ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Bacteriological finding of urinary tract infection in diabetic patients

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Manuscript Info

Manuscript History:

Received: 25 August 2014
Final Accepted: 26 September 2014
Published Online: October 2014

Key words:

Diabetes mellitus, Genitourinary, Uropathogens, Antibiotics

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Abstract

Background: Diabetes mellitus has adverse effect on genitourinary system and patients suffering from diabetes mellitus are more prone to have urinary tract infection**.**

Aims: To determine the prevalence of uropathogens in diabetic patient and to study their antibiotic susceptibility.

Patients and Methods: urinary isolates and their patterns of susceptibility to the antimicrobials were evaluated in 60 diabetic patients with UTI (35 females-non pregnant and 25 males) from 122 diabetics attending National Center of diabetes Baghdad .Iraq . The specimens were examined for the various uropathogens using the standard microbiological procedures. Antibiotic susceptibility testing was performed for various antibiotics by Kirby Bauer disc diffusion method and the results were interpreted as per Clinical Laboratory and Standards Institute guidelines. The data was tabulated and analyzed.

Results: The study showed that females are more vulnerable to pathogenic attack than males throughout a wide age distribution. *Escherichia coli* was the most common pathogen had been isolated followed by *Staphylococcus aureus*, *Enterobacter* species, *Klebsiella pneumoniae* and a few others. The isolates showed moderate to high level of sensitivity to various antibiotics tested.

Conclusions: Diabetic patients are at a high risk of development of urinary tract infections. So continued surveillance of resistance rates among uropathogens is needed to ensure appropriate approach for the treatment of these infections.

Introduction

Urinary Tract Infections (UTI) are one of the frequent infections that are encountered in clinical practice.[1] Individuals with diabetes mellitus are reported to have increased risk of UTI both in frequency and severity.[2] Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[3] 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 UTI and particularly to upper urinary tract infections.[4] Many studies have shown that diabetes mellitus (DM) has a long term deleterious effect on genitourinary system that causes significant morbidity and mortality.[5] The incidence of diabetes mellitus (DM) throughout the world is increasing strikingly and is becoming a serious public health problem especially in the developing countries.[6]

The most common organisms causing UTI are *E.coli* while *Proteus*, *Klebsiella*, *Streptococcus* and *Staphylococcus* also commonly the causative agents.[7] Treatment options for UTI in diabetes may be similar to as in non-diabetics but have to be initiated timely and may take a longer time for cure. Antimicrobial resistance among uropathogens causing UTI is also increasing.[5] The aim of this study is to determine the prevalence of different kind of uropathogens in diabetic patients and the resistance pattern of antibiotics in various pathogens.

Patients and Methods:

This is cross sectional study, it was done in National Center of Diabetes- Baghdad .Iraq during May and June 2013 on 122 patients with diabetes mellitus. For all, detail history including history of UTI were taken; complete clinical examination and routine investigations were performed.

A midstream urine samples were collected from each patient (122) in a sterile containers after proper patients education. Samples were inoculated onto blood and MacConkey agar plate and incubated for 24 hrs. at 37C. Identification of significant isolates was done by using conventional and confirmatory tests.

A significant bacteriuria was defined as culture of a single bacterial species from the urine sample at concentration of more than 10^5CFU/ml associated with microscopic finding of each white blood cells or pus cells more than 10 cell in high power field. [8]

The antimicrobial susceptibility of each isolated pathogen was determined by disc diffusion method according to Bauer-Kirby et al [9] on Mueller-Hinton agar plates were incubated for 24hrs at 37C after inoculation with microorganisms and placement of the disks and the diameters of the inhibition zones were measured.

The antibiotics used included Amikacin (30µg), Gentamicin (10µg), Ciprofloxacin (5µg), Nitrofurantion (300µg), Amoxicillin (30µg), Imipenem (10µg), Cefoxitin (30µg), Clindamycin (30µg), Chloramphenicol (30µg), Cephalothin (30µg), Co-trimemethaxazoloe (25µg), Erythromycin (15µg), Piperacillin (100µg), Tetracyclin (30µg) and Trimethoprim (25µg). The results were interpreted as per Clinical Laboratory and Standards Institute guidelines. [10]

Statistical analysis

Analysis of data was carried out using the available statistical package of SPSS-22 (Statistical Packages for Social Sciences-version 22). Data were presented in simple measures of frequency, percentage, mean, standard deviation, and range (minimum-maximum values).

The significance of difference of different percentages (qualitative data) were tested using chi-square test (χ^2-test) with application of Yet's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05.

Results:

The 122 patient with diabetes mellitus were examined for urinary tract infection, were males 64(52.5%) and females 58(47.5%) samples respectively (Table1).

Table 1. Sociodemographic variables of Diabetic patients studied and bacterial isolates.

		No	%
Age (years)	**<20**	**10**	**8.2**
	20-29	5	4.1
	30-39	8	6.6
	40-49	12	9.8
	50-59	41	33.6
	=>60	46	37.7
	Mean±SD (Range)	51.4±17.1(4-79)	
Sex	Male	64	52.5
	Female	58	47.5
Bacterial isolate	Yes	60	49.2
	No	62	50.8
Type of isolates	*E. coli*	36	60.0
	K. pneumoniae	3	5.0
	P. aeruginosa	1	1.66

Enterobacter spp.	5	8.33	
Staph. aureus	12	20.0	
Staph. saprophyticus	3	5.0	

Table 2 shows the prevalence of urinary tract infection among diabetic patient was (49.1%) and the prevalence rate was higher in females 35(60.3%) than males 25(39.1%).

Table 2. The bacterial isolates distribution by sex

		Male		**Female**		**P value**
		No	%	No	%	
Bacterial isolate	No	39	60.9	23	39.7	
	Yes	25	39.1	35	60.3	0.019*
Type of isolates	*E. coli*	13	52.0	23	65.7	0.203
	K. pneumoniae	1	4.0	2	5.7	
	P. aeruginosa	1	4.0	-	-	
	Enterobacter spp.	2	8.0	3	8.6	
	Staph. aureus	8	32.0	4	11.4	
	Staph. saprophyticus		-	3	8.6	

*Significant using Pearson Chi-square test at 0.05 level

The female patients with diabetes mellitus and urinary tract infection in our study population were aged between (27-76) years while the males with DM and UTI were aged between (43-74) years.

Significant bacteriuria was seen in 60(49.1%) patients and six types of microorganisms were isolated from positive urine cultures. Among the 60 isolates 45 were gram negative bacilli and 15 were gram positive cocci. Among the 45 gram negative bacilli, 36(60%) were *E.coli*, 5(8.33%) *Enterobacter* species, 3(5%) *Klebsiella pneumonia* and 1(1.66%) *Pseudomonas aeruginosa* . Among the gram positive cocci, *Staphylococcus aureus* 12(20%) and *Staphylococcus saprophyticus* 3(5%) of the patients.

The sensitivity of different isolates to various antibiotics in diabetic patients with urinary tract infection are shown in Table-3. *E.coli* showed highest sensitivity to piperacyclin (61.1%) followed by nitrofurantoin (58.3%) and co-trimemethaxazoloe (55.6%).

Klebsiella pneumoniae showed high sensitivity to piperacyclin (66.7%) and to nitrofurantoin and ciprofloxacin (33.3%).

Enterobacter species exhibited sensitivity to antibiotics varied from (33.3%) for tetracyclin to (100%) for impeneum.

Staphylococcus aureus had highest sensitivity to ciprofloxacin and cefoxitin (75%) and the highest resistance to chloramphenicol (91.7%).

Mostly bacterial isolates exhibited complete resistance to Tetracyclin (100%), only *Enterobacter* species had sensitivity to Tetracyclin (33.3%).

Table 3. The sensitivity % of different isolates to different antibiotics in diabetic patients with Urinary tract infection.

	E. Coli	***K. pneumoniae***	***Enterobacter spp.***	***P. aeruginosa***	***Staph. aureus***	***Staph. saprophyticus***
Gentamycin 10mcg/disc	36.1	0	-	0	16.7	-
Nitrofurantoin 300mcg/disc	58.3	33.3	-	100	-	0

Ciprofloxacin 5mcg/disc	47.2	33.3	-	0	75.0	100
Piperacylin 100mcg/disc	61.1	66.7	-	-	-	-
Co-trimemethaxazolo 25mcg/disc	55.6	0	-	-	-	-
Amoxicillin 30mcg/disc	16.7	0	50.0	-	-	0
Tetracyclin 30mcg/disc	0	0	33.3	-	-	0
Cefoxitin 30mcg/disc	-	-	83.3	100	75.0	66.7
Impeneum 10mcg/disc	-	-	100	0	-	-
Amikacin 30mcg/disc	-	-	-	100	-	33.3
Clindamycin 30mcg/disc	-	-	-	0	66.7	-
Chloramphenicol 30mcg/disc	-	-	-	-	8.3	-
Trimetheprim 25mcg/disc	-	-	-	-	-	33.3

*(0):resistant

*(-):non-treatment

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 affecting diabetic patients. The result of this study showed that isolation of uropathogens was more in female diabetic patients 35(60.3%) as compared to 25(39.1%) of male diabetic patients which is in accordance with findings of other reports, stating high prevalence of UTI in females.[11, 12, 13, 14] The reason behind this high prevalence of UTI in females is due to the female urethra structurally found less effective for preventing the bacterial entry [15] ,the proximity of the genital tract to the anus[16] and sexual intercourse.[17] This study, showed the age range of infected females (27-76) years was also much broader compared to that of males (43-74) years. These finding are in agreement with report of other researches.[7] This increasing incidence of UTI in young age females are associated with high sexual activity and history of recurrent UTI.[18]

Bacteriological studies usually reveal the involvement of gram negative enteric organisms that commonly cause urinary tract infections, such as *E.coli*, *Enterobacter* species and *Klebsiella pneumoniae*. Similarly, the predominant number of pathogens isolated in our study were gram negative bacilli.[19, 20] *E.coli* was the most frequent uropathogens 36(60%) in this study. Higher incidence of *E.coli* related to many factors which are responsible for their attachment to the uroepithelium and able to colonize in the urogenital mucosa with adhesion and pili.[15] Many other studies have also reported similar findings.[21, 22] The other organisms isolated in the study were *Staphylococcus aureus* 12(20%) and *Enterobacter* species 5(8.33%), other authors have reported frequent isolation of the same organisms in urine specimens of diabetic patients.[23, 24]

The antibiotic susceptibility testing of gram negative bacilli were found to be highly sensitive to piperacyclin and nitrofurantoin, while gram positive cocci were found to be more sensitive to ciprofloxacin and cefoxitin which agreed with other report.[25] while in another study it was found gram negative bacilli and gram positive cocci are mostly resistant to nitrofurantoin, ciprofloxacin, cephalosporin and amoxicillin, but are sensitive to gentamicin, amikacin and meropenem.[12]

Conclusions:

Urinary tract infection is a common problem in diabetics. Gram negative bacilli were found to be highly sensitive to pipracyclin and nitrofurantoin while gram positive cocci were found to be more sensitive to ciprofloxacin and cefoxitin. Continuous surveillance of antibiotic susceptibility patterns of uropathogens in diabetic patient should be done to ensure rational use of antibiotics for empirical and definitive treatment of urinary tract infections in this vulnerable group.

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