



# A Study on Epidemiological Profile of Urinary Tract Infections in Perspective of Diabetic Status among Patients Attending Tertiary Care Hospital, Ahmedabad

Viral R Dave<sup>1</sup>, Venu R Shah<sup>2</sup>, K N Sonaliya<sup>3</sup>, Shruti D Shah<sup>4</sup>, Aniruddha R Gohel<sup>5</sup>

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## Author's Affiliation:

<sup>1</sup>Associate Professor; <sup>2</sup>Assistant Professor; <sup>3</sup>Professor & Head, Dept of Community Medicine; <sup>4</sup>Tutor, Dept of Microbiology, GCS Medical College, Hospital & Research Centre, Ahmedabad; <sup>5</sup>Tutor, Dept of Community Medicine, GMERS Medical College, Himmatnagar

## Correspondence

Dr Venu R Shah  
dr.vdave@gmail.com

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## ABSTRACT

**Background** Urinary Tract Infection (UTI) is common illness involving all age groups. Diabetics tend to have more episodes of illness as compared to non diabetics. Present study compared various epidemiological aspects of UTI among diabetic and non diabetic patients.

**Methods:** A hospital based study was conducted among 300 cases (200 non diabetics and 100 diabetics) of UTI attending one of the tertiary care hospitals of Ahmedabad city. Bacterial Isolation and antimicrobial sensitivity was tested in urine samples of all cases. Z test, Chi-square test with Cramers' V and Phi correlation were applied for testing the statistical significance.

**Result:** Mean age of diabetics and non-diabetics was  $55.6 \pm 12.1$  years and  $33.7 \pm 21.9$  years, respectively. UTI cases with positive urinary culture were 92% and 67% in diabetic and non-diabetic groups, respectively. Most common organism isolated among both the groups was *E coli*. In both groups *E coli* and *Klebsiella* had high antimicrobial sensitivity for Imipenam, Gentamycin and Nitrofurantoin. Among diabetics, the duration of diabetes, regularity of medication and type of treatment has significant effect on number of episodes of UTI in a year.

**Conclusion:** *Escherichia coli* were universally common isolate. Aminoglycoside and Nitrofurantoin can still be used empirically to treat UTI irrespective of diabetic status. Screening of urine samples for antimicrobial sensitivity while initiating the course of treatment among all UTI cases is recommended to check for and prevent resistance.

**Key words:** Epidemiological Profile, Diabetes, Urinary Tract Infection

## INTRODUCTION

The term urinary tract infection (UTI) encompasses variety of clinical entities, including asymptomatic bacteriuria, cystitis, prostatitis, and pyelonephritis.<sup>1</sup> Excluding infants and the elderly, females are commonly affected with UTI as compared to males. As many as 50-80% women in general population acquire at least one UTI episode during their lifetime- uncomplicated cystitis in most cases. In healthy postmenopausal women, sexual activity,

Diabetes mellitus and incontinence are risk factors for the UTI. Poor bladder function, obstruction in urinary flow and incomplete voiding are additional factors commonly found in patients with diabetes increasing the risk of UTI. In pregnant women, asymptomatic bacteriuria is associated with pre term birth, perinatal mortality and pyelonephritis in mother.<sup>1</sup>

The worldwide prevalence of DM has risen dramatically over the past two decades. In 2017, it was

estimated that there were 425 million people with diabetes aged 20-79 year which is predicted to rise to 642 million by 2040.<sup>2</sup> In 2017, India reported 72 million individuals having Diabetes.<sup>2</sup> Diabetes mellitus is associated with many complications and in the long run it has some major effects on the genitourinary system which makes diabetic patients more liable to UTI. In general, UTI is reported to be around four times higher among diabetics and females having diabetes reported to have two to three fold higher risk of getting UTI as compared to non diabetic females. Also, diabetic patients are at a higher risk of developing dysuria, acute pyelonephritis, renal abscess, abnormalities of bladder scarring and pyelitis. Hyperglycemia aids the colonization and growth of a variety of organisms. Increasing duration of diabetes and use of Insulin rather than oral medication are also associated higher risk of UTI. Improved glycemic control reduces the rate at which microalbuminuria appears and progresses.<sup>(3)</sup>

The most common organisms causing UTI are *E. coli* while *Proteus*, *Klebsiella*, *Streptococcus* and *Staphylococcus epidermis* can also be the causative agents. Both in community and hospital settings; increasing antimicrobial resistance is found among uropathogens causing UTI. The antibiotic drugs which have been used for the treatment of same include penicillins, cotrimoxazole, older quinolones such as nalidixic acid and cephalosporins and Newer fluorinated quinolone (ofloxacin, ciprofloxacin), gentamicin, amikacin and imipenem.<sup>(4)</sup> In the era of antibiotic resistance the treatment of UTI has become difficult. Bacteria commonly having multi drug resistance are Enterobacteriaceae including *E. coli* and *K. Pneumoniae*<sup>(5)</sup> In public health practice, much importance is given to diabetes as well as its complications. There are vast researches related diabetes directly but epidemiological data related to complications of diabetes are scarce. In clinical practice, Urinary tract infections (UTIs) are frequently noticed and results in significant morbidity and high medical costs. Despite the clinical and public health significance, there is a paucity of research. Present study compared diabetic and non diabetic UTI cases in various aspects including clinical presentation, predisposing conditions, microorganism causing UTI and their susceptibility to antimicrobial drugs.

## METHODS

A hospital based study was conducted among patients of Urinary Tract Infection (UTI) attending one of the tertiary care units of Ahmedabad city. Ethical clearance from institutional committee was sought in advance. Keeping the ratio of Diabetic to non diabetic as 1:2, total 300 cases were included in

the study. Informed consent was received from all the cases prior to data collection. For children below 12 yrs of age, their parents/ guardian were interviewed. Those who refuse to give consent were excluded from the study. Duration of the study was August 2017 to March 2018. Survey questionnaire used for data collection was pre-tested and pre-designed, having details regarding demographic data, clinical presentations and predisposing conditions directing to UTI.

Bacterial Isolation and antimicrobial sensitivity was tested in clean catch midstream urine sample collected from all the cases. Isolation of uropathogens was executed in semi quantitative urine culture using calibrated loop method. A specimen was declared positive if single organism was isolated at the concentration of  $\geq 10^5$  cfu/ml. Antibiotic susceptibility testing was performed by using Kirby-Bauer disk diffusion method.<sup>(6)</sup>

Comparison between Diabetic (100) and Non Diabetic (200) patients was made for various aspects of urinary Tract Infection and culture organisms as well as antibiotic sensitivity testing. Among diabetics, various aspects like mode of treatment, regularity of medication and glycemic control were correlated with the numbers of episodes of UTI in past one year. Criteria used for defining glycemic control was fasting blood glucose  $<110$  mg/dl as per American Association of Clinical Endocrinologists.<sup>(7)</sup>

Data was entered in MS Excel and analyzed using IBM SPSS Statistics for Windows, Version 20.0, Armonk, NY; IBM Corp. Z test was applied for testing the significance difference between two proportions and Chi Square test was used to find the statistical significance between different variables of UTI. Cramer's V & Phi Correlations were applied where applicable to reveal strength of association.

## RESULT

Total 300 cases (100 diabetics and 200 did not have diabetes) with complain of urinary tract infections (UTI) were enrolled in the study. Age wise distribution revealed equal representation among all non diabetic patients having Urinary tract infections (UTI). Among diabetic patients with UTI, 78% belonged to more than 45 years of age. Eighteen percent of patients were between the age 31 and 45 year. It was found that female gender was more prone to have UTI among group of patients with diabetes while gender distribution was near equal among other group. Statistically significant difference was noticed between both groups in terms of age and gender wise distribution. Around 85% of diabetics and 61% of non diabetic patients

**Table 1: Demographic variables of diabetics and non diabetic patients presented with Urinary Tract Infection**

Variables	Patients with UTI		P value
	Diabetics (100)(%)	Non Diabetics (200)(%)	
<b>Age groups (Years)</b>			
<15	0	48(24)	<b>0.0001</b>
15-30	4(4)	47(23.5)	
31-45	18(18)	38(19)	
46-60	44(44)	47(23.5)	
>60	34(34)	20(10)	
<b>Gender</b>			
Female	73(73)	104(52)	<b>0.0001</b>
Male	27(27)	96(48)	
<b>Education</b>			
Illiterate	8(8)	13(6.5)	<b>0.0001</b>
Primary	20(20)	41(20.5)	
secondary	43(43)	52(26)	
higher secondary	17(17)	30(15)	
graduate & above	12(12)	40(20)	
Not eligible*	0	24(12)	
<b>Occupation</b>			
Working	16(16)	71(35.5)	<b>0.0001</b>
Non Working	84(84)	105(52.5)	
Not eligible	0	24(12)	
<b>Marital status</b>			
Married	85(85)	122(61)	<b>0.0001</b>
Unmarried	0(0)	68(34)	
Widow/er	15(15)	10(5)	

\*Children less than 7 years of age

**Table 2: Clinical presentation and predisposing factors to UTI among study participants**

Variable	Diabetics (n=100)	Non-diabetics n=200	p value
<b>Clinical Presentation</b>			
Increase freq of urine	58 (58)	86(43)	<b>0.019</b>
Flank Pain	40(40)	41(20.5)	<b>0.0005</b>
Fever	59(59)	116(58)	0.901
Dysuria	31(31)	92(46)	<b>0.013</b>
Discharge	9(9)	18(9)	1.000
Vomiting	5(5)	16(8)	0.472
Hematuria	15(15)	15(7.5)	<b>0.064</b>
Incontinence	2(2)	22(11)	<b>0.059</b>
Burning Micturation	12(12)	34(17)	0.309
Itching	0 (0)	13(6.5)	<b>0.005</b>
<b>Predisposing factors</b>			
ICCU admission	3(3)	12(6)	0.400
BPH*	5(5)	8(4)	0.765
Renal Calculi	6(6)	6(3)	0.223
Indwelling catheter	8(8)	9(4.5)	0.288
Pregnancy	0(0)	12(6)	<b>0.010</b>
Recent genitourinary surgery	0(0)	2(1)	0.554
None of the above	78(78)	151(75.5)	0.668

\*Benign Prostatic Hypertrophy

were married, out of which 20% and 31% respectively, were sexually active. (Table 1)

Clinical presentation and predisposing factors of

UTI among both groups is depicted in Table 2. Z test for proportion was applied for statistical significance. It was observed that fever; discharge, burning micturation and vomiting were common presenting symptoms among both groups without any statistical significance. Increase urinary frequency, dysuria, flank pain and hematuria and urinary incontinence were significantly more common in group of diabetic patients with UTI (p<0.05). Common conditions predisposing to Urinary Tract Infections in both groups were ICCU admission, Benign Prostatic Hypertrophy, Renal Calculi and indwelling catheter. Six percent of non diabetic females were pregnant.

Cases having positive urinary culture were 92% and 134 (67%) in diabetic and non diabetic groups, respectively. Most common organism isolated in urinary culture of both the groups [Diabetic (87%) and non diabetic group (54.5%)] was *E coli*. Other organisms isolated in urinary culture of both groups were *Enterococcus*, *Klebsiella*, *Pseudomonas* and *Candida*. (Table 3)

On assessing Antibiotic sensitivity pattern for different cultural organisms among both groups, it was found that; In both groups *E coli* and *Klebsiella* had high antimicrobial sensitivity for Imipenam, Gentamycin and Nitrofurantoin followed by Quinolone and Doxycyclin group. Least sensitivity was found for Ampicilin, Cephalosporin and Cotrimoxazole. *Pseudomonas* isolated from diabetic group had higher sensitivity to various antimicrobials (Imipenem, Aztreonam, Gentamycin) as compared to non diabetic group. In both groups *Enterococcus* showed higher sensitivity to Teicoplanin, Linezolid and Vancomycin. *Proteus*, *Staphylococcus*, *Citrobacter* & *acinatobacter* were found only among non diabetic UTI patients. *Proteus* bacteria demonstrated complete sensitivity for aminoglycoside group of antibiotics. Similarly *acinatobacter* and *citrobacter* showed quite a good amount of sensitivity towards most of the antibiotics.

It was found that 12 % (n=24) of patients in non diabetic group had more than one episode of UTI in last one year, while 56 % (n=56) of patients in diabetic group had more than one episodes of UTI. The difference was statistically significant. (Chi square 67.2, p<0.05)

Among diabetic patients having UTI, 44 % had single episode of UTI in last one year. As the duration of diabetes increases number of episodes per year also increases. Patients who were on insulin and among those who had history of irregular medication had more numbers of episodes of UTI in past one year. Majority of cases (69%) were having poor glycemic control. Higher numbers of episodes of UTI was observed in past one year among the diabetics having controlled glucose level in

**Table 3: Microorganisms isolated from urinary culture among diabetics and non diabetics groups**

Culture organisms	Diabetic (n=92)	Non diabetic (n=134)	p value*
E.coli	80(87.0)	73(54.5)	<0.0001
Enterococcus	4(4.3)	16(11.9)	0.057
Klebsiella	1(1.1)	13(9.7)	<b>0.0093</b>
Pseudomonas	4(4.3)	9(6.7)	0.567
Candida	3(3.3)	8(6.0)	0.531
Citrobacter	0	6(4.5)	<b>0.083</b>
Staphylococcus aureus	0	4(3.0)	0.147
Proteus Vulgaris	0	3(2.2)	0.272
Acenatobacter	0	2(1.5)	0.515

\*Z test applied

**Table 4: Association between various attributes of Diabetes and numbers of episode of UTI in last one year among group of patients with Diabetes**

Diabetic Profile	Episodes of UTI in last one year		P value
	< 1 (n=44)	>1 (n=56)	
<b>Duration of Diabetes</b>			
< 1year (n=16)	8 (50%)	8(50%)	0.959
1-5 years (n=51)	22(43.2%)	29(56.8%)	
5-10 years(n=16)	7(43.7%)	9(56.3%)	
>10 years(n=17)	7(41.17%)	10(58.8%)	
<b>Type of treatment</b>			
Insulin(n=5)	0	5 (100%)	<b>0.026</b>
Oral hypoglycemic (n=85)	42(49.4%)	43(50.6%)	
Both(n=10)	2(20%)	8(80%)	
<b>Medication</b>			
Irregular(n=24)	10(41.7%)	14(58.3%)	0.792
Regular(n=76)	34(44.7%)	42(55.3%)	
<b>Glycemic control</b>			
No (n=69)	37(53.6%)	32(46.4%)	<b>0.004</b>
Yes (n=31)	7(22.6%)	24(77.4%)	

current episode. (Table 4) Out of 100 diabetics, 29 had diabetes related co-morbidity like hypertension and myocardial infarction. Sixteen percent-ages of patients had diabetic complications like Diabetic foot (8), Diabetic nephropathy (1), Diabetic retinopathy (5) and Diabetic neuropathy (2).

## DISCUSSION

Present study was conducted among 300 patients (200 non-diabetic and 100 diabetic) attending the tertiary care institute with complain of UTI. Mean Age of diabetic patients was 55.6 years  $\pm$  12.1 years and among non diabetics, it was 33.7 years  $\pm$  21.9 years. In the study carried out by Srinivas et al,<sup>(8)</sup> the mean age among diabetic and non-diabetic patients was 60.2  $\pm$ 13.76 years and 53.47 $\pm$ 18.56 years, respectively. Daad H Akbar<sup>(9)</sup> reported the mean age of diabetics 64 years versus 54 years in non-diabetics. Female predominance was found among both diabetics and non diabetic patients in present

study which was in accordance with findings of other study<sup>(10)</sup>. Acharya D et al<sup>(11)</sup> mentioned that age and gender were comparable in both groups in their study. Ke He et al<sup>(12)</sup> in their study at China found that female Gender and elder age were the significant risk factors of UTIs in diabetic patients.

Predisposing conditions to Urinary Tract Infections in both groups were ICCU admission, Benign Prostatic Hypertrophy, Renal Calculi and indwelling catheter. Similar finding were dictated by Srinivas et al.<sup>(8)</sup> Presence of urinary catheter, ICU admissions, and prolonged hospital stay had been reported as risk factors for UTI in the studies conducted by Daad H Akbar.<sup>(9)</sup> John A. et al<sup>(13)</sup> in their review research found that some predisposing factors such as alterations to the host's natural defense mechanisms, anatomical and physiological factors, premenopausal / menopausal factors, age and sex, obstruction, instrumentation etc. Pregnancy was found to be one of the factors causing UTI among non diabetic females in present study.

UTI cases with positive urinary culture were 92% and 134 (67%) in diabetic and non diabetic groups, respectively. Most common organism isolated in urinary culture of both the groups was *E coli*, which was in accordance to most studies conducted in various part of the world.<sup>(8)(9)(11)(14)</sup> Other organisms isolated irrespective of diabetic status were Enterococcus, Pseudomonas, Klebsiella and Candida. In study conducted by Acharya et al<sup>(11)</sup>, *Escherichia coli* were the most frequent organism followed by *Klebsiella* sps. *Staphylococcus* and *Pseudomonas* were not isolated from UTI patients in their study. In present study *Proteus*, *Staphylococcus*, *Citrobacter* & *acinatobacter* were isolated only among non diabetic UTI patients.

Among diabetic patients, the duration of diabetes has significant effect on number of episodes. Mubarak et al<sup>(15)</sup> also quoted the same. Patients who were on insulin had more numbers of episodes. Numbers of episodes were more among those with irregular medication history. Current study noticed that higher numbers of episodes of UTI was present among the diabetics having controlled glucose level compared to those having uncontrolled diabetes. Because of unavailability of HbA1C result from all cases, glycemic control was measured by current level of fasting glucose. This might be the reason behind such finding. Mubarak et al<sup>(15)</sup> mentioned that, frequency of UTI was higher among diabetic patients whose glucose control was poor. Sewify et al<sup>(16)</sup> in their similar study at Kuwait also found that most UTI cases occurred in the uncontrolled glycemic group versus patients with controlled glycemia. Sanden A et al<sup>(17)</sup> in their study mentioned that glycaemic improvement with insulin treatment had no consistent associa-

tion with decreased UTI risk.

In present study 56% of Diabetic patients & 12% of Non-Diabetic patients had recurrent UTI in last one year while Ikähelmo R et al <sup>(18)</sup> in their study revealed that 44% of the patients had recurrence UTI in one year follow-Up.

## CONCLUSION

Increasing age and female gender had greater representation and clinical features like increase urinary frequency, dysuria, flank pain, hematuria and urinary incontinence were significantly more common in group of diabetic patients with UTI. Common conditions predisposing to UTI in both groups were ICCU admission, Benign Prostatic Hypertrophy, Renal Calculi and indwelling catheter. Incidence of UTI among last year was more among diabetic patients. Patients who were on insulin, history of irregular medication and with poor glycemic control had more numbers of episodes of UTI in past one year. *Escherichia coli* were universally common isolate from urine culture irrespective of diabetic status of patients. Aminoglycoside and Nitrofurantoin can still be used empirically to treat UTI irrespective of diabetic status. Screening of urine samples for antimicrobial sensitivity while initiating the course of treatment among all UTI cases is recommended to check for and prevent resistance. Glucose control with regular medication does have impact on the episode of UTI.

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