

# STUDY OF ASYMPTOMATIC AND SYMPTOMATIC URINARY TRACT INFECTIONS IN PATIENTS WITH DIABETES MELLITUS

**Dr. Manasi Harale<sup>1</sup>, Dr. Simranbir Bhullar<sup>2</sup>, Dr. Arun Biju Oomen<sup>3</sup>**

1. Associate Professor, Dept. Of General Medicine, Dr. D.Y. Patil Medical College, Pune, Maharashtra, India

2. 3<sup>rd</sup> Year Post Graduate, Dept. Of General Medicine, Dr. D.Y. Patil Medical College, Pune, Maharashtra, India

3. 2<sup>nd</sup> Year Post Graduate, Dept. Of General Medicine, Dr. D.Y. Patil Medical College, Pune, Maharashtra, India

## **Corresponding author:**

Dr. Simranbir Bhullar, 3<sup>rd</sup> Year Post Graduate, Dept. Of General Medicine, Dr. D.Y. Patil Medical College, Pune, Maharashtra, India

Email: simranbirbhullar@hotmail.com

## **Abstract**

**Aim:** To study symptomatic and asymptomatic urinary tract infections in patients with diabetes mellitus.

**Materials and Methods:** The current prospective observational research was carried out on one hundred patients with confirmed diagnoses of diabetes mellitus admitted to the Medicine Dr DY Patil Medical College Hospital and Research Centre in Pimpri, Pune, from October 2020 and September 2023. After receiving approval from the institutional ethics committee, the research was carried out. Every patient had a thorough physical examination and complete history taking in accordance with the proforma. All of the collected information was input into a spreadsheet (Microsoft Excel 2010) and then transferred to the data editor in SPSS 20. (SPSS Inc., Chicago, Illinois, USA).

**Results:** The prevalence of symptomatic UTI in the study population was 34% and asymptomatic UTI was found prevalent in 66% of the study subjects. The average age of the subjects with symptomatic UTI was 46.32 years and asymptomatic UTI was 52.16 years. Majority of the subjects in both the groups showed HbA1c levels  $\geq 7$  (69%) and rest (31%) showed levels below 7. Bacterial culture report showed that E. Coli was found more prevalent in both groups (52%) followed by K. Pneumoniae (14%), Pseudomonas (3%), Coagulase Negative Staphylococcus (2%), Enterococcus Spp. (2%) and P. Rettgeri (1%).

**Conclusion:** The study indicated that the presence of prior urinary tract infections and inadequate Glycemic control were significant contributors to the high prevalence of urinary tract infections among the study population.

**Keywords:** UTI, symptomatic, asymptomatic, bacterial culture, HbA1c

## Introduction

Having diabetes makes a person more susceptible to infections in any organ system, including the urinary tract because of its detrimental effects on humoral immunity and neutrophilic function and because it impairs the antioxidant system.<sup>1,2</sup> Diabetics frequently experience reinfection after successful therapy.<sup>3,4</sup>

Urinary tract infections may either be asymptomatic or symptomatic depending on the severity of their symptoms. The presence of substantial bacteriuria in the absence of the symptoms of an acute urinary tract infection is the definition of the condition known as asymptomatic bacteriuria. Infections of the urinary tract that cause symptoms may be broken down into two categories: infections of the lower tract (acute cystitis) and infections of the upper tract (acute pyelonephritis). Considerable bacteriuria with accompanied bladder mucosal invasion is the definition of cystitis. Pyelonephritis, on the other hand, is described as significant bacteriuria with associated inflammation of the renal parenchyma, calices, and pelvis. Cystitis is more common than pyelonephritis.<sup>5</sup>

Patients who have diabetes mellitus may need insulin treatment for the rest of their lives or supplementary therapy with this hormone in order to keep their blood glucose levels under control. Not only does adequate metabolic management reduce the likelihood that a diabetic patient would have disease-related problems, but it also reduces the likelihood that such a patient will get infected.<sup>6</sup>

In addition to proper therapy, the World Health Organization (WHO) advises keeping an eye out for any negative consequences that may arise as a result of this condition.<sup>7</sup> The screening for diseases that might later develop into renal disease is one of the therapies that has been recommended.<sup>8</sup> In light of this guideline and the projected estimate of an increase in diabetes mellitus, particularly in nations with a low socioeconomic status, and taking into consideration the dearth of data regarding the findings of asymptomatic and symptomatic bacteriuria amongst the diabetic population in India, it is strongly recommended that this study be carried out.

## Materials and Methods

The current prospective observational research was carried out on one hundred patients with confirmed diagnoses of diabetes mellitus admitted to the Medicine Dr DY Patil Medical College Hospital and Research Centre in Pimpri, Pune, from October 2020 and September 2023.

### Inclusion criteria

1. Patients with diabetes mellitus (diagnosed as per WHO diagnostic criteria 2006)<sup>9</sup>
2. Patients of both the gender involved in the study

### Exclusion criteria

1. Patients with structural urinary tract abnormalities
2. Use of anti-microbial agents in last 14 days

### Operational Definition

- Asymptomatic urinary tract infection:

Abnormally high number of pus cells in urine microscopy or bacterial counts in a urine culture (105cfu/mL) in the absence of other symptoms suggestive of a urinary tract infection

- Symptomatic urinary tract infection:

UTI symptoms include dysuria, desire to urinate, urination frequency, suprapubic discomfort, flank pain, fever, and chills, and the detection of abnormally high number of pus cells in urine microscopy or bacterial counts in a urine culture of 105cfu/mL and above.

### **Methodology**

After receiving approval from the institutional ethics committee, the research was carried out. Every patient had a thorough physical examination and complete history taking in accordance with the proforma.

### **Investigations**

Blood sample for total WBC count, differential count, ESR, haemoglobin %, Blood sugar level (Fasting and Postprandial), and HBA1 were analyzed in detail for each patient (if required, to diagnose emphysematous pyelonephritis). USG of the stomach and pelvic (to rule out any structural abnormalities of kidneys and urinary tract like cyst, abscess, diverticula, calculus).

### **Specimen Collection**

Participating DM patients were instructed to wash their genitalia with soap and water before providing a midstream urine sample (10-20 mL) in a sterile dry container.

### **Culturing and Identification Procedure**

We used a calibrated loop to inoculate MacConkey agar (HKM, China) and Blood agar (Biomark, India) with urine samples from diabetic individuals (0.001mL).<sup>10</sup> The cultures were kept in an aerobic incubator for 24 hours at 37 degrees Celsius. Cultures of midstream urine with a colony count of more than 105 CFU/mL were considered positive.<sup>11</sup> The number of colonies was tallied using a Stuart scientific colony counter. Colony morphology and Gram staining were used to positively identify all cultures. Biochemical tests including catalase and mannitol salt agar and the poly pyrrole reduction (PYR) test were used to further identify Gram-positive bacteria, whereas tests for Gram-negative bacteria included gas generation, hydrolysis of urea, motility, and carbohydrate metabolism.<sup>12</sup>

### **Statistical Analysis**

All of the collected information was input into a spreadsheet (Microsoft Excel 2010) and then transferred to the data editor in SPSS 20. (SPSS Inc., Chicago, Illinois, USA).

Percentages, averages, and standard deviations were all computed as part of the descriptive statistics. The study made use of an independent samples t-test for statistical significance. Specifically, the CI and p-value were established at 95% and 5%, respectively.

### **Results**

Table 1: Prevalence of symptomatic and asymptomatic UTI in study population

UTI type according to symptoms	Frequency	Percent
Symptomatic	34	34.0

Asymptomatic	66	66.0
Total	100	100.0

Table 1: table depicts that the prevalence of symptomatic UTI in the study population was 34% and asymptomatic UTI was found prevalent in 66% of the study subjects.

Table 2: Distribution of UTI type according to gender & age of the study population

Variables	UTI type		Total
	Symptomatic N %	Asymptomatic N %	
Gender			
Female	24	41	65
	70.6%	62.1%	65.0%
Male	10	25	35
	29.4%	37.9%	35.0%
p-value	0.400 (NS)		
Age (In years)			
19-28	6	1	7
	17.6%	1.5%	7.0%
29-38	4	5	9
	11.8%	7.6%	9.0%
39-48	3	15	18
	8.8%	22.7%	18.0%
49-58	19	34	53
	55.9%	51.5%	53.0%
59-68	1	6	7
	2.9%	9.1%	7.0%
69-78	1	5	6
	2.9%	7.6%	6.0%
p-value	0.021 (Sig.)		

Test applied: chi-square test

Table 2: Majority of the subjects in both the groups were females (65%) and rest were males (35%) (p=0.400). The average age of the subjects with symptomatic UTI was 46.32 years and

asymptomatic UTI was 52.16 years. Majority of the study population was found present in the age group of 49-58 years ( $p=0.021$ ).

Table 3: Distribution of UTI type according to HbA1c levels of the study population

		UTI type		Total
		Symptomatic	Asymptomatic	
HbA1c	<7	9	22	31
		26.5%	33.3%	31.0%
	≥7	25	44	69
		73.5%	66.7%	69.0%
Total		34	66	100
		100.0%	100.0%	100.0%
p-value		0.482 (NS)		

Test applied: chi-square test

Table 3: depicts the distribution of the study population in both the groups according to HbA1c levels. Majority of the subjects in both the groups showed HbA1c levels  $\geq 7$  (69%) and rest (31%) showed levels below 7 ( $p=0.482$ ).

Table 4: Distribution of the frequency of the symptoms in the study population

Symptoms	Frequency	Percent
Flank Pain	20	20.0
Frequent Urination	22	22.0
Urgent Urination	19	19.0
Fever	14	14.0
Supra Pubic Pain	7	7.0
Dysuria	15	15.0
Vomiting	3	3.0
Nausea	3	3.0

Table 4: depicts the distribution of the frequency of different symptoms in symptomatic UTI. Majority of the subjects presented with frequent urination (22%) followed by flank pain (20%), urgent urination (19%), dysuria (15%), fever (14%), supra pubic pain (7%) and 3% each with vomiting and nausea.

Table 5: Distribution of UTI type according to urine analysis of the study population

Urine analysis	UTI type		Total
	Symptomatic	Asymptomatic	
Pus cells	16	60	76
	47.1%	90.9%	76.0%
p-value	0.001 (Sig.)		
Epithelial cells	14	19	33
	41.2%	28.8%	33.0%
p-value	0.212 (NS)		
RBC's	15	23	38
	44.1%	34.8%	38.0%
p-value	0.366 (NS)		

Test applied: chi-square test

Table 5: depicts the urine analysis report of the subjects in both the groups. Pus cells were found more prevalent in both groups (76%) followed by RBCs in urine (38%) and epithelial cells (33%). On application of chi-square analysis, the distribution between the groups was found for pus-cells showed statistically significant ( $p=0.001$ ) and statistically non-significant distribution was observed for epithelial cells and RBC's ( $p=0.212$ ;  $0.366$ ).

Table 6: Distribution of the frequency of gram positive and gram-negative bacteria according to type of UTI

		UTI type		Total
		Symptomatic	Asymptomatic	
Microbes	Coagulase Negative Staphylococcus	1	1	2
		2.9%	1.5%	2.0%
	E. Coli	18	34	52
		52.9%	51.5%	52.0%
	Enterococcus Spp.	0	2	2
		.0%	3.0%	2.0%
	K. Pneumoniae	5	9	14
		14.7%	13.6%	14.0%
	No growth	7	19	26
		20.6%	28.8%	26.0%
	P. Rettgeri	0	1	1
		.0%	1.5%	1.0%

	Pseudomonas	3	0	3
		8.8%	.0%	3.0%
	Total	34	66	100
		100.0%	100.0%	100.0%
	p-value	0.0218 (NS)		

Test applied: chi-square test

Table 6: depicts the bacterial culture report of the subjects in both the groups. E. Coli was found more prevalent in both groups (52%) followed by K. Pneumoniae (14%), Pseudomonas (3%), Coagulase Negative Staphylococcus (2%), Enterococcus Spp. (2%) and P. Rettgeri (1%). On application of chi-square analysis, the distribution between the groups was found statistically non-significant ( $p=0.001$ ).

### Discussion

Patients with diabetes mellitus are at increased risk for urinary tract infections (UTIs),<sup>13,14</sup> with up to 35% of diabetic patients developing a UTI at some point. Diabetic people are more likely to get a urinary tract infection (UTI) due to a variety of risk factors. They are more vulnerable to infection because their host immune systems are compromised. This includes reduced neutrophil activity, a weakened T-cell driven immunological response, lowered synthesis of prostaglandin E, thromboxane B2, and leukotriene B4, and weakened antioxidant defenses. Insufficient bladder emptying brought on by the autonomic nervous system's malfunction can result in urine incontinence, which in turn encourages uropathogens to colonize and invade the urogenital niches.<sup>15,16</sup> Urinary tract infections (UTIs) are often seen in people with diabetes because of the presence of glucose in their urine and their poor ability to regulate their metabolism.<sup>17</sup>

Patients with bacterial UTIs may best be treated by determining the specific organism(s) responsible for their illness and then choosing an antibiotic that is effective against that organism.<sup>18</sup>

In this research, 34% of the population had a symptomatic UTI, whereas 66% had an asymptomatic UTI. Our study's results contradict those of the existing literature since we focused only on diabetic individuals who had a preexisting diagnosis of a urinary tract infection. Observations of ASB were made by Joffe et al.<sup>19</sup>, Kass et al.<sup>20</sup>, and Hansen et al.<sup>21</sup> in respective percentages of 20, 18, and 18.5%.

Patients with symptoms of a UTI were, on average, 46.32 years old, whereas those without symptoms were, on average, 52.16 years old. The majority of the participants in the research were middle-aged, falling in the range of 49 to 58 years old. The results we obtained jive with those of the studies by Hamdan et al. and Boroumand et al.<sup>22,23</sup>

All except 35 of the participants in the current research were male. Several investigations, including one by Turan et al. showing that 77.2% of females were UTI-positive, have validated the importance of female sex as a risk factor for UTI in diabetics.<sup>24</sup> Results identical to those found by Jha et al.<sup>25</sup> (70%) were also reported by Banerjee et al.<sup>26</sup> (59%), but to a lesser extent.

On the other hand, Matteucci et al. found significantly greater proportions of female participants (86.4% and 86%, respectively), leading them to conclude that female gender was a risk factor for UTI.<sup>27</sup> The incidence of UTIs was found to be 12.9% greater in women than in men over the course of a year, according to a research based on administrative data of the population of the United States.<sup>28</sup> Previous research with a group similar to ours also reports a higher incidence of UTI among women.<sup>29</sup> The increased incidence is more likely owing to physiological changes in the body as a result of diabetes than to anatomical characteristics of the female urinary system, such as the narrow urethra and bacterial colonisation in the perianal region.<sup>30</sup>

Sixty-nine percent of the participants had HbA1c values 7, whereas 31% had levels 7. Additionally, RBS levels were shown to be above 200. This showed that glycemic control was subpar in the studied population.

Diabetic patients' glycemic control (HbA1c) is a contentious risk factor for UTI. There are studies supporting and refuting its function as a risk factor. Poor glycemic control was proven by Turan et al. to be a risk factor for ASB in their investigation.<sup>18</sup>

The HbA1c found by Matteucci et al. on an average was 7.9%.<sup>51</sup> According to Bonadio et al., the average HbA1c is 9.6%.<sup>21</sup> Zhanel et al. reported a mean HbA1c of 13.3%, but they, too, found no correlation between HbA1c and ASB.<sup>31</sup> In their respective studies, Similar conclusions have been reached by Nicolle et al. and He et al.<sup>32,33</sup> Differences in research populations and selection methods likely account for the contradictory findings regarding the association between glycemic control and ASB.

A history of urinary tract infections (UTIs) was also shown to increase the likelihood of having severe bacteriuria in this research. Seventy-one percent or more of participants in both groups had a prior history of UTI. Studies conducted elsewhere in the same nation have shown a similar pattern: those with a history of UTIs are more likely to develop bacteriuria of clinical significance.<sup>34,35</sup>

Among those with a symptomatic UTI, the most common ones were urgency (21%), frequency (22%), dysuria (15%), fever (14%), supra pubic discomfort (7%), and vomiting (3%). In line with these results, Yenehun Worku G et al.<sup>36</sup> showed that 90 (40%) of research participants had flank/loin discomfort, 80 (35.56%) reported frequent urination, and 66 (29.3%) experienced urgent urination. 52 (23.2%), 18%, 17%, 16%, and 5% (2.2%) of individuals had fever, dysuria, suprapubic discomfort, nausea, and vomiting, respectively.



The current study's bacterial culture results indicated that E. Coli was determined to be the most common (52%) and then K. Enterococcus spp. (6%), Streptococcus agalactiae (4%), Klebsiella pneumoniae (4%), and Mycoplasma pneumoniae (2%). (2%) and P. 1% Rettgeri. Overall, E. coli was found in 52.0% of participants in this research and in the vast majority of previous investigations (67% in India<sup>37</sup>, 63% in Dessie<sup>38</sup>, 54.6% in Sudan<sup>22</sup>, and 68.9% in Romania<sup>39</sup>). E. coli was shown to be the most common uropathogen. This absolute preponderance of E. Because E. coli is a prevalent flora of the GI tract and intestine, it is not unusual to find it in the urine tracts of people with UTIs. Once there, it employs its well-characterized virulence characteristics to colonize the urinary tract.

Next to S. aureus, K. pneumoniae (14.0%) was the most common bacterial isolate in our investigation. A same distribution pattern was seen in the Ethiopian investigation.<sup>33</sup> Enterococcus spp. and CoNs were each identified at a rate of 2.0% of all bacterial isolates, however this represents a very tiny percentage of the total population of bacteria.

### Conclusion

The prevalence of symptomatic UTI in the study population was 34% and asymptomatic UTI was found prevalent in 66% of the study subjects. The study indicated that the presence of prior urinary tract infections and inadequate Glycemic control were significant contributors to the high prevalence of urinary tract infections among the study population. Frequent urination followed by flank pain, urgent urination, dysuria, and fever were most observed symptoms in symptomatic UTI. Significant bacteriuria was obtained from 74% of participants. E Coli was found more prevalent followed by K. Pneumoniae and Pseudomonas.

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