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## **Bacterial infection of the urinary tract and glucose level in patients presented with urinary tract infection in tertiary care hospital, Bihar**

**Dr. Hari Shankar Kumar\***

Post Graduate Trainee, Department of Microbiology, MGMC & LSK Hospital, Kishanganj, Bihar, India.

\*Corresponding author

**Dr. A Roy**

Head, Department of Microbiology, MGMC & LSK Hospital, Kishanganj, Bihar, India.

**Abstract**--Objectives: This study was to evaluate the bacterial Infection of the Urinary Tract and Glucose Level in patients presented with Urinary Tract Infection in tertiary care hospital. Methods: Sterilized universal (glass) containers were used in collecting early morning midstream urine from patients. Subjects were instructed to void 5mls of Mid-Stream urine. Two hundred early morning, mid-stream urine samples was collected from one hundred patients of urinary tract infection, age between 1 to >60 years with the presence of bacterial species and 2mls of blood was obtained for glucose screening (glycosuria). Testing for Glucose, macroscopic Examinations, and gram stain procedures were performed to all blood samples. Results: Most of the patients 46(23%) were in age group of 51-60 years. 43(21.5%), 39(19.5%) and 35(17.5%) patients were in age group of 21-30 years, 41-50 years and 31-40 years respectively. most predominant isolated bacteria causing urinary tract infection were Escherichia coli 27(32.53%). Other isolated microorganisms were staphylococcus species 18(21.67%), streptococcus species 18(21.67%), 16(19.27%) Klebsiella species and 2(2.41%) proteus spp, pseudomonas spp. Prevalence of UTI was higher in females 49(59.04%) than males 34(40.96%). out of 200 samples, 83(41.5%) samples were infected. Among them, 24(28.92%) had both bacterial infection with glucose. Conclusions: Prevalence of urinary tract infection was greater in middle aged female. Most common isolated organism was Escherichia coli. Glycose urea was the most common findings seen in urinary tract infection patients. Hence, UTIs result in considerable economic and public health burdens and substantially affect the life quality of afflicted individuals. Prompt management should be administered with suitable antimicrobial therapy to those

infected. Health education camp should be organised for awareness and prevention from UTI with the co-operation from Government and non-government organizations.

**Keywords**---UTI, Age group, glycosuria.

## **Introduction**

Urinary tract infections are among the most prevailing infectious diseases with a substantial financial burden on society. In the US, UTIs are responsible for > 7 million physician visits annually [1]. Diabetic patients have a higher incidence of UTI than their nondiabetic counterparts [2] with a higher severity UTI which can be a cause of complications, ranging from dysuria (pain or burning sensation during urination) to organ damage and sometimes even death due to complicated UTI (pyelonephritis) [3]. In 2012, the direct medical costs associated with managing UTIs in the 22 million diabetic patients in USA were estimated to be more than \$2.3 billion [4]. In 2007, in the United States alone, there were an estimated 10.5 million office visits for UTI symptoms (constituting 0.9% of all ambulatory visits) and 2–3 million emergency department visits [5,6,7].

Clinically, UTIs are categorized as uncomplicated or complicated. Uncomplicated UTIs typically affect individuals who are otherwise healthy and have no structural or neurological urinary tract abnormalities [8]; these infections are differentiated into lower UTIs (cystitis) and upper UTIs (pyelonephritis) [5,7]. Several risk factors are associated with cystitis, including female gender, a prior UTI, sexual activity, vaginal infection, diabetes, obesity and genetic susceptibility [9,10]. Complicated UTIs are defined as UTIs associated with factors that compromise the urinary tract or host defence, including urinary obstruction, urinary retention caused by neurological disease, immunosuppression, renal failure, renal transplantation, pregnancy and the presence of foreign bodies such as calculi, indwelling catheters or other drainage devices [11].

UTIs are caused by both Gram-negative and Gram-positive bacteria, as well as by certain fungi. The most common causative agent for both uncomplicated and complicated UTIs is uropathogenic *Escherichia coli* (UPEC). For the agents involved in uncomplicated UTIs, UPEC is followed in prevalence by *Klebsiella pneumoniae*, *Staphylococcus saprophyticus*, *Enterococcus faecalis*, group B *Streptococcus* (GBS), *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Candida* spp. [9,12]. For complicated UTIs, the order of prevalence for causative agents, following UPEC as most common, is *Enterococcus* spp., *K. pneumoniae*, *Candida* spp., *S. aureus*, *P. mirabilis*, *P. aeruginosa* and GBS [13,14]. Objectives of this present study was to evaluate the bacterial infection of the urinary tract and glucose level in patients presented with urinary tract infection in tertiary care hospital.

## **Materials & Methods**

This present study was conducted in Department of Microbiology, Mata Gujri Memorial Medical College and LSK hospital Kishanganj, Bihar during a period

from October 2021 to May 2022. Entire subjects signed an informed consent approved by institutional ethical committee of MGMC, Kishanganj was sought.

**Sample collection:** Two hundred early morning, mid-stream urine samples was collected from one hundred patients presenting with urinary tract infection, age between 1 to >60 years were studied for the presence of bacterial species and 2mls of blood was obtained for glucose screening (glycosuria). Sterilized universal (glass) containers were used in collecting early morning midstream urine from patients. Subjects were instructed to void 5mls of Mid-Stream urine.

**Testing for Glucose (Blood Samples):** A drop of blood was placed on an electronic device for measuring the blood glucose level called Blood glucose meter and the results was documented immediately.

**Macroscopic Examinations:** The colour and appearance of the urine specimens were noted, whether the specimen appears clear or turbid.

**Microscopic Examination of Centrifuged Urine:** A drop of well mixed centrifuged, unstained urine was placed on a microscopic slide, and covered gently with cover slit and examined under x 10 and x 40 objectives of the microscope for bacterial cells, yeast, erythrocytes etc.

Culturing of Urine Samples were aseptically inoculated on MacConkey Cled and blood agar and incubated aerobically at 37°C for 24 hours after which the plates were read for the presence of bacteria.

**Gram Stain Procedures:** A loop full of the pure colonies growth from nutrient agar was placed on a glass slide and spread to make a thin smear and allowed to air dry, fixed with gentle heat and placed on a staining rock. The smear was flooded with 0.5 percent crystal violet solution for 60 seconds. The crystal violet was replaced with Lugol's iodine and allowed to act for 60 seconds and rinsed in water. The smear was then colonized rapidly with acetone until no purple colour was produced and then counter stained with neutral red for 1 minute, rinsed with water and allowed to dry. The slide was then examined microscopically with x 100 objective. Both gram positive and negative bacteria were subjected to biochemical test which gave different type of isolates.

## **Observations**

Total two hundred early morning, mid-stream urine samples were collected from one hundred patients of urinary tract infections. All the patients were with age group of 1 to >60 years. Most of the patients 46(23%) were in age group of 51-60 years. 43(21.5%), 39(19.5%) and 35(17.5%) patients were in age group of 21-30 years, 41-50 years and 31-40 years respectively.

Table 1. Age wise distribution of the patients screened for urinary tract infection

Age group (years)	No of tested	Percentages
1-10	4	2%
11-20	20	10%
21-30	43	21.5%
31-40	35	17.5%
41-50	39	19.5%
51-60	46	23%
>60	13	6.5%
Total	200	100%

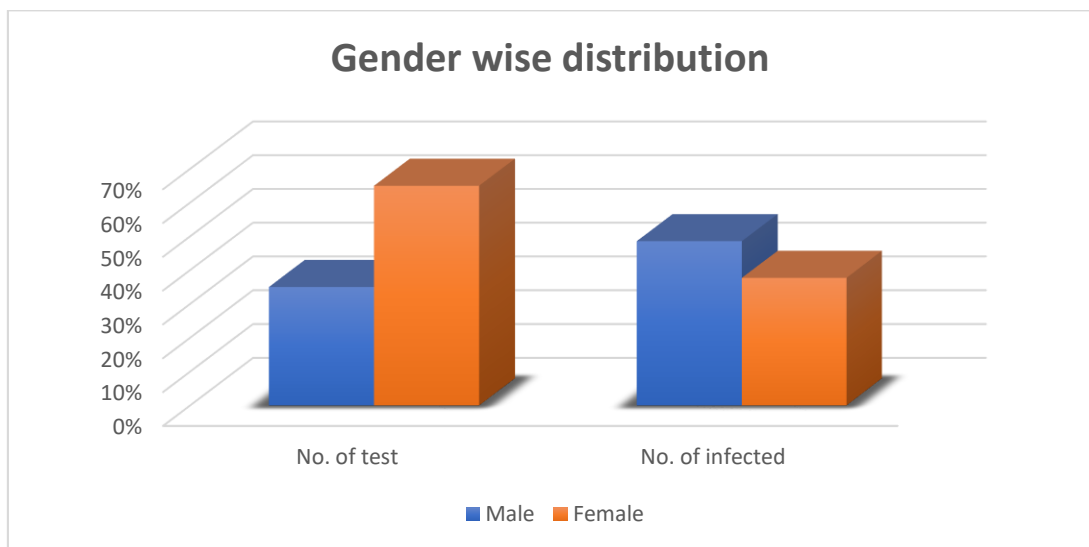


Figure.1. Gender wise distribution for urinary tract infections

Among 200 samples, 130(65%) and 70(35%) samples were of females and males respectively.

Table 2. Showing the prevalence of urinary bacteria

Type of Bacteria	No of Male infected	No of Female infected	Total
Escherichia coli	12(35.29%)	15(30.61%)	27(32.53%)
Proteus spp	1(2.94%)	1(2.22%)	2(2.41%)
Klebsiella spp	7(20.58%)	9(20%)	16(19.27%)
Streptococcus spp	7(20.58%)	11(22.22%)	18(21.67%)
Staphylococcus spp	6(17.65%)	12(24.44%)	18(21.67%)
Pseudomonas spp	1(2.94%)	1(2.22%)	2(2.41%)
Total	34(40.96%)	49(59.04%)	83(100%)

In this present study, most predominant isolated bacteria causing urinary tract infection were Escherichia coli 27(32.53%). Other isolated microorganisms were Staphylococcus species 18(21.67%), streptococcus species 18(21.67%),

16(19.27%) Klebsiella species and 2(2.41%) proteus spp, pseudomonas spp. Prevalence of UTI was higher in females 49(59.04%) than males 34(40.96%). Escherichia coli 27(32.53%) was the most common isolated microorganisms.

Table 3. Showing the prevalence of infection based on age group

Age group (Years)	No of Male samples	No of Female samples	Total
1-10	1(2.94%)	1(2.04%)	2(2.41%)
11-20	5(14.71%)	7(14.29%)	12(14.46%)
21-30	11(32.35%)	11(22.45%)	19(22.89%)
31-40	7(20.59%)	9(18.37%)	14(16.87%)
41-50	8(23.53%)	13(26.53%)	20(24.09%)
51-60	1(2.94%)	6(12.24%)	7(8.43%)
>60	1(2.94%)	2(4.08%)	3(3.61%)
Total	34	49	83

In this present study, out of 200 samples, 83(41.5%) samples were infected. Majorities of the male samples 11(32.35%) were in age group of 21-30 years. And majorities of the females 13(26.53%) were belonged in age group of 41-50 years.

Table 4. Showing the prevalence of glycosuria based on age group

Age group (Year)	No of male with glucose	No of female with glucose	Total
0-10	0	0	0
11-20	1(5.55%)	1(3.12%)	2(4%)
21-30	1(5.55%)	4(12.5%)	5(10%)
31-40	4(22.22%)	9(28.12%)	13(26%)
41-50	6(33.33%)	3(9.37%)	9(18%)
51-60	4(22.22%)	13(40.62%)	17(34%)
>60	2(11.11%)	2(6.25%)	4(8%)
Total	18(36%)	32(64%)	50(100%)

Out of 83 UTI patients, 50(60.24%) patients had glycosuria. Among them, 18(36%) were male and 32(64%) were female. Majorities of glycosuria patients 17(34%) were belonged in age group of 51-60 years.

Table 5. Showing the patients of urinary tract bacterial infection with Glucose

Age group (Year)	No. of male	No. of female	Total
0-10	0	0	0
11-20	1(10%)	0	1(4.16%)
21-30	1(10%)	1(7.14%)	2(8.33%)
31-40	1(10%)	3(21.43%)	4(16.67%)
41-50	2(20%)	3(21.43%)	5(20.83%)
51-60	3(30%)	5(35.71%)	8(33.33%)
>60	2(20%)	2(14.28%)	4(16.67%)
Total	10(41.67%)	14(58.33%)	24(100%)

Out of 83 UTI patients, 24(28.92%) had both bacterial infection with glucose. Among them, 10(41.67%) were males and 14(58.33%) were females. Majorities of patients 8(33.33%) were belonged in age group of 51-60 years.

## Discussions

Urinary tract infections (UTIs) are one of the most common microbial diseases encountered in medical practice affecting people of all ages [15]. Higher glucose concentrations in urine may promote the growth of pathogenic bacteria [16]. High renal parenchymal glucose levels create a favourable environment for the growth and multiplication of microorganisms, which might be one of the precipitating factors of pyelonephritis and renal complications such as emphysematous pyelonephritis [17]. Various impairments in the immune system, including humoral, cellular, and innate immunity may contribute in the pathogenesis of UTI in diabetic patients [18].

In our present study, two hundred early morning, mid-stream urine samples were collected from one hundred patients of urinary tract infections. All the patients were with age group of 1 to >60 years. Most of the patients 46(23%) were belonged in age group of 51-60 years. Prevalence of UTI was higher in females 49(59.04%) than males 34(40.96%). *Escherichia coli* 27(32.53%) was the most common isolated microorganisms.

A study based on administrative data of the United States population revealed a higher incidence of UTI in female versus male gender (12.9% vs. 3.9%) during a year [19]. In addition to this, the tendency of female gender for UTI is also reported in previously published studies with a geographical population like ours [20]. The higher occurrence is related more to the anatomy of the female urinary system short urethra and bacterial colonization in the perianal area and less associated with physiological changes in the body due to diabetes [21].

In our present study, most predominant isolated bacteria causing urinary tract infection were *Escherichia coli* 27(32.53%). Other isolated microorganisms were *Staphylococcus* species 18(21.67%), *Streptococcus* species 18(21.67%), 16(19.27%) *Klebsiella* species and 2(2.41%) *Proteus* spp, *Pseudomonas* spp. 50(60.24%) patients had glycosuria. Among them, 18(36%) were male and 32(64%) were female. 24(28.92%) had both bacterial infection with glucose. Among them, 10(41.67%) were males and 14(58.33%) were females.

Geerlings et al. have reported that bacteriuria was more widespread in diabetic women with uncontrolled glycemia,[22]. As most of the previous studies on UTI in diabetic patients were carried out in women, there is limited evidence describing aspects of UTIs in diabetic men [23]. Multiple factors are suggested to be involved in the high occurrence of UTIs in diabetes patients. These include but are not limited to glucosuria [24], increased bacterial adherence to uroepithelial cells due to hyperglycaemia [25], and neurogenic bladder [26]. In this context, Canagliflozin and Dapagliflozin, new antihyperglycemic molecules inhibiting renal glucose reabsorption and thus increasing glucosuria, were recently tested in clinical trials and were found to be associated with only a slight increase of UTI in T2D [27]. This suggests that the contribution of glucosuria is limited in UTI and it does not

explain its increased prevalence in diabetic patients. Nevertheless, there was a higher correlation between glucosuria and genital infection in Dapagliflozin-treated patients probably due to a greater effect of glucosuria in promoting the growth of fungal pathogens associated with genital infection as compared to bacterial pathogens typically associated with UTI [28]. In a new report, James and Hijaz have reviewed recent publications on lower urinary tract symptoms (LUTS) and UTI in diabetic women and have concluded that aging and obesity are significantly associated with worsened LUTS [29]. Glucosuria was also found to be associated with UTI and diabetic patients appeared to be at a higher risk for colonization with the virulent, extended-spectrum  $\beta$ -lactamase-producing *E. coli* and *Klebsiella* species in UTI [29].

UTIs are caused by both Gram-negative and Gram-positive bacteria, as well as by certain fungi (FIG. 1). The most common causative agent for both uncomplicated and complicated UTIs is uropathogenic *Escherichia coli* (UPEC). For the agents involved in uncomplicated UTIs, UPEC is followed in prevalence by *Klebsiella pneumoniae*, *Staphylococcus saprophyticus*, *Enterococcus faecalis*, group B *Streptococcus* (GBS), *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Candida* spp. [9,12]. For complicated UTIs, the order of prevalence for causative agents, following UPEC as most common, is *Enterococcus* spp., *K. pneumoniae*, *Candida* spp., *S. aureus*, *P. mirabilis*, *P. aeruginosa* and GBS9 [13,14].

## Conclusions

This present study concluded that prevalence of urinary tract infection was greater in middle aged female. Most common isolated organism was *Escherichia coli*. Glycose urea was the most common findings seen in urinary tract infection patients. Hence, UTIs result in considerable economic and public health burdens and substantially affect the life quality of afflicted individuals. Prompt management should be administered with suitable antimicrobial therapy to those infected. Health education camp should be organised for awareness and prevention from UTI with the co-operation from Government and non-government organizations.

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