

Research Article**Study of Uropathogens among Type II Diabetic Patients and Their Antimicrobial Resistance Pattern among Rural South Indian Population**Dhandapany Senthil Pragash¹, Smiline Girija², Usha Shekar¹, Vijaya Rayapu,¹ Malathi¹¹Department of Microbiology, Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Melmaruvathur, Tamilnadu - 603319, India.²Department of Microbiology, Meenakshi Ammal Dental College, Maduravoyal, Chennai, Tamilnadu - 600095, India.***Corresponding author**

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Abstract: Infection of the urinary tract (UTI) is among the most frequent infectious diseases in humans. Urinary tract infection is also a most common infection among the diabetic patients. The aim of our study is to know the prevalence of various uropathogens among long term Type II Diabetic patients and to reveal their corresponding antimicrobial resistance pattern. Urine samples were collected from randomly selected 260 diabetic patients who suffered from urinary tract infection. Urine cultures were done by standardised method. Urine samples were inoculated onto Blood agar and MacConkey agar and colonies identified using appropriate biochemical methods. Data was analyzed statistically. The results of our study showed that females (71%) are more prone to pathogenic urinary tract infection than males (43%). In terms of pathogenic distribution, *Escherchia coli* (54%), *Klebsiella* (21%), *Pseudomonas* (12%), *Proteus* (4%), *Acinetobacter* (1%), *Staphylococcus aureus* (14%), *Enterococci* (1%) and Coagulase negative *Staphylococcus auerus* CoNS (8%) were common among the diabetic patients. The overall prevalence of urinary tract infection was 58%. Our result revealed that there was significant growth bacteriuria in 152 patients. High level resistance is seen to Cotrimoxazole, Ciprofloxacin, Ceftazidime and Cefipime. Sensitivity of Nitrofurantoin to *Pseudomonas* and *Acinetobacter* were not tested as they have intrinsic resistance to that drug. Amikacin is found to be very effective against all the isolates. Most of the isolates were sensitive to Imepenem.**Keywords:** Urinary tract infection, Diabetes mellitus, antibiotic sensitivity, *E.coli*.

INTRODUCTION

Diabetes mellitus is the most common endocrine disease and is associated with organ complications due to micro vascular and macro vascular disease. Diabetes mellitus is a group of metabolic diseases in which a person has high blood glucose, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. Urinary tract infections can be a particular problem for people with diabetes as glucose in the urine makes it a fertile culture media for bacterial growth. Susceptibility to bacterial infection increases with longer duration and greater severity of diabetes. High glucose content in the urine and defective host immune factors predispose to infection. Hyperglycaemia causes neutrophil dysfunction by increasing intracellular calcium levels and interfering with actin, diapedesis and phagocytosis. People with diabetes also suffer from simple and complicated infections, although the association between diabetes mellitus and increased susceptibility to infection has been found. Acute complications include diabetic ketoacidosis and non-ketotic hyper-osmolar coma.

Serious long-term complications include cardiovascular disease, chronic renal failure, diabetic retinopathy, perirenal abscess, emphysematous pyelonephritis, emphysematous cystitis, fungal infections, xantho-granulomatous pyelonephritis and papillary necrosis [1]. Urinary tract infections include a spectrum of clinical entities in which the presence of bacteriuria is the common denominator. Other types of microorganisms such as viruses and fungi may also infect the urinary tract but usually do so under special circumstances of systemic infection or decreased host resistance. Asymptomatic bacteriuria, acute pyelonephritis and complications of UTI are reported to be more common in patients with diabetes [2].

MATERIALS AND METHODS

A total of 260 urine samples were collected from the out patients and in patients in our hospital during the study period (July 2012 to June 2013). Institutional ethical committee approval was obtained for this study. The midstream urine specimens were obtained by clean-catch method. The samples were collected in sterile containers after obtaining informed

consent and cultured within one hour of collection. The samples were plated out on MacConkey and Blood agar media and incubated aerobically overnight at 37°C. Samples that showed pure growth of isolate in a count of $\geq 10^5$ colony forming units (CFU) per ml of urine after overnight incubation were considered to indicate significant bacteriuria. The characteristic bacteria on the culture media were aseptically isolated and subjected to microscopy and appropriate biochemical tests for proper identification. Antimicrobial sensitivity tests were carried out by disc diffusion technique using Muller Hinton Agar. *E. coli* ATCC strain 25922 susceptible to all the antibiotics was used as control. The Antibiotics used for susceptibility testing in our study were Cotrimoxazole (COT), Amikacin (AK), Ciprofloxacin (CIP), Ceftazidime (CAZ), Cefipime (CPM), Imepenem (IPM) and Nitrofurantoin (NIT).

RESULTS

Table 1: Urinary tract infection among the diabetes mellitus patients of both the genders

Groups	Significant bacteria	Percentage
Male (n = 120)	52	43 %
Female (n = 140)	100	71 %
Total (n = 260)	152	58 %

Legends 1: A total of 260 urine samples were collected, out of which, females (140) and males (120) samples respectively. The overall prevalence of urinary tract infection was 58% and the prevalence rate was higher in females (71%) than males (43%). Our result revealed that there was significant growth bacteriuria in 152 patients.

Table 2: Distribution of organisms among both the genders of diabetes population.

Organisms	Total	Percentage
<i>Escherchia coli</i>	82	54 %
<i>Klebsiella</i>	32	21 %
<i>Pseudomonas</i>	18	12 %
<i>Proteus</i>	6	4 %
<i>Acinetobacter</i>	2	1 %
<i>Staphylococcus aureus</i>	21	14 %
<i>Enterococci</i>	2	1 %
<i>CoNS</i>	12	8 %

Legend 2: From our study it was clearly found that the pathogens like *Escherchia coli* (54%), *Klebsiella* (21%), *Pseudomonas* (12%), *Proteus* (4%), *Acinetobacter* (1%), *Staphylococcus aureus* (14%), *Enterococci* (1%) and *CoNS* (8%) were common among the diabetic patients with urinary tract infection.

Table 3: Resistance patterns of organisms to antibiotics

Organism	Amikaci n	Ceftazidim e	Ciprofloxaci n	Imipena m	Cotrimoxazol e	Cefepim e	Nitrofurantoin
<i>Escherchia coli</i>	44	84	62	2	81	67	18
<i>Klebsiella</i>	32	60	48	1	80	32	8
<i>Pseudomonas</i>	47	63	58	2	95	47	-
<i>Proteus</i>	33	50	50	0	83	17	33
<i>Acinetobacter</i>	50	100	100	0	100	0	100
<i>Staphylococcus aureus</i>	0	25	25	0	50	0	-
<i>Enterococci</i>	25	100	100	0	100	100	100
<i>CoNS</i>	0	4	8	0	14	0	-

Legend 3: Our study shows the resistance pattern of isolates to different antibiotics. High level resistance is seen to Cotrimoxazole, Ciprofloxacin, Ceftazidime and Cefipime. Sensitivity of Nitrofurantoin to *Pseudomonas* and *Acinetobacter* were not tested as they have intrinsic resistance to that drug. Nitrofurantoin showed higher sensitivity for the other organisms. Amikacin is found to be very effective against all the isolates. Most of the isolates were sensitive to Imepenem.

DISCUSSION

This study shows that the *E. coli* predominated among all the patients and *Klebsiella spp.* being the second commonest in both the patient groups [3,4]. From this study, it is obvious that Cotrimoxazole is no

more useful against uropathogens as only 17% of the isolates were susceptible for that drug. Previously this antibiotic was used as the drug of choice for empirical treatment of UTI [5]. The broad spectrum activity of Fluoroquinolones has made them as one of the best therapeutic options for UTI. In the present study the isolates showed low degree of susceptibility to Fluoroquinolones which indicates that they can no more be opted for treating UTI. It is obvious from our study that there is increased resistance for higher generation Cephalosporin antibiotics like Ceftazidime and Cefipime [6,7,8]. This is an indication that many of the organisms are ESBL and Amp C producers. For these organisms, drugs with inhibitors like Augmentin may be tried but, which should be reserved for the last line

of treatment. Very less number of organisms are resistant to Imepenem (3%) which shows that carbapenemase producing strains is not much in our study. Carbapenems are the final therapeutic option for any infection [9]. But it is advocated that they should be used as a last line antibiotic to prevent the occurrence of carbapenem resistance. Hence they cannot be given for empirical treatment. Antimicrobial resistance for Nitrofurantoin has not occurred much attributed to its localized action only on the urinary tract and hence not exposed outside the urinary tract. The susceptibility pattern of Nitrofurantoin is satisfactory in our study as its activity on the urinary isolates is very effective. Since *Pseudomonas* spp. and *Acinetobacter* spp. have intrinsic resistance to Nitrofurantoin, testing sensitivity of *Pseudomonas* against Nitrofurantoin is of no use [10,11,12]. It is shown in our study that Nitrofurantoin has tremendous effect against other Uropathogens (*E.coli*, *Klebsiella* spp., *Proteus* spp., *Staphylococcus aureus*). Hence our study recommends Nitrofurantoin as the drug of choice for empirical treatment of UTI. Amikacin also has showed strong activity against most of the organisms including *Pseudomonas*, *Acinetobacter* and all the other organisms responsible for UTI in hospital setup. With the evidence from our study, we can suggest Amikacin to be prescribed as the empirical treatment for UTI in hospitalised diabetic patients with UTI [13]. But keeping the emerging antimicrobial resistance in mind, it is strongly suggested that the antibiotic therapy should only be commenced after the sensitivity report from the Microbiology laboratory. This would not only help in the prudent use of antibiotics but also would curb the dissemination of antimicrobial resistant strains in the community as well as in the hospital.

CONCLUSION

In summary, the prevalence of lower UTI was high in women with diabetes than in men. *Escherichia coli* were commonly isolated. The gram negative pathogens were highly resistant to Cotrimoxazole, Ciprofloxacin, Cotrimoxazole and Ceftazidime. Diabetic patients are at a high risk of development of UTIs, so it is recommended that continued surveillance of resistance rates among uropathogens is needed to ensure appropriate recommendations for the treatment of these infections.

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REFERENCE:

1. Adeyeba PO, Omosigho YO, Adesiji YO; Bacterial urinary tract infections in patients with diabetes mellitus. Int. J. Trop. Med, 2007;2:89-2.

2. Goswami R , Bal CS , Tejaswi S , Punjabi GV , Kapil A ,Kochupillai N; Prevalence of urinary tract infection and renal scars in patients with diabetes mellitus. Diab Res Clin Pract 2001;53:181-6.
3. Bashir MF, Qazi JI, Ahmed N, Riaz S; Diversity of urinary tract pathogens and drug resistant isolates of *Escherichia coli* in different age and gender groups of Pakistanis. Trop. J. pharm. Res 2008;7:1025-31.
4. World Health Organization: Definition, Diagnosis and Classification of diabetes mellitus and its complications; Part 1: Diagnosis and Classification of diabetes mellitus, Geneva. Department of non communicable Disease Surveillance. WHO; 1999.
5. Gupta V, Yadav A, Joshi RM; Antibiotic resistance pattern in uropathogens, IJMM, 2002; 20(2):96-98.
6. Azad U, Khan, Mohd S Zaman; Multidrug resistance pattern in Urinary Tract Infection patients in Aligarh. Biomedical Research 2006;17(3):248-251.
7. Yvonne Vasquez, MPH W-Lee Hand; Antibiotic Susceptibility Pattern of Community Acquired Urinary Tract Infection Isolates from female patients on the US (Texas)-Mexico Border. The Journal of Applied Research, 2004;4(2):321-326.
8. Jesús Rodríguez-Bano, Maria Dolores Navarro; Epidemiology and Clinical Features of Infections Caused by Extended-Spectrum Beta-Lactamase producing *Escherichia coli* in Non-hospitalized Patients; Journal of Clinical Microbiology. 2004;42(3):1089-1094.
9. James AK, Laurie J, Clyde T, Mark EJ, Daniel FS; Trends in Antimicrobial Resistance among Urinary Tract Infection Isolates of *Escherichia coli* from Female Outpatients in the United States. Antimicrob Agents Chemother. 2002;46(8):2540-2545.
10. Ribera MC, Pascual R, Orozco D, Perez Barba C, Pedrera V, Gil V; Incidence and risk factors associated with urinary tract infection in diabetic patients with and without asymptomatic bacteriuria. Eur J Clin Mic Inf Dis. 2006 June; 25(6):389-393.
11. Adeyeba OA, Adesiji YO, Omosigho PO; Bacterial Urinary tract infections in patients with Diabetes Mellitus. International Tropical Journal of Medicine. 2007;2:89-92.
12. Delzell JE, Lefevre ML; Urinary tract infection during pregnancy. Am Fam physician, 2000; 61:713-721.
13. Jha N, Bapat SK; A study of sensitivity and resistance of pathogenic micro organisms causing UTI in Kathmandu valley. Kathmandu University Medical Journal 2005; 3(10):123-129.