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### RESEARCH PAPER

# Bacteriological profile of urinary tract infections in type-2 diabetes mellitus patients in a tertiary care hospital

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### ABSTRACT

**Background and aims:** People with Diabetes mellitus, a highly prevalent endocrine disorder, are prone to various infections, including urinary tract infections. *E. Coli* causes the vast majority of urinary tract infections. This paper aims to evaluate the bacteriological profile of urinary tract infections among patients with type 2 diabetes mellitus in a tertiary care hospital. **Materials and methods:** The institution-based observational study was conducted on 95 patients attending the outpatients and inpatient departments of Medicine and Endocrinology at Gauhati Medical College and Hospital (GMCH). All patients had undergone urine routine and microscopy, urine culture and sensitivity with colony counts, FBS, PPBS, Glycosylated Hemoglobin, Renal function test, Ultrasound abdomen and X-ray KUB & CT Scan of the abdomen, if necessary. **Results:** The study showed that in the urine culture, 70.5% of the patients had *E. Coli*, 10.5% had *Klebsiella*, 5.3% had *Proteus*, 4.2% had *Enterococci*, 3.1% had *Candida* and 1.1% each had *Pseudomonas* and *Staphylococcus aureus*. At the same time, the urine culture of 4.2% of patients had shown no growth. Antibiotic sensitivity based on urine culture evaluation showed that most *E.coli* were sensitive to Meropenem, followed by Piperacillin-Tazobactam and Nitrofurantoin. *Klebsiella* was sensitive to Meropenem, Ampicillin and Piperacillin-Tazobactam. *Proteus* were sensitive to Piperacillin-Tazobactam and Meropenem. **Conclusion:** *E. coli* was the most typical organism isolated from urine cultures of patients with Type 2 Diabetes mellitus, followed by *Klebsiella*. Most strains were sensitive to Nitrofurantoin, Ampicillin, Piperacillin-Tazobactam and Meropenem.

**Keywords:** *E. Coli*; *Klebsiella*; urine culture; nitrofurantoin.

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### INTRODUCTION

Diabetes mellitus is a common endocrine disorder. Changing lifestyle and urbanization has amplified the incidence of this disease. According to WHO's Global Report on Diabetes 2014, the prevalence of Diabetes in Southeast Asia is around 8.6%.<sup>1</sup> In India, Diabetes is a chief health hazard. India, with the largest number of diabetic subjects in the world, had earned the dubious distinction of being termed the "Diabetic capital of the world".<sup>2</sup>

Infections are also of particular concern for diabetic patients. People with diabetes are especially prone to various infections.<sup>3</sup> Urinary tract infections are more frequent and severe in patients with Diabetes Mellitus. Age, metabolic control, and long-term complications, particularly diabetic kidney disease and cystopathy, are general host factors that increase the risk for urinary tract infections in people with diabetes.<sup>4</sup> *E. coli* is the most frequent cause of urinary tract infection accounting for 85% of community-acquired and 50% of hospital-acquired infections. Other gram-negative

enterobacteria include Proteus and Klebsiella and gram-positive Staphylococcus, saprophyticus and Enterococcus faecalis.<sup>5</sup>

Awareness of the disease and knowledge of the spectrum of bacteria and their sensitivity to antibiotics will help reduce morbidity and mortality associated with urinary tract infections. Though many studies have been reported from India and abroad, there is a shortage of these studies in this part of the region. So this study has been taken up to evaluate the bacteriological profile of urinary tract infections in type 2 diabetes mellitus patients in a tertiary care hospital.

**MATERIAL AND METHODS**

This institution-based observational study was carried out from Jul 1 2019, to Jun 30 2020, including all the type 2 diabetes mellitus patients with symptoms of urinary tract infections attending the outpatients and inpatients departments of Medicine and Endocrinology at Gauhati medical college and hospital (GMCH), Assam.

**Inclusion Criteria:** Patients aged over 12 years with Type 2 Diabetes Mellitus and coming with features of urinary tract infection were included in the study.

**Exclusion Criteria:** Patients having a history of receiving antibiotics within two weeks before culture and patients on continuous indwelling catheters were excluded from the study. Menstruating women, gestational diabetes patients, Type 1 diabetes mellitus patients, those with immunocompromised states like HIV, patients on steroids, malignancy and transplant recipients were also not included. Specific types of diabetes are brought on by other factors like monogenic diabetes syndromes (such as maturity-onset diabetes of the young [MODY]), exocrine pancreas diseases (such as cystic fibrosis and pancreatitis), drug- or chemical-induced diabetes (such as with the use of glucocorticoids in the treatment of HIV/AIDS or after organ transplantation), latent autoimmune diabetes in adults (LADA), etc. are also excluded. Moreover, patients with ages below 12 years and those not willing to give consent were also omitted from the study.

All patients who fulfilled the inclusion criteria of the study underwent a physical examination and had undergone urine routine microscopy, urine culture and sensitivity with colony counts, fasting blood sugar, post-prandial blood sugar, Glycosylated Hemoglobin, Renal function test, Ultrasound abdomen and X-ray KUB & CT Scan Abdomen, if necessary.

**RESULTS**

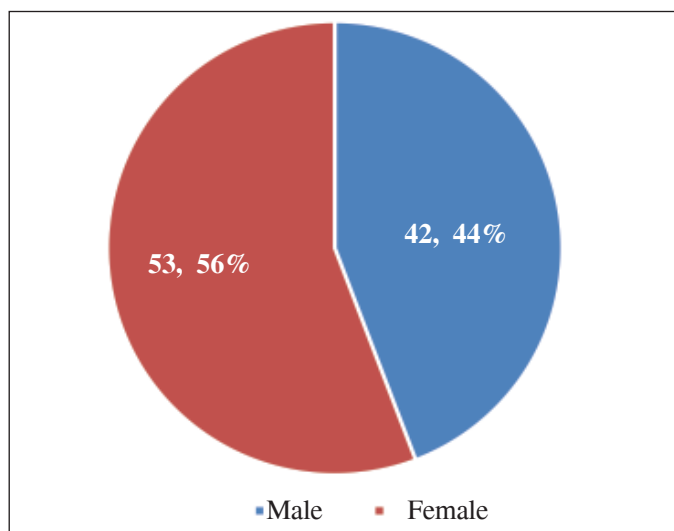
A total of 95 patients with Type 2 Diabetes Mellitus having features of urinary tract infection presenting to Gauhati Medical College and Hospital (GMCH) during the study period and fulfilling the inclusion criteria were included in the study.

In this study, the maximum number of Type 2 Diabetes patients with urinary tract infections was 55-64 years (37.89%). The mean age of presentation was 56.3 years, as shown in **Table 1**.

**Table 1** Age distribution

Age (in Years)	No. of Patients(n=95)	Percentage (%)
25-34	1	1.05
35-44	13	13.68
45-54	24	25.26
55-64	36	37.89
65-74	19	20.00
75-84	2	2.10

The majority, 56% of the patients, were male, with a male-to-female ratio of 1:0.79 (**Figure 1**).



**Figure 1** Sex distribution

As seen in **Table 2**, out of the 95 patients, 4 had no growth of organisms in urine culture. E-coli was the most common organism isolated in urine culture observed in 70.5% of the cases, followed by Klebsiella (10.5%). Proteus (5.3%) and Enterococci (4.2%).

**Table 2** Organisms isolated in urine culture

Organisms in urine culture	No.of Patients (N=95)	Percentage (%)
E. Coli	67	70.5
Klebsiella	10	10.5
Proteus	5	5.3
Enterococci	4	4.2
Candida	3	3.1
Pseudomonas	1	1.1
Staphylococcus aureus	1	1.1
No growth	4	4.2

Antibiotic sensitivity was assessed by evaluation of urine culture. The majority of E.coli infected patients were sensitive to Meropenem (90.7%), Piperacillin-Tazobactam (89.7%) and Nitrofurantoin (73.7%). E-coli was also found sensitive to Ampicillin (52.4%), Co-trimoxazole (41.1%) and Fluroquinilones (40.7%). Klebsiella was primarily sensitive to Meropenem (91.5%), Ampicillin (89.7%) and Piperacillin-Tazobactam (88.7%). Proteus was sensitive to Piperacillin-Tazobactam (93.1%), Meropenem (88.7%), Nitrofurantoin (62.7%) whereas, Enterococcus was primarily sensitive to Gentamicin (60.7%) and Amikacin (57.9%). Pseudomonas showed 100% sensitivity to Piperacillin-Tazobactam and Meropenem. Staphylococcus aureus was sensitive to Amoxyclav (100%), Fluoroquinolone (100%), Nitrofurantoin (100%) and Gentamicin (100%), as shown in **Table 3**.

**Table 3** Antibiotic sensitivity of various organisms isolated in urine culture

Antibiotics	Organisms (n=88)*					
	E Coli(67, 70.5%)	Klebsiella(7, 10.5%)	Proteus (5, 5.3%)	Enterococcus (4, 4.2%)	Pseudomonas (1, 1.1%)	Staphylococcus aureus (1, 1.1%)
Nitrofurantoin %	73.7	57.3	67.2			100
Ampicillin %	52.4	89.7	51.6	23.7		
Cefuroxime %	20.7		19.4			
Ceftriaxone %	12.7	13.5	11.2	12.5		
Amoxy Clav %	30.4	15.4	22.6			100
Fluroquinilones %	40.7		29.4	20.4		100
Gentamicin %	6.1	17.8	5.1	60.7		100
Cotrimoxazole %	41.1	16.7	39.4	32.8		
Amikacin %	10.1	19.4		57.9		
Meropenem %	90.7	91.5	88.7		100	
Piperacillin + tazobactam %	89.7	88.7	93.1		100	

\*Candida isolate not included.

## DISCUSSION

In this study, the mean age of the patients was 56.3 years ranging from 25 to 84 years. The male: female ratio of patients was 1:0.79.

Out of the 95 patients, 67(70.5%) showed the presence of E.Coli in urine culture. Klebsiella (10.5%), Proteus (5.3%), Enterococci (4.2%), Candida (3.1%), Pseudomonas (1.1%) and staphylococcus aureus (1.1%) were the other organisms found in the present study. Four (4.2%) patients had no growth. This finding is similar to another study which reported E.coli as the most common cause of UTI, accounting

for 85% of community-acquired and 50% of hospital-acquired infections.<sup>6</sup> Other gram-negative Enterobacteriaceae include Proteus and Klebsiella & gram-positive Staph. saprophyticus and Enterococcus faecalis. These findings are also concordant with the study done by Goswami et al.,<sup>7</sup> at AIIMS in 2001 on the prevalence of UTI and renal scars in Diabetics and healthy controls, which also concluded that E.coli was the most common isolate (64.3%) followed by Staph. aureus (21.4%) & Klebsiella (14.3%). Increased incidence of E-coli (54.1%) in diabetic patients with bacteriuria was also reported in another study.<sup>8</sup> Various authors have reported E Coli as the most common organism similar to our findings.<sup>9-14</sup>

Klebsiella was the second most common organism isolated (35.71%) in our study. The findings match with observations by Zhanel et al.,<sup>10</sup> Vigg et al.,<sup>12</sup> and Shah BV et al.<sup>15</sup> However, O'Sullivan et al.,<sup>11</sup> and Huvos et al.,<sup>14</sup> reported Proteus as the second most common organism in their studies.

Diabetes patients are prone to urinary tract infections caused by fungi, particularly by Candida species. In this study, Candida was found in 3.1% of diabetic patients. This finding is consistent with the study done by Fisher JF et al.,<sup>16</sup> where Candida was isolated among 5% of patients. Another study by Yismaw G et al.,<sup>17</sup> revealed that Candida was present in 7.5% of symptomatic urinary tract infections in diabetes.

Antibiotic sensitivity based on evaluation of urine culture showed that the majority of E.coli infected patients were sensitive to Meropenem (90.7%), Piperacillin-Tazobactam (89.7%), Nitrofurantoin (73.7%), Ampicillin (52.4%), followed by Co-trimoxazole (41.1%) and Fluroquinilones (40.7%). Klebsiella is found to be sensitive to meropenem (91.5%), Ampicillin (89.7%), and Piperacillin-Tazobactam (88.7%). Proteus is primarily sensitive to Piperacillin-Tazobactam (93.1%), Meropenem (88.7%), and Nitrofurantoin (62.7%) while, Enterococcus was to Gentamicin (60.7%) and Amikacin (57.9%). Pseudomonas was 100% sensitive to Piperacillin-Tazobactam, Meropenem and Staph. aureus was sensitive to Amoxyclav (100%), fluoroquinolone (100%), Nitrofurantoin (100%) and Gentamicin (100%).

Studies done by Bonadio et al.,<sup>8</sup> Shah BV et al.,<sup>9</sup> and Zhanel et al.,<sup>10</sup> states that E.coli were susceptible to Nitrofurantoin, Ampicillin, Fluroquinolone, Meropenem, Piperacillin-Tazobactam. This was in contrast to the study by Sobel JD et al.,<sup>18</sup> where E.coli were found resistant to fluoroquinolones. A study by Sharma S et al.,<sup>19</sup> reported that E. coli was the most common organism, followed by Klebsiella. Further, most of these organisms were susceptible to Nitrofurantoin and Imipenem, indicating that they could

be the preferred antimicrobial agents in treating urinary tract infections.

## CONCLUSION

The present study found that *E.coli* was the most common organism isolated from a urine culture, followed by *Klebsiella* among Type 2 Diabetes mellitus patients with urinary tract infections. Nitrofurantoin, Ampicillin, and Piperacillin-Tazobactam and Meropenem were good antimicrobial agents for treating urinary tract infections since most strains were sensitive to these substances.

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## REFERENCES

- World Health Organization. Global status report on noncommunicable diseases. World Health Organization 2014;15.1;39.
- Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9<sup>th</sup> edition. *Diabetes Res Clin Pract* 2019 Nov; 157:107843.
- Chin-Hong PV. Infections in patients with diabetes mellitus: the importance of early recognition, treatment, and prevention. *Adv Stud Med* 2006;6(2):71–81.
- Fünfstück R, Nicolle LE, Hanefeld M, Naber KG. Urinary tract infection in patients with diabetes mellitus. *Clin Nephrol* 2012 Jan;77(1):40-8.
- Lee DS, Lee SJ, Choe HS. Community-Acquired Urinary Tract Infection by *Escherichia coli* in the Era of Antibiotic Resistance. *Biomed Res Int* 2018 Sep 26;2018:7656752.
- Hall LM, Duke B, Urwin G, Guiney M. Epidemiology of *Enterococcus faecalis* urinary tract infection in a teaching hospital in London, United Kingdom. *J Clin Microbiol* 1992 Aug; 30(8):1953-7.
- 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. *Diabetes Res Clin Pract* 2001 Sep;53(3):181-6.
- Bonadio M, Meini M, Gigli C, Longo B, Vigna A. Urinary tract infection in diabetic patients. *Urol Int* 1999; 63(4):215-9.
- Shah BV, Jadhav KP, Acharya VN. Study of urinary tract infection in diabetic subjects. *J Assoc Physicians India* 1984 Dec;32(12):1037-40.
- Zhanell GG, Nicolle LE, Harding GK. Prevalence of asymptomatic bacteriuria and associated host factors in women with diabetes mellitus. The Manitoba diabetic urinary infection study group. *Clin Infect Dis* 1995 Aug; 21(2):316-22.
- O'sullivan DJ, Fitzgerald MG, Meynell MJ, Malins JM. Urinary tract infection. A comparative study in the diabetic and general populations. *Br Med J* 1961 Mar 18; 1(5228):786-8.
- Vigg B, Rai V. Asymptomatic bacteriuria in diabetes. *J Assoc Physicians India* 2007;51:374 -76.
- Geerlings SE, Hoepelman AI. Immune dysfunction in patients with diabetes mellitus (DM). *FEMS Immunol Med Microbiol* 1999 Dec;26(3-4):259-65.
- Huvos A, Rocha H. Frequency of bacteriuria in patients with diabetes mellitus: a controlled study. *N Engl J Med* 1959 Dec 10;261:1213-6.
- Shah BV, Jadhav KP, Acharya VN. Study of urinary tract infection in diabetic subjects. *J Assoc Physicians India* 1984 Dec;32(12):1037-40.
- Fisher JF, Newman CL, Sobel JD. Yeast in the urine: solutions for a budding problem. *Clin Infect Dis* 1995 Jan; 20(1):183-9.
- Yismaw G, Asrat D, Woldeamanuel Y, Unakal C. Prevalence of candiduria in diabetic patients attending Gondar University Hospital, Gondar, Ethiopia. *Iran J Kidney Dis* 2013 Mar;7(2):102-7.
- Sobel, J.D. Candiduria. *Drug Treatment in Urology* 2009; 9:149.
- Sharma S, Govind B, Naidu SK, Kinjarapu S, Rasool M. Clinical and laboratory profile of urinary tract infections in Type 2 diabetics aged over 60 years. *J Clin Diagn Res* 2017 Apr;11(4):OC25-OC28.