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Research Article

Uropathogens and the Antimicrobial Susceptibility Patterns in Patients with Type 2 Diabetes

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Abstract

Purpose: To determine the frequency of different Uropathogens and their susceptibility pattern in patients with type 2 diabetes mellitus.

Method: All urine specimens of patients with type 2 diabetes mellitus received in Microbiology section of Clinical and Research Laboratory of Baqai Institute of Diabetology and Endocrinology during January to December 2012 were included in the study. Samples were cultured by standard methods by 1 µL loop on Cled medium with Andrade indicator and blood agar plates. Samples with more than 10^5 CFU/mL bacteria were considered as positive. Identification and susceptibility testing was determined by using the Clinical and Laboratory Standards Institute (CLSI) guidelines.

Results: Out of 67 urine specimens 33 (49.25%) were positive culture. The magnitude of positivity was differed significantly between females and males (20 male and 47 female). Uropathogens was more frequent in females 88% as compare to male 12% in patients with diabetes. *Escherichia coli* was the most frequent pathogen 72%, followed by *Klebsiella pneumoniae* 14%, *Acinetobacter baumannii* 6.9% and *Proteus vulgaris* 3.90%. Majority of gram negative uropathogens were highly resistant against Cefuroxime, nalidixic acid, norfloxacin, sulphamethoxazole, ciprofloxacin and cefotaxime. 90.48% of E. coli strains showed the high resistance towards cefuroxime, nalidixic acid and sulphamethoxazole and 85.71% towards norfloxacin and ciprofloxacin.

Conclusion: The most frequent isolate was *Escherichia coli* while *Acinetobacter baumannii* was less frequent but highly resistant. Imipenem, piperacillin/tazobactam, sulbactam / cefoperazone and ertapenem were most susceptible drugs against uropathogens in patients with diabetes.

Introduction

Diabetes mellitus is a metabolic disorder associated with long-term vascular complications leading to morbidity and mortality [1]. It is the fastest growing non-communicable disease throughout the world [1,2] and the fourth leading cause of death in most developed countries. Pakistan belongs to high prevalence area, having 6.6 million affected people, with projected estimates expected to 11.4 million by the year 2030 [3].

Urinary tract infections (UTIs) are one of the most common and the most frequently occurring infections in humans [4-7], counting for 7 million office visits, more than 1 million emergency room visits, and 100,000 hospitalizations each year [6]. Diabetes mellitus is associated with many complications and in the long run it has some major effects on the genitourinary system which makes diabetic patients more liable to Urinary tract infections (UTIs) and particularly to upper UTIs [8] Urinary tract infection is a significant problem both in community and Patients with diabetes. Patients with diabetes are at high risk to develop Urinary tract infections. The longer duration of diabetes with uncontrolled hyperglycemia is associated with the prevalence of bacteriuria [9]. According to a study from Netherlands 10% of these UTI occurs in patients with diabetes [10].

Escherichia coli (*E. coli*) is the most common isolates in 75% to 90% of UTI [5,11]. Other commonly reported organisms in urine cultures are *Proteus, Klebsiella, Enterobacter, Pseudomonas* species, *Enterococcus* species, *streptococci, staphylococci* and *Candida albicans* [11]. There are controversies on incidence, prevalence and microbiological features of UTI between diabetic and non-diabetic patients but various studies showed Escherichia coli as the most frequent causative agent of UTIs in patients with diabetes [5,9,12].

The knowledge regarding the prevalence of different microorganisms and antibiotics susceptibility is important for the treating physician so that the proper antibiotics can be prescribed.

Therefore the aim of the present study was to determine the frequency of different uropathogens and there antibiotics susceptibility pattern in patients with diabetes attending a tertiary care diabetes unit.

Material and Methods

Urine specimens of patients with type 2 diabetes from outpatient department and admitted patients at Baqai Institute of Diabetology and Endocrinology (BIDE) received in Microbiology section of Clinical and Research Laboratory of BIDE from January to December 2012 were included in the study. Clean-catch midstream urine specimens were received from 67 patients with diabetes (47 female and 20 male). Urine specimens were cultured by standard methods

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by 1 µL loop on Cled medium (Oxoid) with Andrade indicator and blood agar (Oxoid) plates [7,13-16] and were incubated at 37°C for 24 hours or overnight. Samples with more than 10^5 CFU/mL bacteria were considered as positive. Growth of Normal Skin Flora (NSF) was considered as insignificant [7]. Gram negative organisms were identified using Triple Sugar Iron (TSI), citrate utilization, Sulphide Indole Motility media (SIM) and urea hydrolysis [7,17]. Mueller-Hinton agar was used for antibiogram test [13,17]. Susceptibility testing was determined by using the Clinical and Laboratory Standards Institute (CLSI) guidelines recommended modified Kirby-Bauer disc diffusion method with commercial antibiotic discs (Oxoid).

The antimicrobial discs used for susceptibility testing were clavulanic acid (30 µg), piperacillin/tazobactam (110 µg), cefuroxime (30 µg), cefotaxime (30 µg), cefpirome (30 µg), sulbactam / cefoperazone(105 µg), aztereonam (30 µg), imipenem (10 µg), ertapenem (10 µg), amikacin (30 µg), nalidixic acid (30 µg), norfloxacin (10 µg), ofloxacin (5 µg), ciprofloxacin (5 µg) and sulphamethoxazole (25 µg) (Table 1).

Zone of inhibition ≥ 26 mm *for* cefotaxime and cefuroxime, ≥ 22 mm for aztereonam, ≥ 21 mm for piperacillin / *tazobactam,* cefpirome, sulbactam / cefoperazone and ciprofloxacin, ≥ 19 mm for norfloxacin, ≥ 18 mm for clavulanic Acid, ≥ 17 mm for amikacin and nalidixic acid, ≥ 16 mm *for* Imipenem, ofloxacin and sulphamethoxazole considered sensitive.

Statistical analysis

Analysis of data was done on Statistical Package for Social Sciences (SPSS), version 13.0. Data presented in the form of frequency and percentage.

Table 1: Antimicrobial susceptibility pattern of *Escherichia coli and Klebsiella pneumonia.*

	Escherichia coli		*Klebsiella pneumoniae*	
ANBIOTIC	**S (%)**	**R (%)**	**S (%)**	**R (%)**
CXM (30 µg)	9.52	90.48	0.00	100
NA (30 µg)	9.52	90.48	0.00	100
SXT (25 µg)	9.52	90.48	25	75
CIP (5 µg)	14.29	85.71	0.00	100
NOR (10 µg)	14.29	85.71	0.00	100
CTX (30 µg)	28.57	71.43	0.00	100
AMC (30 µg)	33.33	66.67	25	75
CPO (30 µg)	38.10	61.90	0.00	100
ATM (30 µg)	61.90	38.10	25	75
AK (30 µg)	76.19	23.81	75	25
SCF (105 µg)	90.48	9.52	100	0.00
TZP (110 µg)	95.24	4.76	75	25
ETP (10 µg)	95.24	4.76	100	0.00
IPM (10 µg)	100	0.00	100	0.00

Abbriviations: R: Resistant; S: Sensitive; CXM: Cefuroxime; NA: Nalidixic Acid; SXT: Sulphamethoxazole; CIP: Ciprofloxacin; NOR: Norfloxacin; CTX: Cefotaxime; AMC: Clavulanic Acid; CPO: Cefpirome; ATM: Aztereonam; AK: Amikacin; SCF: Sulbactam-Cefoperazone; TZP: Tazobactam-Piperacillin; ETP: Ertapenem; IPM: Imipenem

Results

A total of 67 urine specimens (20 male and 47 female) were analyzed during the study period. Thirty three (49.25%) uropathogens were isolated from 67 urine specimens of patients with diabetes. High frequency of uropathogens was observed in female 88% than in male 12%. Gram negative bacilli were 88% and Candida was 12%. *Escherichia coli* was the most common pathogen isolated in 72% followed by *Klebsiella pneumoniae* 14%, *Acinetobacter baumannii* 6.9% and *Proteus vulgaris* 3.90% as shown in Figure 1.

E. coli strains were mostly susceptible to imipenem (100%) followed by ertapenem and piperacillin/tazobactam (95.24%), sulbactam / cefoperazone (90.48%), amikacin (76.09%) and aztereonam (61.90%) as shown in Table 1.

K. pneumoniae strains showed high susceptibility towards imipenem, sulbactam / cefoperazone and ertapenem (100%) followed by piperacillin/tazobactam and amikacin (75%) as shown in Table 1.

Proteus vulgaris showed the highest susceptibility towards imipenem and aztereonam (100%) followed by Cefpirome and amikacin (50%). *Acinetobacter baumannii* strains were susceptible to sulbactam / cefoperazone only.

Discussion

E. coli was the most frequent uropathogen in patients with type 2 diabetes in our study, an observation supported by some other studies [8,9,11,18,19]. We found 72% of *E.coli* in urine specimens of patient with type 2 diabetes whereas it was 13% [11] in a Libyan and 28% in a study from Ethiopia [18]. K. *pneumoniae* was found to be the second frequent uropathogen in our study. The frequency of K. *pneumoniae* found in urine specimens of patient with type 2 diabetes vary in different reports. 6% in an Ethiopian study [18], 3.8% in a local study [9] and it was 14% in our study. *Proteus vulgaris* (non fermenting gram negative bacilli) was found in only 0.4% in an Indian study [4] where as our study results showed 3.90% *Proteus vulgaris* in urine specimens of patients with diabetes.

In our study majority of *E.coli* strains showed susceptibility toward imipenem, same findings obtained in a study from Bangladesh [20]. 95.24% and 90.48% of *E.coli* strains showed susceptibility toward

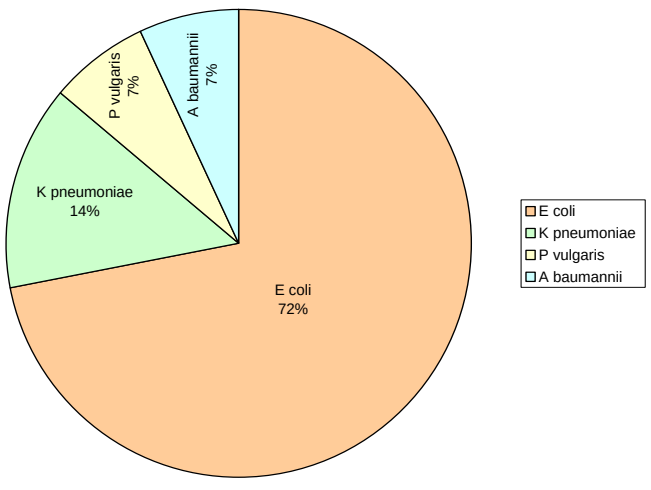

Figure 1: Frequency of different uropathogens in patients with diabetes.

Piperacillin/tazobactam and sulbactam / cefoperazone while it was 68.5% and 85% respectively in an Indian study [21].

We found 76.09% *E.coli* strains susceptible to amikacin. Whereas studies in Bangladesh 97% [4], 84.7% [20] of E coli strains were susceptible to Amikacin. Results of an Indian study showed 80.7% E coli susceptible to Amikacin [21]. 61.90% of E. coli strains susceptible to aztereonam in our study. It was as low as 22.2% in an Indian study [21]. 58% E. coli strains susceptible to clavulanic acid in a Libyan [5] and 42.6% in an Indian study [21]. It was only 33.33% in our study. E. coli strains showed susceptibility to cefotaxime 44.4% in an Indian study [21] and 28.57% in our study. Results of studies from Bangladesh showed 21% [4] and 25.0% [20], from Libya 68% [5], from Italy 91.6% [12] and from Africa 100% [22] of E coli strains susceptible to ciprofloxacin whereas 14.29% in our study. E. coli strains showed less susceptibility to cefuroxime in our study 9.52%. While it was high in two studies 86.7% [22] and 30.0% [20]. E. coli strains showed susceptibility to Nalidixic acid as low as 9.52% in our study, while 12.6% in a study from Bangladesh [20], 86.7% in a study from Africa [22] and 68% in a Libyan study [5]. Only 9.52% of E. coli strains showed susceptibility to sulphamethoxazole. It was 38.9% [21], 41.6%, [20], 68% [5] and 80.8% [12] in Indian, Bangladesh, Libyan and Italian studies respectively.

Majority of K. pneumoniae strains showed high susceptibility towards imipenem and sulbactam / cefoperazone in our study. Whereas it was 98.5% towards imipenem in a study from Cameron [23] and 87.9% towards sulbactam/cefoperazone in an Indian study [21]. Susceptibility of *K. pneumoniae* strains towards amikacin was 100% in a study from Bangladesh [4] 95.4% in a study from Cameron [23], 88.9% in Libyan study [5] and 75% in our study.

88.9% K. strains showed susceptibility towards piperacillin / tazobactam in an Indian study [21] while our study results showed 75% of *K. pneumoniae* strains susceptibility towards piperacillin / tazobactam.

25%of *K. pneumoniae* strains showed susceptibility towards Sulphamethethoxazole in our study while it was high in a Libyan study 83% [5].

K. pneumoniae strains showed susceptibility towards clavulanic acid 25% in our study whereas it was 56% [5] and 55.6% [21] in Libyan and Indian studies respectively. 38.2% K. *pneumoniae* sensitive to Aztereonam in an Indian study [21] and 25% in our study.

Conclusion

The most frequent isolate was *Escherichia coli* while *Acinetobacter baumannii* was less frequent but highly resistant. Imipenem, piperacillin/tazobactam, sulbactam / cefoperazone and ertapenem were most susceptible drugs against uropathogens in patients with diabetes.

Limitations

Our study has limitation, a relatively small number of specimens because it was a laboratory data base study.

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