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Research Article

# Prevalence of Urinary Tract Infections in Diabetics and Non-Diabetics

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## I N F O

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## A B S T R A C T

*Introduction:* Urinary tract infections (UTIs) are the most common bacterial infections. Diabetes mellitus is a predisposing factor for developing UTIs because of the presence of glucose in urine, which provides a good culture medium. The objective of this study was to evaluate the prevalence of UTI in diabetic and non-diabetic individuals. Material and Methods: This research was a hospital-based observational study conducted for six months beginning in January 2023 and ending in June 2023. A total of 870 cases were studied in the Central Laboratory, SIMS, Hapur. Result: There were 870 cases in total; 96% of cases were positive for UTI in diabetics, whereas 72% of cases were negative for UTI in non-diabetics. Conclusion: The study revealed that the diabetes increases the risk of getting UTI in both males and females.

**Keywords:** Urinary Tract Infection (UTI), Diabetes Mellitus, Hyperglycaemia

## Introduction

Urinary tract infection(UTI) is the most common bacterial infection. It is defined as the presence of bacteriuria greater than or equal to $10^5$ colony-forming bacteria per millilitre.[1] Escherichia coli is the most common causative pathogen causing UTIs. Organisms such as Enterobacter spp., Klebsiella spp., and Enterococcus faecalis are some of the other causative agents.

UTIs can be divided clinically into complicated and uncomplicated UTI. Uncomplicated UTIs can be further classified into lower UTIs (cystitis) and upper UTIs (pyelonephritis).[2]

There are several risk factors for the development of UTIs such as female gender, diabetes mellitus, sexual activity, prior UTIs, vaginal infections, blockage anywhere in the urinary tract, and catheter use.

Diabetes mellitus is a metabolic group of disorders characterised by persistent hyperglycaemia due to deficiency and/ or diminished effectiveness of insulin.[3]

Diabetes mellitus can be classified into two types: type 1 diabetes mellitus and type 2 diabetes mellitus. Type 1 diabetes mellitus is due to the cell-mediated destruction of beta cells, which leads to the inability of the pancreas to synthesise insulin. Type 2 diabetes mellitus is the most common form of diabetes mellitus and is characterised by insulin resistance and inadequate insulin secretion to overcome peripheral insulin resistance[3].There are abnormalities in carbohydrate and protein metabolism, which can lead to glycosuria and increased protein catabolism. Glycosuria occurs when the renal threshold is exceeded, i.e., blood sugar levels are more than 180 mg/dl. Proteinuria is the excretion of more than 150 mg/24 hours of protein in adults.[3]

Patients with type 2 diabetes mellitus are at increased risk of infections, with the urinary tract being the most frequent site. Impairments in the immune system, in addition to poor metabolic control and incomplete bladder emptying due to autonomic neuropathy, can also lead to UTIs.[4]

Pathogens that normally reside in the gastrointestinal tract pollute the periurethral area colonise the urethra, then migrate to the bladder and invade the umbrella cells by pili and the expression of adhesins. The inflammatory response of the host is activated, and there is neutrophil infiltration. Sometimes some bacteria escape the immune system through morphological changes. These bacteria multiply and form a biofilm.[1]

In patients with diabetes mellitus, there is an increased risk of getting a UTI because of diabetic neuropathy, which can lead to bladder dysfunction. Dysfunction of voiding and retention of urine leads to decreased bacterial clearance by micturition, thereby facilitating the growth of the bacteria leading to UTI.[1]

UTI can lead to severe complications, including bacteraemia, renal abscess, and renal papillary necrosis. Diabetes can also modify the genitourinary system and cause damage to the kidney, leading to pyelonephritis[5].

In this article, we aim to analyse the prevalence of UTI in diabetics and non-diabetics.

## Materials and Methods

The present hospital-based observational study was conducted in the Central Laboratory, Department of Pathology, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, from January 2023 to June 2023. A total of 870 samples were received during the study period in the Central Laboratory and all of them were included in the study. Informed consent was taken from the patients. The study has been approved by the institutional ethical committee.

### Inclusion Criteria

All urine samples received during the study period were included in the study.

### Exclusion Criteria

- Urine samples that were less than 5 ml in quantity
- Urine samples that werecollected in non-sterile containers
- Urine samples that appeared contaminated

## Procedure

- The midstream urine sample collected in a sterile container was received in the laboratory.
- After receiving the urine sample, a physical examination of the sample was conducted, including volume, colour, appearance, and sediments
- A chemical examination of the sample by Siemens Combistix SG was done. Parameters such as specific gravity, glucose, and albumin were analysed.
- After that, about 10 ml of the sample was centrifuged in a centrifuge tube for 5 minutes at 1500 rpm, and the supernatant was discarded. The tube was tapped at the bottom to resuspend the sediment. A drop of this sediment was placed on a glass slide and covered by a cover slip. The slide was viewed under a light microscope, and pus cells were noted.

## Results

The sample size in the present study was 870. The ages of the participants varied between 5 and 90 years. The maximum number of cases who were diabetic and had UTIs were between the ages of 50 and 59 years. Most of the cases who were non-diabetic and had UTI belonged to the age group of 20–29 years, whereas a majority of the participants who were non-diabetic and negative for UTI belonged to the age group of 50–59 years.

Among the 870 cases, males constituted 322 cases (37.02%), and females comprised 548(62.98%) cases (Table 1). The male-to-female ratio was1:2, which showed a female preponderance in the study.

Out of the total of 181diabetic patients in our study, 174 (96%) were positive for UTI, and 7 (4%) cases were negative (Table 2).

Out of a total of 689 non-diabetic cases, 502 (72%) cases did not have UTI, and 187 (27%) cases were positive for UTI.

Out of 322 males 75 were diabetic and 247 were non diabetic. Females were more in comprising of 548 cases out of which 106 were diabetics and 442 were non diabetic (Table 3).

**Table 1.Distribution of Patients according to Gender**

N = 870

| Gender | Patients | |
|---|---|---|
| | Number | Percentage |
| Male | 322 | 37.02 |
| Female | 548 | 62.98 |
| Total | 870 | 100 |

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**Table 2.Comparison of Pus Cells in UTI among Diabetics and Non-diabetics of Different Age Groups**

| Age Group (In Years) | Diabetic | | Non-diabetic | |
|---|---|---|---|---|
| | Pus Cells (< 5) | Pus Cells (> 5) | Pus Cells (< 5) | Pus Cells (> 5) |
| 0-9 | 0 | 0 | 12 | 4 |
| 10-19 | 0 | 0 | 43 | 10 |
| 20-29 | 1 | 21 | 91 | 44 |
| 30-39 | 1 | 23 | 101 | 25 |
| 40-49 | 0 | 35 | 79 | 40 |
| 50-59 | 0 | 54 | 102 | 41 |
| 60-69 | 4 | 22 | 52 | 9 |
| 70-79 | 1 | 15 | 18 | 13 |
| >80 | 0 | 4 | 4 | 1 |
| Total | 7 | 174 | 502 | 187 |
| Percenatge | 4% | 96% | 72% | 27% |

**Table 3.Genderwise Distribution of Patients into Diabetics and Non-diabetics**

| Gender | Diabetic | Non-diabetic | Total |
|---|---|---|---|
| Male | 75 | 247 | 322 |
| Female | 106 | 442 | 548 |

## Discussion

Diabetic patients are more susceptible to developing UTIs as compared to non-diabetics. Many mechanisms can explain the higher incidence of UTI among diabetics, such as high glucose in the urine, which aids in the growth of uropathogens. High blood sugar can also cause bladder dysfunction due to neuropathy, which leads to stasis and retention of urine.[6]

The age group in which UTI occurred among diabetics was 50–59 years whereas, for non-diabetics, the age group with UTI was 20–29 years. A study conducted by Ahmed of Hawler Medical University in Iraq showed that out of 150 diabetic patients, 53 had UTIs. The median age was 31–40 years and the study showed female predominance, which is similar to the present study.[7]

A higher glucose level can disturb humoral, innate, and cellular immunity.[12] A systemic review of 37 observational studies using PubMed was done at Taibah University. In this study, it was observed that UTIs frequently occurred in patients with diabetes mellitus due to impaired immune status and the presence of glucose in the urine, which made UTIs very important to investigate.[8,9]

Emphysematous pyelonephritis can develop due to high glucose levels, creating a favourable environment for bacterial colonisation.

The present study showed that UTI was more common in diabetic females as compared to males due to the short urethra and proximity to the anal canal. An American database study done in 2014 showed that UTI diagnosis was more common in males and females with diabetes than in those without diabetes.[10-12] A change in the normal flora of the vagina and a decrease in pH levels may also contribute to UTI.

We also observed that diabetic patients had a higher incidence of fever, dysuria, and haematuria. This is consistent with the study conducted by Garg et al.[13] according to which fever, dysuria, pain in the abdomen, vomiting, and haematuria were significantly higher in the diabetic group as compared to non-diabetics.

The most common organism that causes UTIs is E. coli, both in diabetic and non-diabetic patients. This organism adheres to urothelial cells by binding to glycolipids present on their cell membranes through fimbriae. In one of the study of the Clinical Services Department of the Desman Diabetes Institute. They studied 722 urine samples and found that Escherichia coli is the most common pathogen causing UTI in diabetics.[14]

A meta-analysis of 22 studies published in 2011 found a point prevalence of 12.2% of UTI among diabetic patients versus 4.5% in non-diabetics,[15] which is similar to the present study.

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A systemic review and meta-analysis study was conducted by the Wollo University of Ethiopia. They reviewed 14 studies, which included 3773 people. They found that there was an increased prevalence of UTIs in diabetic patients because of poor circulation, weakened immune system due to the reduced ability of white blood cells to fight infections, and poor bladder contractions. It also showed that gender, level of education, and having a history of UTIs are predictors of UTIs.[7]

## Conclusion

It can be concluded that UTI is more common in diabetics as compared to non-diabetics. It is caused by a more resistant pathogen and is associated with worse outcomes in diabetics than in non-diabetics. Treatment should be tailored according to the severity of the infection and the culture results. Further studies are needed to improve the treatment of patients with diabetes and UTIs.

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