Bangladesh J Med Microbiol 2010; 04 (01): 6-8

Bangladesh Society of Medical Microbiologists

Original Article

The Pattern of Organism Causing Urinary Tract Infection in Diabetic and Non Diabetic Patients in Bangladesh

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Abstract

Urinary tract infection (UTI) is common both in the diabetic and non-diabetic patients. The widespread use of antimicrobial agents leads to emergence of resistant microorganisms. Since the pattern of bacterial resistance is constantly changing, the monitoring of the antimicrobial susceptibilities of the predominantly isolated organisms becomes more important. Aim of this study was to determine the etiologic agents and their antibiotic sensitivity pattern in both diabetic and non-diabetic patients with urinary tract infection (UTI). A total of 288 diabetics (196 female and 92 males) and 63 non diabetic patients (43 female and 20 males) with symptomatic UTI were included in this study. Among the study cases, 43.8% diabetic patients and 42.9% non-diabetic patients had positive growth from urine. Rate of isolation of *Escherichia coli* in diabetic was less (61.8%) compared to non diabetic (77.8%). Rate of other organisms isolated in diabetic and non diabetic patients were respectively: *Klebsiella sp* 6.9% vs 3.7%, *Enterococcus* 12.2% vs3.7%, *Pseudomonas species* 3.8% vs 0%, *Candida species* 4.6% versus 3.7%, *Staphylococcus aureus* 4.6% versus 7.4% etc. *E coli* isolated from diabetic patient was significantly ($p<0.05$) less sensitive to ceftriaxone, ceftazidime, cefuroxime, netilmicin, gentamicin, ciprofloxacin and nitrofurantoin than that of non diabetic patients. In addition, isolation rate of the Extended Spectrum Beta Lactamase producing gram negative bacilli was found higher among diabetic population (47.8%) compared to the non-diabetics (9.1%).

Key words: Urinary tract infection (UTI), Diabetic and non diabetic patient, Extended Spectrum Beta Lactamase.

Introduction

Diabetes mellitus (DM) has long been considered to be a predisposing factor for urinary tract infection (UTI)[1] and the urinary tract is the principle site of the infection in diabetics with increased risk of complications of UTI. [2]

The mechanisms which potentially contribute to UTI in these patients are defects in the local urinary cytokine secretions (IL-8, IL-6), increased adherence of the microorganisms to the uroepithelial cells, partly due to a changed and lowered Tamm Horsfall protein, and granulocyte dysfunction, possibly as a result of an abnormal intracellular calcium metabolism.[2,3] On the other hand, hyperglycemia facilitates the colonization and growth of variety of organism.[4]

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The most common cause of UTI in men and women with and without DM is *Escherichia coli*. In non-diabetic male and female, the frequency of organism causing UTI are: *Escherichia coli* 31.4% & 58.2%, *Enterococcus* spp. 9.4% & 6.5%, *Pseudomonas* spp. 17.2% & 4.7% respectively. The organisms causing UTI in diabetic female are *Escherichia coli* 54.1%, *Enterococcus* spp 8.3%, *Pseudomonas* spp 3.9%, while in diabetic male it is 32.5%, 9.4%, 8.5% respectively.[1]

Antimicrobial resistance among bacteria causing UTI is increasing.[1] Few data are available on microbiology of UTI in diabetic and non-diabetic patients. Therefore, the present study was undertaken to determine the pattern of organisms causing UTI and their antibiotic susceptibility pattern in diabetic and non-diabetic patients.

Methods of study

Study Population & Period: A total of 351 diabetic and non-diabetic patients, with clinically diagnosed UTI, attending both outpatient & inpatient departments of Bangladesh Institute of Research and Rehabilitation In Diabetes, Endocrine and Metabolic Disorder (BIRDEM) hospital were studied. Study

was conducted during period of December, 2008 to April, 2009 in the Department of Microbiology, BIRDEM.

Sample Collection and Microbiological method: Data regarding age, sex, type & duration of diabetes, sign and symptoms of UTI were recorded in specific questionnaire forms. The criteria used to differentiate diabetic patients from non-diabetic was by fasting blood sugar of 7.1 m mol/l. Mid stream urine (MSU) sample was collected for microscopic examination and culture. The samples were cultured in blood agar and MacConkey agar media. The growth of 10^5 cfu/ml was considered as a significant bacteriuria.[5] Symptomatic patients with pyuria (> 5 pus cells/HPF) and lower colony count (10^2-10^5cfu/ml) were also considered as culture positive sample. Isolates were identified by standard methods.[6] For each of the isolates, antibiotic susceptibility was done by Kirby Bauer disk diffusion technique.[7] Gram negative bacilli were tested for extended spectrum ß-lactamase (ESBL) production by a double disc diffusion method.[8]

Result

Out of 351 urine samples, 288 patients (196 female and 92 males) were type 2 diabetic and 63 (43 females and 20 males) were non-diabetic patients. The mean ages of diabetic and non diabetic patients were 49.5 ± 8.3 years and 43.4 ± 17.4 years respectively. Majority of patients (263/351) were in between 20 to 60 years age and the culture positivity rate was 45.6%. Out of 351, 76 patients were above 60 years, culture positivity rate 42.1% and 12 were below 20 years whose culture positivity rate was only 8.3%. A total of 153 (43.6%) sample showed significant growth. Rate of culture positivity in different category of population is given in Table 1.

Table 1: Rate of culture positive UTI in different category of population

Category of patients		Total no. of suspected UTI	Culture positive N (%)
Indoor		128	62 (48.5)
Outdoor		223	91 (40.8)
Diabetic		288	126 (43.8)
Non-diabetic		63	27 (42.9)
Male	DM	92	38 (41.3)
	NDM	20	6 (30)
Female	DM	196	88 (44.9)
	NDM	43	21 (48.9)
Catheterized		65	39 (60.0)
Non Catheterized		286	114 (39.9)

Culture positivity rates were found almost same in diabetic-non-diabetic, indoor-outdoor patients except between catheterized and non catheterized group ($p < 0.05$). *Escherichia coli* was the most frequent uropathogen isolated, and was responsible for UTI in 57.5% and 63.8% of diabetic males & females and 83.3% & 76.1% of non-diabetic males & females. Rate of isolation of *Escherichia coli* in diabetics was less (61.8%) compared to non diabetics (77.8%). Frequency of other organisms (*Staphylococcus aureus, Klebsiella* species, *Pseudomonas* species, *Enterococcus* species , *Candida)* in both male-female diabetic patients found higher (38.2%) than non diabetics (22.2%). In addition, other organisms were also found higher in indoor and catheterized than that of out door and non catheterized groups (Table 2).

Table 2: Pattern of organisms isolated from indoor and outdoor UTI patients with and without diabetes.

Name of organisms	No. of organism isolated							
	Diabetics				Nondiabetics			
	Indoor	Out door	Catheterized	Noncatheterized	Indoor	Out door	Catheterized	Noncatheterized
E.coli	29 (50.8)	52 (70.3)	18 (52.9)	63 (64.9)	6 (60)	15 (88.2)	6 (66.6)	15 (83.5)
Klebsiella sp.	2 (3.5)	7 (9.4)	1 (2.9)	8 (8.2)	0 (0)	1 (5.9)	0 (0)	1 (5.5)
Enterococcus sp.	12 (21.1)	4 (5.4)	7 (20.6)	9 (9.3)	1 (10)	0(0)	0 (0)	1(5.5)
Pseudomonas sp.	2 (3.5)	3 (4.1)	0 (0)	5 (5.2)	0 (0)	0(0)	0 (0)	0 (0)
Candida sp.	5 (8.8)	1 (1.3)	4 (11.8)	2 (2.1)	1 (10)	0(0)	1 (11.1)	0 (0)
Staph. aureus	3 (5.3)	3 (4.1)	3 (8.9)	3 (3.1)	2 (20)	0(0)	2 (22.2)	0 (0)
*Other organisms	4 (7.0)	4 (5.4)	1 (2.9)	7 (7.2)	0(0)	1 (5.9)	0 (0)	1 (5.5)
Total =N	57 (100)	74 (100)	34 (100)	97 (100)	10 (100)	17 (100)	9 (100)	18(100)

Figure within parenthesis indicate percentages.

*Other organisms include *Acinetobacter , Streptococcus, Staphylococcus epidermidis, Citrobacter.*

Escherichia coli isolated from diabetic patients is significantly ($p<0.05$) less sensitive to ceftriaxone, ceftazidime, cefuroxime, netilmicin, gentamicin, ciprofloxacin and nitrofurantoin compared to nondiabetic patients, but rate of sensitivity to ampicillin, cephalexin, imipenem, amikacin, nalidixic acid, cotrimoxazole almost similar in both diabetic and non-diabetic patients (Table 3).

Table 3: Antimicrobial sensitivity of *E. coli* isolated from diabetic and non-diabetic patients

Antimicrobial Agents	Diabetic Patient			Non Diabetic Patient			P value
	No. of tested strains	Sensitive		No. of tested strains	Sensitive		
		No.	%		No.	%	
Ampicillin	43	8	18.6	8	1	12.5	>0.05
Cephalexin	33	7	21.2	4	1	25.0	>0.05
Ceftriaxone	84	30	35.7	18	11	61.1	<0.05
Ceftazidime	84	33	39.2	18	11	61.1	<0.05
Cefuroxime	40	12	30.0	12	7	58.3	<0.05
Imipenem	77	77	100.0	14	14	100.0	>0.05
Amikacin	72	62	84.7	18	14	77.7	>0.05
Netilmicin	75	48	64.0	18	15	83.3	<0.05
Gentamicin	70	37	52.9	17	14	82.3	<0.05
Ciprofloxacin	84	21	25.0	18	9	50.0	<0.05
Nalidixic Acid	79	10	12.6	18	4	22.2	>0.05
Cotrimaxazole	84	35	41.6	18	6	33.3	>0.05
Nitrofurantoin	84	67	79.8	18	14	94.4	<0.05

Note: P>0.05= Nonsignificant; P<0.05= Significant; P value were obtained by χ^2 test.

Isolation of Extended Spectrum Beta Lactamase producing gram negative bacilli in diabetic population was found higher (47.8%) than that of non-diabetics (9.1%) (Table 4).

Table 4: Rate of ESBL positive organism in diabetic and non-diabetic patients.

Organisms	Diabetic			Non-diabetic		
	Total no. of isolates	ESBL positive		Total no. of isolates	ESBL positive	
		N	%		N	%
E coli	81	41	50.6	21	2	9.5
Klebsiella	9	2	22.2	1	0	0
Total	90	43	47.8	22	2	9.1

Discussion

In this study, we have tried to determine whether there are differences in the bacteriologic patterns of UTI and in the antibiotic sensitivity patterns of the pathogens concerned with diabetic and non-diabetic patients.

In the present study the rate of *E. coli* isolation in the diabetic males and females (57.5% and 63.8%) was lower than non-diabetic male and female (83.3% and 76.1%).

We have observed a higher isolation rate of *Pseudomonas* spp in diabetic males (7.5%) and *Enterococcus* spp in diabetic females (16.5%) than non-diabetic groups. The percentage of *Klebsiella* spp causing UTI in diabetic patients (6.9%) was higher than non-diabetic (3.7%) which was similar to other studies done in different countries. [9, 10, 11]

It has shown in several studies that women are at increased risk to develop UTI then men.[12] Majority of the culture positive patients in our study were also female (45.6%) (Table 1).

Catheter associated UTI is now a growing problem in hospitalized patients. In the present study, culture positivity rate in catheterized patients (60%) was found significantly higher ($p<0.05$) than non- catheterized patients (39.9%).

Regarding the antimicrobial sensitivity profile of the uropathogenes, we observed that the isolated *E. coli* strains were sensitive at similar rate to ampicillin, cephalexin, imipenem, amikacin, nalidixic acid and cotrimoxazole in both diabetic and non-diabetic patients but sensitivity to ceftriaxone, ceftazidime, cefuroxime, netilimicin, gentamicin, ciprofloxacin and nitrofurantion were found significantly more ($p<0.05$) in non-diabetic group compared to diabetic group. One study was done in Iraq by Abdul Sahib and found ciprofloxacin resistant *E.coli* significantly higher in diabetic patients than control group ($p= < 0.05$).

So, in conclusion, we found a low proportion of *E. coli* isolates in patients with UTI in diabetic compared to non-diabetics. In addition, the resistance of *E. coli* isolated from diabetic patients was significantly more than non- diabetic patients. In our series of patients, diabetes mellitus could be considered as a risk factor for cause of UTI by organisms other than *E.coli* and for higher antibiotics resistance among them.

References:

1. Bonadio M, Costarelli S, Morelli G, Tartaglia T. The influence of diabetes mellitus on the spectrum of uropathogens and the antimicrobial resistance in elderly adult patients with urinary tract infection. *BMC Infect. Dis.* 2006; 6:54.
2. Sahib AKY. Study of ciprofloxacin resistant *Escherichia coli* (CREC) in type 2 diabetic patients with symptomatic urinary tract infections. *Iraq J Comm Med* 2008; 21(1): 58-63.
3. Baqui R, Aziz M, Rasool G. Urinary tract infection in diabetic patients and biofilm formation uropathogens. *Infect.Dis. of Pakistan* 2008; 17(1): 7-9.
4. Hasan MK, Nazimuddin K, Ahmed AKMS, Sarker RSC, Haque M, Musa AKM. Differences in a bacteriological and antibiotic sensitivity patterns in UTI among hospitalized diabetic and non diabetic patients. *J Medicine 2007;* 8: 10-3.
5. Das RN, Chandrashekhar TS, Joshi HS, Gurung M, Shrestha N, Shivananda PG. Frequency and susceptibility profile of pathogens causing urinary tract infections at a tertiary care hospital in western Nepal. *Singapore Med J* 2006; 47(4): 281-5.
6. Colle JG, Miles RS, Watt B. Tests for the identification of bacteria. In : Mackie and MacCartney Practical Microbiology, 14th edn. New York: Churchill Livingstone Inc 1996; pp: 131- 49
7. Bauer AW, Kirby WMM, Sherris JC, Tierch M. Antibiotic susceptibility testing by a standardized simple disk method. *Am J Clin Pathol* 1966; 45:493-9
8. Emery CL, Weymouth LA. Detection and clinical significance of extended spectrum b-lactamases in a tertiary care medical centre. *J Clin Microbiol* 1997; Vol.35.No 8: 2061-67
9. Bonadio M, Meini M, Spitaleri P, Gigli C. Current microbiological and clinical aspects of urinary tract infections. *Eur Urol* 2001; 40(4):39-44.
10. Stapleton A. Urinary tract infections in patients with diabetes. *Am J Med* 2002; 113(1A):80-4.
11. Ronald A, Harding G: Complicated urinary tract infections. *Infect Dis Clin North Am* 1997; 11:83-92.
12. Raco MVO, Barez MYC. Profile of community acquired urinary tract infections in Davao city. Phil J. Microb. Infect Dis. 1998; 28 (2): 62-6.