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Bacterial Urinary Tract Infections in Patients with Diabetes Mellitus

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Abstract: Diabetic patients comprise a large proportion of our outpatient population and deserve special attention. To determine the prevalence, the clinical characteristics, risk factors, causative organisms and antimicrobial susceptibility of Urinary Tract Infection (UTI) in diabetic patients. Mid-stream urine samples were obtained from a total of 320 patients attending medical outpatient clinic, University College Hospital, Ibadan and apparently healthy volunteers from February to July 2006. Medical records were also reviewed and the patients were divided into two groups according to the presence or absence of diabetes, Patients that were confirmed to be diabetic were included in the study. Out of 320 midstream urine samples examined, 174(54.3%) were diabetic, out of which 37(21%) had significant bacteruria, these include 23(61.9%) females and 14(38.1%) males while in 146 control healthy volunteers only 7(5%) had significant bacteruria, which accounted for 84(58%) of male and 62(42%) of female within the age range of 20-65. Escherichia coli was the predominant bacterial isolate as a causative agent of urinary tract infection in both diabetics and healthy volunteers The antibiotic sensitivity pattern showed that most islolates were sensitive to ofloxaxin, Gentamycin, Nitrofurantoin, Nalixidic acid, Cotrimaxole and Rocephine while they are resistant to tetracyclines, ampicillins, cefuroxime and ceftazidine. The complications of diabetes are of great importance both financially and in terms of mortality and morbidity, because of frequency and severity of UTI in these groups of patients it is recommended that periodic screening of diabetics patients be undertaken to permit early detection and treatment of assymptomatic bacteruria.

Key words: Urinary tract infection, diabetes mellitus, pyuria, bacterial, risk factors

INTRODUCTION

Diabetes mellitus is a metabolic syndrome characterized by an inappropriate elevation of blood glucose as a result of relative or absolute lack of insulin (Sullivan *et al*., 1961). It has become a major public health problem particularly in developing country (King and Reiwers, 1991). Diabetes mellitus has a long-term effect on the genitourinary system and diabetics are more prone to UTIs and particularly to upper urinary tract infections (Patternson and Andriole, 1997). The reason for this predisposition is not completely understood. Studies are limited, however, evidence of some reports have shown that diabetes affects many systems that protect against infection in general and against urinary tract infections specifically. Poor circulation of blood in diabetes reduces the ability of infection-fighting white blood cells to get to their target site, even when they do get there, they are less able to ingest the offending bacteria and kill them than normal white blood cells. Many people with diabetes also have dysfunctional bladders that contract poorly; this allows urine to remain in static pools for long periods of time, providing luxurious ponds for bacteria to grow in (Andriole, 2002). The high prevalence of urinary tract infection among diabetic patients and the evidence of rapid parenchymal involvement (Akbar, 2001) emphasize the need for knowledge of the prevalence, clinical awareness of the problem and clarification of its consequences in order to define the magnitude of public health resources required to care for the disease. Therefore, the aim of this study is to determine the prevalence, etiology, sex variations and antimicrobial

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susceptibility pattern of urinary tract infection in diabetics attending Medical outpatient Department University College Hospital, Ibadan.

MATERIALS AND METHODS

Specimens collection: Mid stream urine samples were collected from proven diabetics (120 minute plasma glucose value ≥11.1 mmmol L^{-1}) (WHO, 1985) attending Medical Out patient Clinic, at UCH, Ibadan between February and July 2006 and apparently healthy volunteers who served as controls who have all given their informed consent. All urine specimens were obtained aseptically in well labeled, screw capped universal containers and transported promptly to the laboratory for microscopy and culture.

Microcopical examination of urine: All sample were examined for colour, turbidity and presence and absence of blood and about 10 mL of each urine sample were centrifuged at 3000 revolution per minutes for 5 min. Wet preparations and Gram stained smears of deposits were examined microscopically for the presence of pus cells, red blood cells, crystals, epithelial cells, parasites, yeasts and bacterial cells.

Culture: Standard methods for urine cultures were done using blood agar, MaCconkey and Cysteine Lactose Electrolyte Deficient agar plates and incubated aerobically at 37°C. Significant bacteruria was determined by the standard loop method (Cohen and Kash, 1967). Bacteria organisms were isolated and identified according to standard bacteriological procedure (Cowan and Steel, 1963).

Antimicrobial susceptibility testing: Standardized disc diffusion method was used for all isolates to a wide range of antibiotics on Mueller-Hinton agar as recommended by the National Committee for the Clinical Laboratory Standards (NCCLS, 1993).

Data analysis: Data obtained were analyzed by using the appropriate statistical tool.

RESULTS

A total of 320 mid-stream urine samples from diabetes and healthy volunteers between the age range of 20-65, which consist of 120 male and 100 female, of these 174 had diabetes mellitus and accounted for 37 (21%) patients with significant bacteruria these include 23 (61%) of female and 14 (38.1%) of male, while in 146 control healthy volunteers only 7(5%) had significant bacteruria, these include 84(58%) of male and 62(42%)as shown on Table 1.

Table 1: Prevalence of UTI in patients with and without diabetes mellitus

Patients	Total no of patients	Prevalence of UTI	(%)
Diabetes mellitus	174	37	21
Healthy volunteers	146	7	5

Table 2: Microscopical examination of urine of diabetic patients

Urine load inclusion	Total number	(%)
White blood cells	68	39
Red blood cells	17	9.8
Epithelial cells	24	13.8
Crystals	17	9.8
Cast cells	10	5.8
Yeast cells	15	8.6

Table 3: Isolation pattern of organisms in urine samples from diabetics

Organisms	Total	(%)	Female	(%)	Male	(%)
Eschericia coli	17	46	10	59	7	41
Klebsiella species	11	30	9	81	2	19
Candida albicans	4	11	3	15	1	25
Proteus species	2	5	1	50	2	100
Staphylococus aureus	2	5	1	50	1	50
Pseudomonas species	1	3	0	0	1	100

Table 4: Prevalence of organization in urine samples of diabetes in relations to their age and sex

Age group	Significant Male	(%)	Bacteruria Female	(%)
20-35	2	14	2	8.7
36-45	2	14	6	26
46-55	4	29	8	35
56-65	6	43	7	30.4
Total	14	38	23	62

Table 2 shows the result of urine microscopy. Data revealed that 68 (39%) had Pyuria, 17 (9.8%) had numerous red blood cells, 24 (13.%) had epithelial cells, 17 (9.8%) had crystals, 10 (5.8%) had cast cells and 15 (8.6%) had yeast cells, but one of the samples examined had parasites. The most frequent causative agents of UTI is *Escherichia coli* accounting for 17(46%) of the isolates followed by *Klebsiella species* 11(30%), *Candida albicans,* 4(11%). Proteus 2(5%), *Staphylococcus aureus* 2(5%) and *Pseudomonas aeruginosa* 1(3%) (Table 3). The prevalence of organisms in urine samples of diabetes patients by age and sex is shown on Table 4. The highest prevalence of UTI in diabetics was observed in age range of 46-55, 8(35%) in female and age 56-65 6(43%) in male. The antibiotic sensitivity pattern showed that most isolates were sensitive to ofloxaxin, Gentamycin, Nitrofurantoin, Nalixidic acid, Cotrimaxole and Rocephine while they are resistant to tetracyclines, ampicillins, cefuroxime and ceftazidine (Table 5).

Table 5: Antibiotic susceptibility patterns of isolates

	Eschericia coli (17)		klebsiella species (11)		Proteus mirabilis (2)		Staphylococcus aureus (2)		Pseudomonas aeruginosa (1)	
Antimicrbiall agents	No sensitive	No resitant	No sensitive	No resitant	No sensitive	No resitant	No sensitive	No resitant	No sensitive	No resitant
Ofloxaxin	16(69)	6(31)	10(90)	1(10)	2(100)	0(0)	2(100)	0(0)	1(100)	0(0)
Rocephine	10(59)	7(41)	9(82)	2(18)	1(50)	1(50)	0(0)	2(200)	0(0)	1(100)
Nitrofurantoin	11(69)	6(31)	9(82)	2(18)	2(100)	0(0)	2(100)	0(0)	0(0)	1(100)
Cottrimozaxole	12(69)	5(31)	6(55)	5(45)	0(0)	2(100)	1(50)	1(50)	1(100)	0(0)
Gentamycin	4(24)	13(76)	8(73)	3(27)	2(100)	0(0)	2(100)	0(0)	1(100)	0(0)
Ampicillin	6(24)	11(76)	2(18)	9(82)	0(0)	2(100)	2(100)	0(0)	0(0)	1(100)
Tetracycline	13(31)	4(69)	5(45)	6(55)	2(100)	0(0)	2(100)	0(0)	0(0)	1(100)
Nalixidic acid	9(76)	8(24)	7(64)	4(36)	7(64)	4(36)	7(64)	4(36)	0(0)	1(100)
Ceftazidine	8(47)	9(53)	7(64)	4(36)	(0)	2(100)	0(0)	2(100)	0(0)	1(100)
Cefuroxime	8(47)	9(53)	7(64)	4(36)	1(50)	1(50)	1(50)	1(50)	0(0)	1(100)
Azithromycin	9(53)	8(47)	5(45)	6(55)	1(50)	1(50)	1(50)	1(50)	0(0)	1(100)

DISCUSSION

Diabetes mellitus has for a long time been associated with increase in prevalence of bacteruria compared with patients without (Sullivan *et al*., 1961; Harding *et al*., 2002). It was therefore, not surprising to find in this study a prevalence of UTI of 21%, a much higher rate than that found in healthy controls 5%. This is in agreement with a similar study carried out in Lagos University Teaching Hospital, a prevalence rate of 21.7% was obtained in a sample size of 152 while 6(5.77%) of significant bacteruria was demonstrated in healthy volunteers (Oduyebo *et al*., 2001) with *Escherichia coli* being the predominating isolates accounting for 17(46%). The spectrum of pathogens isolated in this study is the same as in the usual population of patients with UTI (Abu-Bakare and Oyaide, 1986) and this has been shown to be attributable to the ability of *E. coli* to grow better in urine with high concentration of glucose as found in poorly controlled diabetes (King and Reiwers, 1993).

It is noteworthy, that out of the 174-midstream urine samples from diabetics examined in this study, only 37 (21%) yielded growth while 137(79%) of the urine sample yielded no growth. It is usually recommended that only urine with significant pyuria be considered for culture (Cunha, 1996) as was done in this study, out of 174 mid steam urine samples examined, 65(39.1%) shows significant pyuria and were all cultured, of these only 37(56%) had positive urine culture while 31(44%) yielded no growth. Some authors have found a poor correlation between microscopic pyuria(3≥ pus cells per high power field) and cultural diagnosis of UTI (Okada *et al*., 2000). If this is followed, asymptomatic bacteruria without pyuria might be missed out which will be dangerous for these categories of patients. It was also observed in this study that most of the urine samples that have as high as 6-8 pus cells per high power field and above yielded no growth. This observed phenomenon might be due to the fact that these groups of patients are usually placed on antibiotics to prevent infection thereby reducing the culture yield of the specimens (Cunha, 1999). It was also observed in this study that 80% of all diabetics investigated that had bacteruria were assymptomatic, the implication of this is that urine microscopy, culture and sensitivity should be done after periodical screening of bacteruria in diabetics which will facilitate early detection of assymptomatic bacteruria in order to prevent complications associated with UTI in diabetes. In this study, the occurence of UTI in diabetics was observed in subjects between the age of 20 and 65 and was found to increase with age and incidence of bacteruria is more frequent in female patients than male. This was confirmed by previous reports, that may not be unconnected with the mounting evidence that host and risk factors predispose females to bacteria than males (Adres, 1971; Imperato *et al*., 1976). However, some of these risk factors like obesity, nutrition, socioeconomic class and pregnancy were not observed in this study.

The result of antibiotic susceptibility pattern of the causal agents in this study revealed that most isolates were resitant to ampicillins, tetracyclines that are relatively cheaper and more frequently prescribed while the quinolones they inhibited most of the isolates. This finding correlates with the outcome of results of other workers in this environment on the major problems in the management of UTI in Diabetics and the high incidence of reoccurrence and emergence of multi-resistant organisms against the common, cheap and grossly abused drugs (Odugbemi, 1981; Ogunsola *et al*., 1997). Judicious use of antibiotic policy and legislative measures against indiscriminate use of drugs should be enforced. It was not possible to follow up patients due to short duration of the study, hence the effect of UTI and complications in diabetics could not be assessed.

CONCLUSION

However, because of frequency and severity of UTI in diabetes patients, prompt diagnosis and early therapy is warranted and therefore the challenges will be to provide long-term care, control the elevated blood sugar and maintenance of normal health to prevent complications arising from UTI in diabetics patients.

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