scores
The turn-around time for blood culture from the time of draw to final conclusive reporting is approximately 5 days. This may impact on the length of stay in subjects who have blood culture positive initially. Subjects found to have non-CAP pathogens related to other serious systemic infections required higher hospitalization costs due to their higher length of stay (median, 14 days). On the other hand, there was a significant increase in length of stay (median, 9 days) among the 25 subjects with contaminants. In our study, patients with contaminant growth spent 4 days more than the median 5 days of hospitalization in those with bacteremia related to CAP. According to recent estimates by Bekeris et al, the incremental expense per in-patient with a contaminated blood culture in 2004 was $5506. The length of stay and rates of contamination in our subjects are similar to those reported in other studies. Thus, the incremental cost of in-patient stay incurred by our health care system due to contamination of blood culture in our study is estimated to be approximately $137,650.

Table 12: Comparison of Pneumonia severity in study groups among all subjects

<table>
<thead>
<tr>
<th>Pneumonia Severity</th>
<th>All patients</th>
<th>Blood culture positive</th>
<th>Blood culture negative</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=504</td>
<td>N=16</td>
<td>N=488</td>
<td></td>
</tr>
<tr>
<td>Mild to Moderate</td>
<td>320</td>
<td>8 (50%)</td>
<td>312 (63.9%)</td>
<td>NS</td>
</tr>
<tr>
<td>(P1I Grades 1,2,3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>194</td>
<td>8 (50%)</td>
<td>176 (96.1%)</td>
<td></td>
</tr>
<tr>
<td>(P1I Grades 4,5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION

Our study is unique that it involves a large sample of inpatients with CAP from inner city minority ethnic groups namely Hispanics and African American New Yorkers who had significant co-morbidity, including HIV disease. In our study sample, Hispanics were noted to be older and at higher odds of lung disease than others. However, there were no statistically significant differences in odds of any other clinical feature of outcome between Hispanics and others in our study including bacteremia related to CAP.

The yield of blood cultures for any pathogen (CAP or non-CAP) during the entire hospital stay was very low (6.3%). 90% of blood cultures drawn were negative and an additional 3.6 % were considered contaminants. This contaminant rate in our study is comparable to the interquartile range of 2.15% to 3.67% reported among other US institutions. Although the CAP pathogen group was relatively younger compared to controls (difference 5.2 years; p < 0.05; 95% CI 0.29-10.27), age was not found to be an independent predictor of blood culture positive status by step-wise regression analysis. Also, no gender preponderance was noted among the study groups.

Clinical signs that were found likely to be associated with bacteremia in our subjects are tachypnea, tachycardia, low systolic blood pressure and fever. In addition, odds of having low serum sodium, random glucose, serum hematocrit were higher with CAP bacteremia group. However, the study group did not have higher odds for chest X ray abnormalities including pleural effusion.

A higher proportion of minority subjects with bacteremia related to CAP were HIV positive. Adjusted analysis showed HIV to be independently associated to bacteremia related to CAP. Our patients with CAP and HIV were relatively younger than non-HIV patients with CAP. The HIV predominance noted in the CAP pathogen group may also reflect the increased prevalence of HIV infection among our inner city young subjects that may predispose them to increase risk of pneumonia. The relationship between HIV and increased rates of bacteremia has been reported earlier. Our study findings corroborate with the higher rate of bacteremia reported in HIV-infected patients with or without AIDS in one other study. Whether the increased predisposition to bacteremia is due to immunodeficiency state related to HIV has not been clearly proven. HIV patients also present with diffuse infiltration on chest x-ray compared to non-HIV individuals.

We found no significant correlation between bacteremia related to CAP and the need for ICU or mechanical ventilation, ARDS, Sepsis, MSOF and discharge status. In one large study, a correlation between liver disease and signs...
of sepsis and CAP related bacteremia was noted. (14)
However, we did not observe this predisposition in our
patients. Mortality related to this hospitalization related to
pneumonia was found to be lower than the population
estimate 1.98 per 1000 discharges (15) despite high morbidity
and risk status of our patients.

The length of stay and associated health care cost estimates
are certainly increased due to blood culture positive status,
especially in those with non-CAP pathogens compared to
CAP pathogens. There was also a significant excess health
care spending noted in the group who had contaminant blood
cultures associated with increased length of stay. Few other
studies have also shown that the value of blood cultures in
all patients with CAP is generally low and could increase
cost of care related to increased length of stay.

One limitation of the study is the single center, retrospective
design. However, our sample size had sufficient power to
detect a 25% difference between any clinical feature
associated with bacteremia between the study and control
groups. Any difference less than 25% may be too small to
provide any meaningful clinical information. Our case
control design with a ratio of nearly one case to twenty
controls enhanced the power of the study despite the low
yield of positive blood cultures noted among study patients.
Further, we utilized blinded investigators to verify all study
data from a fully computerized health information system
and limit bias. The small proportion of clinical events
including mortality in the CAP groups with high morbidity
may reflect successful implementation of the CAP treatment
guidelines in our institution. We used non-parametric tests to
analyze statistical significance among the limited adverse
clinical outcomes.

CONCLUSION

Routine blood cultures are associated with low yield among
inner city minority patients with CAP. Hispanics and
African Americans were similar with respect to all clinical
features except higher HIV positive status among Hispanic
subjects. Bacteremia with CAP pathogens group were noted
to have abnormal vital signs, lower serum sodium, glucose
and anemia. There was no relation to other clinical features
or outcomes except positive HIV status in this population.
These clinical features may help identify hospitalized
minority subjects at high risk for bacteremia.

Contaminant cultures can lead to increased length of stay
and health care costs. These higher costs combined with low
yield may have a large impact on pneumonia care costs,
CAP being one of the most common diagnoses for
hospitalization in the US.

Based on the results, we support the continued testing of
blood cultures among selected minority subjects especially
among those with high risk clinical features. Further,
prospective studies are required to confirm our findings.

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