ORIGINAL ARTICLE

# Spectrum Study of Organisms in Patients of UTI of Diabetics

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**Abstract**

Diabetes mellitus is considered the leading cause of death in which T2DM is the predominant form of diabetes worldwide, accounting for 90% of cases. Globally, the number of people with diabetes is expected to rise from the current estimate of 285 million in 2010 to 438 million in 2030. Type2 DM is associated with various vascular and non vascular complications including skin infections, urinary tract infections etc. Urinary tract infection is one such infection which is very commonly seen. Since the microorganisms causing UTI vary in their susceptibility to antimicrobials from place to place and time to time, constant screening of trends and susceptibility pattern of predominant organisms against antimicrobials is essential. Increased adherence of E. coli expressing type 1 fimbriae to uroepithelial cells of diabetic women may play an important role in the pathogenesis of UTIs especially if the diabetes is poorly controlled. Although UTI seldom leads to complications, it can cause significant morbidity and mortality. The study aims to determine the spectrum of uropathogens and antibiotic sensitivity pattern in UTI infections associated with T2DM. Most of the isolates showed intermediate to low level of resistance to one or more antimicrobials tested. This indicates that regular monitoring is required to establish reliable information about resistance pattern of urinary pathogens for optimal empirical therapy of diabetic patients with UTI.

**Key Words**

Diabetes, Urinary Tract Infection, Antibiotic Sensitivity

## Introduction

UTI which is most commonly found bacterial infection accounting for nearly 7 million office visits and 1 million hospitalizations of women, the elderly, and patients with spinal cord injuries and/ or catheters, Multiple sclerosis, HIV and diabetes. UTI is an infection occurring anywhere in urinary tract, encompasses ABU, cystitis, pyelonephritis and prostatitis.(1) UTI in patients with diabetes are due to the same urinary pathogens as those found in general population, with the majority of ascending infection due to E coli, Proteus spp., Enterobacter spp., and Enterococcus faecalis. Klebsiella, and Group B streptococcus are also more common in patients with diabetes. Fungi like candida is considered to be as a common predisposing factor for UTIs.(2) Screening is recommended in asymptomatic individuals of any age with BMI >25kg/meter square and who have one or more additional risk factors like physical inactivity, first degree relative with diabetes, Blood Pressure >140/90, HDL cholesterol<35 or TG >250 etc. In those without risk factors, testing should begin at the age of 35-40 years. (3) In view of more common occurrence of UTI in diabetic patients and considering their successful management which depends upon the identification of the types of organisms that cause the disease and the selection of an effective antibiotic against the organism in question. The emergences of resistant bacterial strains in hospitals pose a continued challenge to treat and control the spread of infections. Moreover, the indiscriminate use of antibiotics often results in the increased resistance of urine pathogens to most commonly used antimicrobial drugs (4). In addition, resistance to the commonly used antibiotics was found to be very high among the isolates,

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leaving clinicians with very few choices of drugs for the treatment of UTI (5). There is a paucity of research addressing the etiologies, risk factors and management of UTI in diabetic patients Therefore, this study was done to identify the associated risk factors and type of organism isolated in diabetic patients with UTIs attending the OPD of medicine and the admitted patients in medicine wards GMC Jammu. Thus the data presented in this study will provide information to clinicians on the selection of antimicrobial agents for the treatment of diabetic patients suffering from UTI.

**Material and Methods**

An observational study was conducted in the department of internal medicine GMC Jammu during the period from October 2013 to September 2014.A total of 420 patients presenting with symptoms suggestive of UTI in medicine OPD as well as Medicine wards. A symptom of UTI is defined the presence of at least two of the following complaints: dysuria, urgency, frequency, incontinence, supra pubic pain, flank pain or cost vertebral angle tenderness, fever (temp.38? C) and chills. All study participants during the study period were interviewed using pre-tested questionnaire that includes socio demographic and clinical data by attending physicians and transferred to a questionnaire prepared for this study Out of the total, 220 patients were either culture negative or had insignificant colonies, so were excluded from the study. Diabetic patients on antibiotics for the last two weeks, catheterized and pregnant patients were also excluded.

All study participants during the study period were interviewed using pre-tested questionnaire that includes socio-demographic and clinical data and HbA1C was estimated by immune turbidimetric method. The Ethical committee of the institution approved the study and written informed consent was obtained from all the study subjects.

Collection, handling and transport of specimens: Routine examination of urine was performed in all the patients.Midstream urine samples were collected from the patients after giving proper guidelines.The urine samples were immediately transported to the Department of Microbiology for analysis.If the urine samples were found to be contaminated by normal flora of the vagina and urethra,the subject was asked to submit another sample.

Samples were processed using the following standard procedures: smears for gram staining, culture for morphology, biochemical tests for identifying the species of the pathogens, and antimicrobial susceptibility by Kirby-Bauer method, also known as disc diffusion antibiotic sensitivity testing. It uses antibiotic impregnated wafers to test whether bacteria are affected by antibiotics. In this test, wafers containing antibiotics are placed on an agar plate where bacteria have been placed, and the plate is left to incubate. If an antibiotic stops the bacteria from growing or kills the bacteria, there will be an area around the wafer where the bacteria have not grown enough to be visible. This is called zone of inhibition. The size of this zone depends on how effective the antibiotic is at stopping the growth of bacterium. A stronger antibiotic will create a larger zone, because a lower concentration of the antibiotic is enough to stop growth. The bacteria in question is swabbed uniformly across a culture plate. A filter-paper disk, impregnated with the compound to be tested, is then placed on the surface of the agar. The compound diffuses from the filter paper into the agar. The concentration of the compound will be highest next to the disk, and will decrease as distance from the disk increases. If the compound is effective against bacteria at a certain concentration, no colonies will grow where the concentration in the agar is greater than or equal to the effective concentration. This is the zone of inhibition. This along with the rate of antibiotic diffusion are used to estimate the bacteria's sensitivity to that particular antibiotic. In general, larger zones correlate with smaller minimum inhibitory concentration (MIC) of antibiotic for that bacteria. Inhibition produced by the test is compared with that produced by known concentration of a reference compound. This information can be used to choose appropriate antibiotics to combat a particular infection.

All aspects of the Kirby-Bauer procedure are standardized to ensure consistent and accurate results. The media used in Kirby-Bauer testing is Mueller-Hinton agar at only 4 mm deep, poured into either 100m or 150mm Petri dishes. The pH level of the agar is kept between 7.2 and 7.4. Inoculation is made with a broth culture diluted to match a 0.5 McFarland turbidity standard, which is roughly equivalent to 150 million cells per ml. (6)

Incubation Procedure: Using an aseptic technique, a sterile swab is laced into the broth culture of a specific organism and then gently the excess liquid is removed by gently pressing or rotating the swab against the inside of the tube. Using the swab, Mueller-Hinton agar plate is streaked to form a bacterial lawn. To obtain uniform growth, the plate is streaked with the swab in one direction, and rotated by 90° and then again streaked in that direction. This rotation is repeated 3 times. The plate

*Table. 1 Profile of USG Findings*

| USG findings | No. | %age |
|---|---|---|
| NR | 74 | 39% |
| Residual Urine | 32 | 18 % |
| Calculi | 29 | 16.5% |
| Cystitis | 24 | 12% |
| Abscess | 11 | 5.5% |
| HOUN | 11 | 5.5% |
| Emphysematous pyelonephritis | 07 | 3.5% |
| BHP | 12/56 | 21.4% |

*NR: normal ; HOUN: hydrouretronephros ; BHP: Benign Hypertrophy Prostate*

***Table.2 Antimicrobial Susceptibility Pattern of Gram-negative Bacteria Isolated from Urine Culture of Diabetic Patients***

| | | Antimicrobial Agents Tested | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Bacteria Isolated** | **Total Nos** | **Pip/taz** | **Sul/cef** | **Imi/cil** | **cefotaxime** | **NFU** | **Levo** | **Meropenem** | **Gentamycin** | **Amikacin** |
| E- coli | 118 | 86 (72.8%) | 31 (26.2%) | - | - | 41 (34.7%) | 34 (28.8%) | 59 (50%) | - | 32 (27.1%) |
| Klebsiella | 28 | 25 (89.3%) | 11 (39.2%) | 10 (35.7%) | 9 (32.1%) | - | - | - | - | - |
| Pseudomonas | 12 | 11 (91.6%) | 4 (33.3%) | - | - | - | - | 5 (41.6%) | - | 8 (66.6%) |
| Enterobacter | 8 | 7 (87.5%) | 4 (50%) | - | - | - | - | 4 (50%) | - | - |
| Citrobacter | 4 | 4 (100%) | - | - | - | - | - | 2 (50%) | 2 (50%) | 2 (50%) |

*Pip/taz: piperacillin/tazobactam; Sul/cef:sulabactam/cefaperazone; Imi/cil: imipenem/cilastin NFU: nitrofurantoin; Levo: levofloxacin*

***Table.3 Antimicrobial Susceptibility Pattern of Gram-positive Bacteria Isolated from Urine Culture of Diabetic Patients***

| | | Antimicrobial Agents Tested | | | | |
|---|---|---|---|---|---|---|
| **Bacteria Isolated** | **Total Nos** | **Pip/Taz** | **Sul/cef** | **Imi/cil** | **Gentamycin** | **Ceftazidime** |
| Enterococci | 9 | - | 3 (33.3%) | 7 (77.7%) | 4 (44.4%) | - |
| staphylococci | 6 | 3 (50%) | 3 (50%) | 4 (66.6%) | - | 5 (83.3%) |

is allowed to dry for approximately 5 minutes. Antibiotic Disc Dispenser is used to dispense discs containing specific antibiotics onto the plate. Using a flame-sterilized forceps, each disc is pressed to the agar to ensure that the disc is attached to the agar. Plates were incubated overnight at an incubation temperature of 37 °C (98.6 °F). Quality control procedures were incorporated to assure the quality of stains, media, biochemical and antibiotic discs.

A diagnosis of UTI was made if urine culture shows > 103 to 105 colony forming units [CFU/ml] of a single potential pathogen or two potential pathogens.(7) A pure culture of Staph. aureus was considered positive regardless of the number of CFU/ml. Presence of candida in any number was also considered to be significant. USG abdomen and pelvis was also done in all patients to look for residual urine volume and any other significant finding.

## Results

The results of the current study are shown in *table 1-3*

## Discussion

Socio demographic profile of the subjects included in the study showed that Women had significantly higher prevalence of UTI than men. (8) Out of the total 200 patients studied 144 (72%) were females and 56(28%) were males.(9) All the patients were divided into 3 age groups: 19 patients under <45 years (9.5%), 54 between 45-55 years (27%) and 127 were > 55 years (63.5%). Out of all the 200 patients, 52(26%) had a history of diabetes for <10 years and 148(74%) had history of diabetes for > 10 years. (10)

In the USG abdomen, 78 patients had a normal scan (39%), 36 (18%) had finding of residual urine, 33 (16.5%) showed the presence of calculi, 24 (12%) had a scan

suggestive of cystitis, 11 (5.5%) patients had renal abscess, 11 (5.5%) patients had HOUN and 7 (3.5%) showed the presence of emphysematous pyelonephritis. (11) Urine cultures of patients predominantly showed the growth of gram negative organisms in 170 (85%) cases, whereas 30 (15%) showed the growth of gram positive organisms. Out of all the gram negative organisms, E.Coli was predominant, 118 patients (59%), followed by Klebsiella (14%). Increased adherence of E.coli expressing type 1 fimbriae to uroepithelial cells of diabetic women may play an important role in the pathogenesis of UTIs especially if the diabetes is poorly controlled and same finding supported by Geerlings SE *et al*. (12)

Among gram positive organisms predominant were enterococci 9 (4.5%) followed by staph 6 (3.1%); 15 patients showed growth of candida (7.5%).

**Conclusion**

In this study we found high proportion of gram negative bacilli with predominant uropathogen being E. coli in diabetic patients so laboratories should encourage accurate bacteriological record keeping of urinary isolates. Therefore, continued surveillance of sensitivity rates among uropathogens is needed to ensure appropriate recommendations for the treatment of these infections. The successful management of patients suffering from urinary tract infections in diabetic patients depends upon the identification of the types of organisms that cause the disease and the selection of an effective antibiotic against the organism in question. Emergences of resistant bacterial strains in hospitals pose a continued challenge to treat and control the spread of infections. Moreover, the indiscriminate use of antibiotics often results in the increased resistance of urine pathogens to most commonly used antimicrobial drugs. Most of the isolates showed intermediate to low level of resistance to one or more antimicrobials tested. This indicates that regular monitoring is required to establish reliable information about resistance pattern of urinary pathogens for optimal empirical therapy of diabetic patients with UTI.

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