Bacteremia and septicemia in diabetic patients in Western Saudi Arabia

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ABSTRACT

Objective: The present study aims to define the pattern of bacteremia with clinical sepsis in diabetic patients at King Abdul-Aziz University Hospital (KAUH), Jeddah, Kingdom of Saudi Arabia (KSA), in relation to the type of infection, microbial pattern, source, complication, outcome, and the risk factors associated with high mortality.

Methods: Retrospective study of adult diabetic patients with bacteremia and septicemia admitted to KAUH during a 2 years period between January 2000 through to December 2002 was carried out.

Results: A total of 4850 blood culture were submitted to the Microbiology Laboratory of KAUH over a 2 years period. Two hundred and ninety (6%) cases had positive blood cultures, 70 were diabetic patients with an incidence rate of 24% with p-value of 0.043 which is statically significant. Urinary tract infection was the most common source of bacteremia in our study group with Escherichia coli as the most frequent organism in 62%. Mortality rate was 44%. Old age was an important risk factors for high mortality with p-value 0.011, which is statically significant. Other risk factors included comorbidity associated with diabetes, septic shock, mechanical ventilation and disseminated intravascular coagulation.

Conclusion: Increase age was one of the important risk factors for high mortality rate in our study group. Good empiric antibiotics coverage should be instituted early in high risk groups.

for both Saudi and expatriates. This is a retrospective study which included all episodes of bacteremia documented in the Microbiology Laboratory in adult patients (> 13-years of age) with a history of diabetic mellitus during the 2-year period January 2000 through December 2002. The criteria for blood stream infection in diabetics with evidence of clinical sepsis were fever (38°C), hypotension (systolic blood pressure <90 mm Hg); or oliguria (urine output <20 ml/h). The recognized pathogens are isolated from blood culture and not from skin contaminants.

Blood culture was obtained under aseptic precautions. Blood cultures were performed using the BactAlert Microbial Detection system (Organon Teknika, United States of America) 2 bottles for culture media were used, one for aerobic and another for anaerobic growth. Culture bottles were loaded into the instruments and remained there for 5-7 days or until designated positive. Identification of bacteria was performed with standard diagnostic microbiological methods. Organisms that are commonly recovered from the environment or skin were considered as contaminants unless associated with the clinical sepsis or results of culture from other body sites, or the 2 positive sets of blood cultures indicate a high probability for true blood stream infection. The medical notes of adult diabetic patients with evidence of clinical sepsis and true positive blood stream infection were included in this study. The clinical data were collected from medical charts were analyzed patient's age, sex, nationality and the cause of admission. The detailed information of each patient regarding the duration of diabetes mellitus, its treatment whether oral hypoglycemic agents or insulin injections used before admission, complications of diabetes mellitus, associations with other underlying disease, use of immunosuppressive medications (steroid ad chemotherapy) Source of bacteremia, microorganisms isolated, and the ward in which bacteremia occurred, presence of foreign body such as urinary catheter, central line, endotracheal tube, and peripheral intravenous lines were recorded. Evidence of clinical sepsis during the time of bacteremia fever, Systolic blood pressure <90 mmHg or oliguria (20 ml/h) were recorded. Complications of septicemia like shock, acute tubular necrosis, respiratory failure, disseminated intravascular coagulation (DIC), and coma were also recorded. Duration of hospital stay and the outcome of hospitalization whether discharge or demise were documented.

Statistical package for the social science was used to analyze the data. The results obtained were analyzed using Student's t-test. Results were considered significant if p-value was less than 0.05.

**Results.** From a total of 4850 blood clutters carried out at the microbiology laboratory at KAUH. Two hundred and ninety episodes of bacteremia were recovered in adult patients above 13-years of age.

**Table 1** - Nationality of hospitalized diabetic patients.

<table>
<thead>
<tr>
<th>Nationality of patients</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi</td>
<td>37 (53)</td>
</tr>
<tr>
<td>Non-Saudi</td>
<td>33 (47)</td>
</tr>
<tr>
<td>Yemenis</td>
<td>14 (24)</td>
</tr>
<tr>
<td>Palestinian</td>
<td>7 (21)</td>
</tr>
<tr>
<td>Ethiopian</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Somalian</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Moroccan</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Bangladeshi</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Thai</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Kenyan</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Syrian</td>
<td>1 (3)</td>
</tr>
</tbody>
</table>

**Table 2** - Complications and underlying disorders in diabetics for hospitalizations.

<table>
<thead>
<tr>
<th>Complications and underlying disorders</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular accidents</td>
<td>10 (14)</td>
</tr>
<tr>
<td>Coma and vegetative patients</td>
<td>8 (11.4)</td>
</tr>
<tr>
<td>Chronic renal failure and hemodialysis</td>
<td>6 (8.6)</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>10 (14)</td>
</tr>
<tr>
<td>Chronic liver disease</td>
<td>4 (5.7)</td>
</tr>
<tr>
<td>Malignant with febrile neutropenia</td>
<td>3 (4.3)</td>
</tr>
<tr>
<td>Diabetic foot and cellulites</td>
<td>10 (14)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>35 (40)</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>17 (24.3)</td>
</tr>
<tr>
<td>Malignant with metastasis</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Others</td>
<td>10 (14)</td>
</tr>
<tr>
<td>Chest infection with or without chronic obstructive airways disease</td>
<td>10 (14)</td>
</tr>
<tr>
<td>Post operative for intra abdominal surgery</td>
<td>5 (7)</td>
</tr>
</tbody>
</table>

Bacteremia rate reported to be 6% form total blood culture. Of the total bacteremia, 70 episodes had occurred in diabetic patients with a percentage of 24%. Two hundred and twenty episodes of bacteremia 76% had occurred in non-diabetic patients were mean p-value is 0.043. The mean of patients in our study was 58.8 ± 17 years. Thirty-seven patients (53%) were Saudis, 33 (47%) expatriate with ratio a 1:2:1. (Table 1). Forty-six patients of them were males, 24 females with male: female ratio of 1.9:1. Mean duration of diabetes was 13 ± 7.27 years. Of the total diabetic patients, 37 (53%) were on insulin treatment and 33 (47%) were on oral hypoglycemic agents before admission to the hospital. Most of the bacteremic episodes occurred in medical followed by surgical ward and intensive care unit.
Bacteremia and septicemia in diabetic patients ... Qari

The mean hospital stay till demise was 35 ± 22, while stay in diabetic patients discharged from hospital was 24 ± 28 days with $p$-value of 0.086. (Table 4)

**Outcome.** Thirty-one patients died with a mortality rate of 44% among our diabetic cohort with bacteremic episodes. Mortality rate was higher in elderly patients with multiple co-morbidity and underlying disorders. Mortality rate was higher when bacteremia was complicated by septic shock, which was reported in 20 (28.6%), of patients. Mechanical ventilation after cardio pulmonary arrest was associated with poor prognosis in 28 (40%) of patients. Eleven (15.7%) patients had severe disseminated intra-vascular coagulopathy mainly seen in patients with chronic liver disease. Acute tubular necrosis with acute renal failure was reported in 7 (10%) patients. (Table 5)

<table>
<thead>
<tr>
<th>Character of patients</th>
<th>Patients ended with demise</th>
<th>Patients ended with hospital discharge</th>
<th>$p$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>64 ± 15 (31-88)</td>
<td>54.4 ± 17 (11-84)</td>
<td>0.011</td>
</tr>
<tr>
<td><strong>Hospital stay</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>35 ± 22 (5-90)</td>
<td>24 ± 28 (4-120)</td>
<td>0.086</td>
</tr>
<tr>
<td>Range in days</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

E - Escherichia, MRSA - methicillin resistant staphylococcus aureus, staph - staphylococcus

<table>
<thead>
<tr>
<th>Complications</th>
<th>n (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intubations and ventilation</td>
<td>28</td>
<td>(40)</td>
</tr>
<tr>
<td>Septic shock</td>
<td>20</td>
<td>(28.6)</td>
</tr>
<tr>
<td>Disseminated intravascular coagulation</td>
<td>11</td>
<td>(15.7)</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>7</td>
<td>(10)</td>
</tr>
</tbody>
</table>

**Complications and underlying disorders.** Hypertension. Ischemic heart diseases were the common complications seen in our diabetic patients, cerebro-vascular accident, pyelonephritis, diabetic foot, chest infection, coma and vegetative patients were the other common causes of hospitalization in our study group. (Table 2)

**Source of bacteremia and microorganism isolated.** Urinary tract infections (pyelonephritis) were the common source of bacteremia with *E. coli* being isolated in 62%. The most frequent cause of bacteremia due to respiratory tract infection was *Klebsiella*. The Intravenous line and catheter were the source of *Staphylococcus aureus* bacteremia. Methicillin resistant *staph. aureus* positive staph organism was seen among diabetic foot. (Table 3)

**Hospital stay.** The mean duration of hospital stay of all patients till discharge was 28 ± 26 days, where the

### Table 3 - Percentage of microorganism isolated from blood culture in diabetic according to source of infection.

<table>
<thead>
<tr>
<th>Type of microorganism</th>
<th>Urinary tract</th>
<th>Respiratory tract</th>
<th>Diabetic and foot cellulites</th>
<th>Intravenous line and catheter</th>
<th>Intra abdominal</th>
<th>Unknown</th>
<th>Multiple sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>n of patients</td>
<td>21</td>
<td>13</td>
<td>10</td>
<td>13</td>
<td>11</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Percentage</td>
<td>(30)</td>
<td>(18.6)</td>
<td>(14)</td>
<td>(18.6)</td>
<td>(15.7)</td>
<td>(10)</td>
<td>(14)</td>
</tr>
<tr>
<td><em>Staph. aureus</em></td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><em>Klebsiella</em></td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><em>E. coli</em></td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Streptococcus</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Entrobacter</td>
<td>0</td>
<td>-</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>MRSA staph</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mixed organisms</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 4 - Comparison between discharged patients and those with mortality.**

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SD - standard deviation
Discussion. There is a high incidence of bacteremic episodes in our diabetic cohort as they contribute to 24% of the total positive blood culture over the period of 2 years at KAUH. Bacteremia has mortality rate of 20-30%.1,3 The outcome of bacteremia and septicemia in diabetics is variable; some authors have reported higher mortality. The mortality rate was high in our study group of 44%. Fatal outcome was associated with several risk factors like increase age, ischemic heart disease, hypertension and cerebrovascular accident. Septic shock, use of mechanical ventilation, intensive care unit admission, intra-abdominal sepsis, underlying malignancy and the source of bacteremia other than urinary tract infection were other factors associated with fatal outcome.4-9 Risk prediction of hospital mortality in our study was similar to the APACHE II prognostic system study.10 Urinary tract infection was the highest source of bacteremia in our diabetic; this is similar to other studies. Whereas E.coli as a cause of urinary tract infection causing bacteremia in our cohort was different from previous reports from other part of KSA and worldwide.11-16 Klebsiella bacteremia was strongly association with respiratory tract infection. Diabetic patients were commonly susceptible to Staphylococcus bacteremia with poorer prognosis than what we have observed in the general population.17 In our study Staphylococcus bacteremia was the most common pathogens in diabetic foot and those with intravenous line.18 Coagulase negative meticillin resistance staphylococcus organism (MRSA) was the frequently isolated organism from infected feet of our diabetic patients. The multiple source of bacteremia was reported in 14% of patients with mixed type of organisms. The unknown source of bacteremia had been reported to range from 9-31 in diabetic patients. Whereas it was reported only in 10% in our study group.19,20 This could be attributed to early identification of the source of bacteremia, organism and early initiation of antibiotics. A hospital acquired infection in diabetes is noted to be 9-32%. Our diabetic patients had a higher hospital acquired infections especially in intensive care unit with of poor prognosis and a high mortality rate. Mean duration of patients ended in death was 35 ± 22 days, whereas 24 ± 28 in survived patients with a mean p-value of 0.086, which is not statistically significant.

In conclusion, bacteremic episodes among diabetic patients had high mortality rate especially if associated with other risk factors like old age, septic shock, intra abdominal sepsis and undying malignancy. The common source of bacteremia in our diabetic patient was urinary tract infection caused by E.coli and Klebsiella. Increase age was one of the important risk factors for high mortality rate in our cohort early use of empiric antibiotics according to the susceptibility of different common organism according to the possible source of bacteremia in elderly diabetic patients to reduce a high mortality rate is recommended.

References
