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Original Research Article

# Microbiological Study of Urinary Tract Infection with Special Reference to Diabetes at Tertiary Care Hospital

**B.M.ShankerVenkatesh[1],N.Vivekanand[2], N.Bharadwaj[3]**
[1]Associate Professor, of Microbiology,RIMS Adilabad, T.S,Pin Code-504001, India
[2]Associate Professor, of Pathology,RIMS Adilabad, T.S, Pin Code-504001, India
[3]Senior Resident Pediatrics, NilouferHospitals,Hyderabad, India

***Corresponding author**
B.M.Shanker Venkatesh
Email: shanker.bunde@gmail.com

**Abstract:** Urinary tract infections (UTI) are among the most common bacterial infections occurring both in males and females encountered in clinical practice and account for significant morbidity and high medical cost.UTI are more common, more severe, and carry worst outcome in patients in Diabetes Mellitus. For this reason, we have evaluated the spectrum of uro pathogens and the profile of antibiotic resistance in both diabetics and non-diabetic patients with UTI with aim to study and assess the pervalance of UTI among diabetics and non-diabetics attending the Medicine Department of Rajiv Gandhi Institute of Medical Sciences (RIMS) and also to identify the most frequent bacteria responsible for UTI.A total of 475 cases attending IP & OP Department of Medicine at RIMS, Adilabad, over a period of one year ranging from February 2015 –January 2016 were screened for this study. Among these 150 diabetic patients (males:65 and females:85), and 135 non-diabetic patients (males:55 and females:80) who were culture positive for uro pathogens were studied.About 28% of the patients, both diabetic and non-diabetic presented with asymptomatic bacteriuria and presence of pyelonephritis was higher among diabetics compared to non-diabetics. The isolation rate of Escherichia coli (E.coli) from urine cultures among diabetic patients was higher (63%) followed by Klebsiella (15%) and Enterococcus (11%) while in non-diabetic patients, isolation of E.coli was 57% followed by Enterococcus (17%) and Klebsiella (17%). Elevated glucose levels in diabetics pre-disposed to UTI with E.coli being the most common uropathogens. Therefore, for prevention of complications, investigation for uropathogens in diabetics with UTI is very important.
**Keywords:**Urinary tract infections, Diabetes Mellitus, asymptomatic bacteriuria, Uropathogens, Escherichia coli.

## INTRODUCTION:

UTI are among the most common bacterial infections after upper respiratory tract infections 3 that lead the patients to seek medical care. It has been estimated that 6 million OP visits and 3 lakh hospital stay every year are due to UTI. Approximately 10% of humans will have a UTI at some time during their lives [1,2].

The exact prevalence of UTI is age and sex dependent. The incidence is low among males, and among females it increases with age (5-10 years, it is 1-2%; 10-15 years, it is 10%; 15-40 years, it is 50%; 40 years and above, it is 30-38%).

Diabetes Mellitus is considered to be a pre-disposing factor for urinary tract infection and a risk factor for multi-drug resistant Uropathogens. High urine glucose content, impaired insulin formation and defective host immune factors associated with Diabetes pre-disposed to the infection. Over time, patients with Diabetes may develop cystopathy, nephropathy and peripheral papillary necrosis complications that pre-dispose them to UTI. In addition, as many as 30% of women with Diabetes Mellitus, have some degree of Cystocoele, Cystourethrocoele or Rectocoele, all of which contribute to frequency and severity of UTI among female diabetics.

E.coli is the most common prevalent causative organism of UTI followed by klebsiella Pneumoniae, Enterococcus, Pseudomona aeruginosa and Candida.A specimen was considered positive for UTI: If a single organism was cultured at a concentration > 10^5 Colony Forming Units (CFU) per ml[3]. Single organism was cultured at a concentration of 10^4 CFU

per ml + 5 leucocytes per high field on microscopy of urine[4].

Bacterial identification was done by standard identification biochemical tests,(Catalase, Oxidase, IMViC tests, H2S production, Lysin decarboxylase, Lactose fermentation, Urea hydrolysis, gas production, hydrolysis of esculin in presence of bile, growth in 6.5% Sodium chloride, hydrolysis of pyraolidonylarylamidase and leucine amino peptidase and reaction with group D anti serum.

Susceptibility testing: Antimicrobial susceptibility testing of the isolates was done by Kirby Bauer disc diffusion method following the National Committee for Clinical Laboratory Standards (NCCLS) guidelines. The following antibiotic discs were put up: Amikacin, gentamycin, ciprofloxacin, nitrofurantoin, nalidixic acid, trimethoprim sulfamethoxazole, cephalexin, ampicillin, carbenicillin, vancomycin and oxacillin.

## MATERIALS AND METHODS

This study was conducted in the department of Microbiology, RIMS Adilabad, a Tertiary Care Hospital, from February 2015 to February 2016. A total of 475 patients with symptoms of UTI attending the IP & OP departments of General medicine at RIMS, Adilabad, were screened and out of which, 285 culture positive cases were consideredforthis study. Out of the 285 patients, there were 150 diabetic patients (males:65 and females: 85), and 135 non-diabetic patients (males: 55 and females: 80).

Known diabetic patients with fasting glucose levels more than 130 mg per dl and post-prandial venous glucose levels more than 200 mg per dl were included under Diabetic category.Socio-demographic variable (age, sex, and other relevant clinical data such as history of catheterization etc) were obtained using a pre-designed questionnaire.

The urine specimen was collected under the following components: Clean catch midstream urine sample: Standardized steps to obtain midstream clean voided urine specimen in OP & IP areas were followed. Straight Catheterisation sample: Mid to late stream urine specimens were collected chronic indwelling catheter: Urine samples before change of indwelling catheter were taken.

Specimen labeling: Patient identification labels were fixed to the specimen container and dated.Urine samples were sent to the laboratory within 15-20 mins of collection of the samples.Isolation and identification of organisms: Macroscopic urine exam, Wet film exam, Centrifuged urine sample deposit for Pus cells, RBCs, epithelial cells, casts and crystals were considered, all urine samples were put up for culture.

## RESULTS

A total of 475 cases were studied, out of which 285 cases were found to be culture positive for Uropathogens. Out of the 285 positive cases, 150 were diabetic (65 males and 85 females) and 135 were non-diabetic (55 males and 80 females)-[Table-1].While analyzing the results, it was found that Escherichia Coli was the predominant pathogen isolated from both sexes and both diabetic and non-diabetic patients. It was found to have occurred significantly more frequently among female diabetics (63%).

Enterococcus species was found almost equally among both males and females, and also diabetics and non-diabetics.Klebsiellapneumoniae was the next most frequently isolated Uropathogen. (22%)Other bacteria that were isolated were Pseudomonas, Proteus, Acinetobacter, Staphylococcus saprophyticus, Staphylococcus aureus and Candida.

The most frequent causative agent of UTI in diabetics and non-diabetics were E.coli (63% vs 57%), Klebsiella (15% vs 17%), Enterococcus (11% vs 17%), Pseudomonas (3% vs 2%), Proteus (2% vs 1%), and Candida was seen only among female diabetics.[ Table-2]. While studying the antibiotic sensitivity pattern, it was found that most of the Uropathogens and especially E.coli was resistant to Ampicillin, and Pseudomonas was resistant to most of the antibiotics like Nitrofurantoin, Nalidixic acid, trimethoprim sulfamethoxazole, cephalexin and ampicillin.[ Table-3].

**Table 1: Distribution of patients with DM and NIDDM**

| Total number of patients screened : 475 | | | |
|---|---|---|---|
| Diabetics 250 | | Non-Diabetics 225 | |
| Male | Female | Male | Female |
| 100 | 150 | 100 | 125 |
| Total number of positive cases : 285 | | | |
| Male | Female | Male | Female |
| 65 | 85 | 55 | 80 |

**Table 2: Organisms isolated from urine culture**

| Organisms | Patients with DM (150) | Patients with Non-DM (135) |
|---|---|---|
| Escherichia Coli | 94 (63%) | 78 (58%) |
| Klebsiella pneumoniae | 22 (15%) | 24 (17%) |
| Pseudomonas aeruginosa | 5 (3%) | 4 (5%) |
| Proteus spp | 2 (1%) | 3 (2%) |
| Acinetobacter | 1 (0.51%) | 1 (1%) |
| Enterococcus species | 16 (11%) | 24 (17%) |
| Staphylococcus aureus | 2 (1%) | 1 (1%) |
| Staphylococcus saprophyticus | 2 (1%) | - |
| Candida | 6 (4%) | - |

**Table 3: Showing organisms resistance in the Antibiotics sensitivity testing**

| Organism | Total no. of isolates | No. of isolate resistant to AMK | No. of isolate resistant to GEN | No. of isolate resistant to CIP | No. of isolate resistant to NIT | No. of isolate resistant to NAL | No. of isolate resistant to SXT | No. of isolate resistant to CEP | No. of isolate resistant to AMP | No. of isolate resistant to CAR | No. of isolate resistant to VAN | No. of isolate resistant to OXA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Escherichia Coli | 172 | 3 (2%) | 5 (3%) | 89 (52%) | 17(10%) | 8(5%) | 82(48%) | 37(22%) | 163(95%) | - | - | - |
| Klebsiella pneumoniae | 46 | 0 (0%) | 8(18%) | 0(0%) | 18 (40%) | 6(12%) | 20(45%) | 13(30%) | 41(90%) | - | - | - |
| Pseudomonas aeruginosa | 9 | 1 (12%) | 1(12%) | 1(12%) | 9(100%) | 9(100%) | 9(100%) | 9(100%) | 9(100%) | - | - | - |
| Proteus spp | 5 | 0(0%) | 0(0%) | 0(0%) | 2(48%) | 0(0%) | 2(48%) | 9(100%) | 5(100%) | - | - | - |
| Acinetobacter | 2 | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 1(50%) | 0(0%) | 2(100%) | - | - | - |
| Enterococcus species | 40 | 14 (35%) | 14 (35%) | 0(0%) | 5(12%) | - | 36(90%) | 20(50%) | 40(100%) | 2(4%) | 0(0%) | 34(86%) |
| Staphylococcus aureus | 3 | 0(0%) | 0(0%) | 0(0%) | 0(0%) | - | 2(66%) | 1(32%) | 3(100%) | 0(0%) | 0(0%) | 2(16%) |
| Staphylococcus saprophyticus | 2 | 0(0%) | 0(0%) | 0(0%) | 0(0%) | - | 2(100%) | 0(0%) | 1(50%) | 0(0%) | 0(0%) | 2(100%) |
| Candida | 6 | - | - | - | - | - | - | - | - | - | - | - |

AMK- Amikacin, GEN- Gentamicin, CIP- Ciprofloxacin, NIT- Nitrofurantoin, NAL- Nalidixic acid, SXT- Trimethoprim-sulfamethoxazole, CEP- Cephalexin, AMP- Ampicillin,
CAR- Carbenicillin, VAN- Vancomycin, OXA- Oxacillin

**DISCUSSION:**

Infection of urinary tract is one of the most common infectious diseases affecting all age groups including men, women and children worldwide [5]. According to previous studies, female patients had a higher pre-disposition to UTI than males [6] Which was also found to be similar in our study.

Patients with diabetes mellitus (DM) are more susceptible to urinary tract infection (UTI) than non-diabetics. Due to the emergence of multidrug resistant (MDR) uropathogenic strains, the choice of antimicrobial agent is restricted [7].

In our study E.coli is the most predominant etiological agent followed by Klebsiella, Enterococcus, Proteus, Pseudomonas, Staphylococcus aureus and Staphylococcus saprophyticus. In a similar study conducted by Mirzaei *et al.;*it was found that Gram negative bacteria and family of Enterobacteriaceae are responsible for most of UTI [8]. New car *et al.;*reported that among the Gram negative bacteria, the predominant isolate was E.coli followed by Klebsiella [9]. Escherichia coli was isolated in 9/50 (18%) hospital acquired infections and 4/8 (50%) community acquired infections in diabetics versus 26/106 (25%) and 8/18 (47%) in non-diabetics. Pseudomonas species were isolated in 16/50 (32%) and 1/8 (13%) in diabetics and 22/106 (21%) and 0/18 in non-diabetics [10].

Akbar DH *et al.;*in their study reported that E.Coli has the highest frequency followed by Klebsiella among diabetics. In our study, women in the age group of 20-29 years were most sufferers probably because they are sexually active. Among the elderly males, after 40 years of age, more incidences are seen probably owing to aging prostatic gland enlargement and decrease of bacteriostatic prostatic secretions. Similar results were observed in a study conducted by Noor *et al.;* [11]. Our studies are similar to several previous studies indicating that E.Coli is still the most common cause of UTI.

While studying the antibiotic sensitivity pattern, it was found that most of the Uropathogens and especially E.Coli was resistant to Ampicillin, and Pseudomonas was resistant to most of the antibiotics like Nitrofurantoin, Nalidixic acid, trimethoprim sulfamethoxazole, cephalexin and ampicillin [12, 13]. There is an increase in resistance of Uropathogens to most antibiotics because of excessive and inappropriate usage, reducing the number of prescriptions of a particular antibiotic can lead to decrease in resistance rate.

**SUMMARY AND CONCLUSION:**

In our evaluation, we found that there was not much difference in features like epidemiological, clinical and micro biological features between diabetic and non-diabetic patients except the treatment in diabetics is more difficult that in non-diabetics. E.Coli is the most predominant etiological agent followed by Klebsiella, Enterococcus, Proteus, Pseudomonas, Staphylococcus aureus and Staphylococcus saprophyticus. In conclusion, in this study, Ciparofloxacin, Nitrofurantoin and Nalidixic acid were finding to be the most appropriate oral antibiotics, and Amikacin and Gentamycin along with third generation Cephalosporins to be the most appropriate parental antibiotics for the empirical therapy of UTI.

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