

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.

Saudi Med J 2003; Vol. 24 (10): 1064-1067

Nosocomial (Hospital-acquired) blood stream infection is an important cause of morbidity and mortality (BSIs). Blood stream infections contribute to extra hospital days and cause more death than any other nosocomial infection, and they rank second behind lower respiratory infections causing extra charges per hospitalization. Bacteremia has mortality rate of 20-30%.¹ As diabetes is one of the most common endocrine problem in the Kingdom Saudi Arabia (KSA), diabetic patients accounted for a large percentage of blood stream infection when compared to other hospitalized patients. Thus, death rates resulting from bacteremia in hospitalized patients was higher in diabetics patients.^{2,3} It is one of the most important causes of hospitalization due to co-morbidity associated with impaired defense mechanism with poor glycemic

control. A relatively high percentage of diabetic patients have been found to have *Escherichia coli* (*E.coli*) related bacteremic, urinary tract infection and acute pyelonephritis. Respiratory tract infection with *Klebsiella pneumonia* (*Kleb.pneumonia*). Other causes bacteremia and septicemia were with different microorganisms. The present study aims to define the pattern of bacteremia with clinical sepsis among diabetics at King Abdul-Aziz University Hospital (KAUH), Jeddah, KSA, in relation to the type of infection, microbiology, source, complication, outcome, and risk factors associated with high mortality.

Methods. King Abdul-Aziz University Hospital is a teaching governmental hospital which provides services

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Received 10th March 2003. Accepted for publication in final form 12th May 2003.

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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 to 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 out put <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 Bact/Alert 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 diabetic mellitus and 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, endo tracheal 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.

Nationality of patients	n (%)
Saudi	37 (53)
Non-Saudi	33 (47)
Yemenis	14 (42.4)
Palestinian	7 (21)
Ethiopian	2 (6)
Somalian	1 (3)
Moroccan	1 (3)
Bangladeshi	1 (3)
Thailand	1 (3)
Kenyan	1 (3)
Syrian	1 (3)

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

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

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 year 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.

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

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

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

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

Character of patients	Patients ended with demise	Patients ended with hospital discharge	p-value
Age			
Mean ± SD	64 ± 15	54.4 ± 17	0.011
Range	(31-88)	(11-84)	
Hospital stay			
Mean ± SD	35 ± 22	24 ± 28	0.086
Range in days	(5-90)	(4-120)	
SD - standard deviation			

Table 5 - Complications of bactericidal and septicemia.

Complications	n (%)
Intubations and ventilation	28 (40)
Septic shock	20 (28.6)
Disseminated intravascular coagulation	11 (15.7)
Acute renal failure	7 (10)

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

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)

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 111 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 *Staph.aureus* bacteremia with poorer prognosis than what we have observed in the general population.¹⁷ In our study *Staph.aureus* bacteremia was the most common pathogens in diabetic foot and those with intravenous line.¹⁸ Coagulase negative methicillin 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

1. Burn-Buisson C, Doyon F, Carlet J. Bacteremia and severe sepsis in adults: a multimer prospective survey in ICUS and words of 24 hospitals. French Bacteremia-Sepsis Study Group. *Am J Respir Crit Care Med* 1996; 154: 617-624.
2. Alhasmi MAF, Alswailem A, Wasry AS. Prevalence of diabetes mellitus in Saudi Arabia. *Saudi Med J* 1995; 16: 294-299.
3. Bryan, Reynolds KL, Metzger WT. Bacteremia in diabetic patients: comparison of incidence and mortality with non-diabetic patients. *Diabetes Care* 1985; 8: 244-249.
4. Akbar DH. Adult bacteremia. Comparative study between diabetic and diabetic patients. *Saudi Med J* 2000; 21: 40-44.
5. Collignon P, Soni N, Pearson. Sepsis associated with central vein catheters in critically ill patients. *Intensive Care Med* 1988; 14: 227-231.
6. Eltahawi AT. Gram-negative bacilli isolated from patients in intensive care unit: prevalence and antibiotics susceptibility. *Chemother* 1997; 9: 403-407.
7. DiPalo S, Ferrari G, Gastoldi R, Fiacco E, Cristallo M, Staudacher C, Chiese R. Surgical septicemia complications in diabetic patients. *Acta Diabetol* 1999; 25: 49-54.
8. Kalfarentzos FE, Dougenis DV, Cristopoulos DC, Spilio JD, William M, Androulakis J. Prognostic criteria in a intra-abdominal sepsis. *Int Surg* 1987; 72: 185-187.
9. Mki DG, Mermel LA. Infections due to infusion therapy In: Bennett JV, Brachman PS editors. Hospital Infections. Philadelphia (PA): Lippincott-Raven; 1998. p. 689-724.
10. Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bernger M, Bastos PG et al The APACHE 111 prognostic system: Risk prediction of hospital mortality for cortically ill hospitalized adults. *Chest* 1991; 100: 1619-1636.
11. Stamm WE, Hooton TM, Johnson JR, Johnson C, Stapleton A, Roberts PL et al. Urinary tract infections from pathogenesis to treatment. *J infect Dis* 1989; 159: 400-406.
12. Al-Thani. Bacteremia and septicemia in Qatar. *Saudi Med J* 1999; 6: 425-432.
13. Qadri SMH, Khalid S, Johnson D, Flourny J. Etiology of bacteremia in a referral hospital in Saudi Arabia. *Ann Saudi Med* 1987; 2: 51-55.
14. Leibovicil L, Samra Z, Konisberger H, Kalter-Leibovici O, Piltik SD, Drucker M. Bacteremia in adult diabetic patients. *Diabetes Care* 1991; 14: 89-94.
15. J Epoke, Odigwe CO, Anyanwu GO, Opara AA. The prevalence of significant bacteriuria in diabetic patients in Calabar. *Diabetes International Journal* 2000; 10: 16-17.
16. Krieger JN, Kaiser DL, Wenzel RP. Urinary tract etiology of bloodstream infections in hospitalized patients. *J Infect Dis* 1983; 148: 57-62.
17. Qari F, Akbar DH. Diabetic foot, presentation and treatment. *Saudi Med J* 2000; 21: 443-446 .
18. Maki DG, Ringer M. Risk factors for infusion- related phlebitis with small peripheral venous catheter. A Randomized controlled trial. *Ann Intern Med* 1991; 114: 845-850.
19. Al-Thani Asma. Bacteremia and septicemia in Qatar. *Saudi Med J* 1999; 20: 425-432.
20. Gadri SM, Khalid SH, Johnson S, Flournoy DJ. Etiology of bacteremia in a referral hospital in Saudi Arabia. *Annals of Saudi Medicine* 1987; 15: 51-55.