



Urinary Tract Infection Patterns in Diabetic Patients: Clinical and Laboratory Insights

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ABSTRACT

Diabetes Mellitus (DM) is a chronic metabolic disorder marked by hyperglycemia. This study aimed to compare the clinical and laboratory profiles of UTIs in diabetic patients with varying glycemic control, identifying common causative organisms and the impact of glycemic management on infection outcomes. We conducted a prospective observational study at RajaRajeswari Medical College and Hospital, Bangalore. Prospective observational study, 100 DM patients with culture-confirmed UTIs were included. The study excluded pregnant and immunocompromised individuals. Results showed that 57% of patients had good glycemic control, while 43% had poor control, with no significant gender difference. The majority (90%) had Type 2 DM. Findings indicated that good glycemic control was associated with better UTI management outcomes. *Escherichia coli* was the predominant pathogen, exhibiting notable resistance to antibiotics like Ciprofloxacin and Gentamicin. The study emphasizes the importance of regular screening for asymptomatic bacteriuria and antibiotic resistance monitoring in diabetic patients to mitigate UTI complications.

KEY WORDS: Diabetes Mellitus (DM), Urinary Tract Infections (UTIs), *Escherichia coli*.

I. INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in either insulin secretion or insulin action, or both.

Urinary tract is the commonest system to be affected by infections in DM. indeed cystitis is the commonest infection in DM, surpassing even respiratory tract infections like acute rhinolaryngitis and acute bronchitis, and skin infections like dermatomycoses. *E. coli* is the most common isolate in UTI in DM. Other pathogens

commonly isolated include *Klebsiella*, *Proteus*, and *Staphylococcus aureus*.²

RESEARCH METHODS

In Department of General Medicine, RajaRajeswari Medical college and Hospital, study from August 2022 To January 2024, Prospective observational study with Sample Size 100 is done.

Inclusion criteria

All patients of Diabetes Mellitus with urine culture showing growth of pathogens $> 10^6$ cfu/ml.

Exclusion criteria

Age < 18 years, Immunocompromised states like HIV and those patients who were on steroids or immunosuppressants. Patients with a history of having received antibiotics within two weeks prior to culture. Patients who were on continuous indwelling catheter. Gestational diabetes mellitus and menstruating women.

Patients who did not give informed consent for the study.

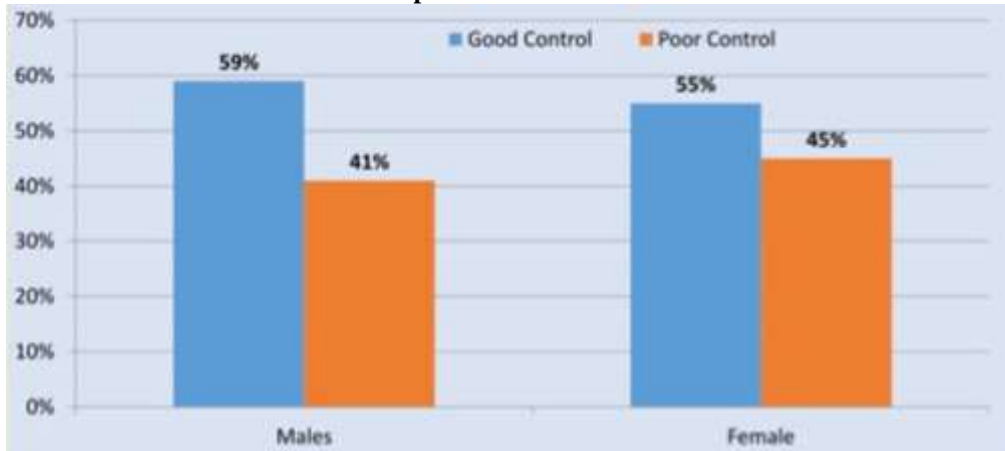
II. METHODOLOGY

All patients who were known cases of DM and were on treatment and/or had a Fasting Blood Glucose (FBG) ≥ 126 mg/dL, or a 2 hour Postprandial Glucose ≥ 200 mg/dL, or a HbA1C value $\geq 6.5\%$ were eligible for the present study. A detailed history was taken and a detailed examination of all systems was done. Sample collection was Mid stream urine/puncture of the Foley's catheter. Urine samples were sent for urine R/M and C/S. Other investigations included CE, FBG 2hour PG, HbA1C and USG abdomen for evaluating urinary tract.



III. RESULTS

Graph1: Sex distribution



Out of the 100 patients selected for this study, 57% had good control and 43% had poor control of their DM with no significant discordance

among the sexes ($P = 0.7$). Also, 10% of patients had Type 1 DM and 90% had Type 2 DM.

Table 1: Duration of Diabetes Mellitus

Duration in years	< 1 year		1-10 years		> 10 years		Total
	No.	%	No.	%	No.	%	
Good control	11	52.3	38	61.2	8	47	57
Poor control	10	47.7	24	38.8	9	53	43
Total	21	100	62	100	17	100	100

It was observed that patients with duration < 1 year (Newly diagnosed cases) and those with duration > 10 years (Long standing cases) had

poorer control (47.7% and 53% respectively) than those who had duration of DM between 1-10 years (only 38.8%). ($P = 0.51$)

Table 2: Treatment taken for Diabetes Mellitus

Treatment taken	Insulin therapy		OHA		No treatment	
	No.	%	No.	%	No.	%
Good control	5	26.3	47	68.1	5	41.6
Poor control	14	73.7	22	31.9	7	58.4
Total	19	100	69	100	12	100

Of the 100 patients, 19 were on Insulin therapy, 69 were on OHAs and 12 were not on any

drugs. Most of the patients on OHAs (68.1%) were found to have Good control, but much lesser



number of patients on Insulin (26.3%) were having Good control (P=0.002).

Table 3: Adherence to treatment treatment and follow - up

Treatment	Good control (n = 57)		Poor control (n = 43)		P
	No.	%	No.	%	
Adherence to treatment	49	85.9	9	20.9	<0.001
Follow-up	41	71.9	7	16.3	<0.001

Table 4: symptoms of UTI

Symptom	Good control		Poor control		Total
	No.	%	No.	%	
Asymptomatic	8	66.7	4	33.3	12
Fever	34	58.6	24	41.4	58
Dysuria	32	51.6	30	48.4	62
Frequency	24	52.1	22	47.9	46
Urgency	18	54.5	15	45.5	33
Hematuria	2	33.3	4	66.7	6
Pyuria	9	45	11	55	20
Suprapubic pain	25	50	25	50	50
Flank pain	8	42.1	11	57.9	19
Incontinence	3	20	12	80	15

88% of the patients had symptomatic UTI. 15% of the patients had Urinary incontinence, and this was found to be much more common in

patients with poor control (P=0.001). No significant statistical difference was seen between the groups for all the other symptoms.

Table 5:Asymptomatic bacteriuria

Sex	Good control		Poor control		Total
	No.	%	No.	%	
Male	1	25	3	75	4
Female	7	87.5	1	12.5	8

12% of the patients had ASB: 8 Females and 4 Males (P=0.42). Also, 8 of the patients had Good control, whereas 4 had Poor control.

**Table 6: Organism isolated in Urine Culture**

Organism	Good control		Poor control		Total
	No.	%	No.	%	
E. coli	40	70.2	30	69.8	70
Klebsiella	3	5.3	3	7	6
Enterococcus	0	0	6	14	6
Coagulase negative Staphylococcus	2	3.5	2	4.7	4
Proteus	2	3.5	1	2.3	3
Pseudomonas	2	3.5	1	2.3	3
Staphylococcus aureus	2	3.5	0	0	2
Streptococcus	2	3.5	0	0	2
Candida	4	7	0	0	4
Total	57	100	43	100	100

8 different bacterial species were isolated. Candida was also isolated in 4 of the patients. E.coli was the most common pathogen seen with 70% of the cases isolating it.

Table 7: Antibiotic sensitivity of various organisms isolated

Organism (Numbers)	Ampicillin	Amoxycillin	Ceftriaxone	FQs	Aminoglycosides	Nitrofurantoin
E. coli (70)	14(20%)	24 (34%)	47 (67%)	20(28%)	51 (72%)	48 (68%)
Other GNBs (12)	3 (25%)	6 (50%)	7 (58%)	9 (75%)	10 (83%)	6 (50%)
GPCs (14)	4 (28%)	10 (72%)	6 (42%)	7 (50%)		14 (100%)

Antibiotic susceptibility testing showed that E.coli and other GNBs were maximally susceptible to Aminoglycosides (72% & 83%). Among GPCs, susceptibility to Nitrofurantoin was 100% and to Amoxycillin was 72%. Uniformly, resistance to Ampicillin was high among all isolates.

IV. DISCUSSION

The study underscores the significant impact of glycemic control on the prevalence and management of urinary tract infections (UTIs) in diabetic patients. Glycemic control plays a critical role in modulating the body's immune response and its ability to combat infections. Poorly controlled diabetes has been associated with a higher risk of infections due to several factors, including impaired neutrophil function, reduced cytokine production, and the presence of glucose in urine which promotes bacterial growth.

The study revealed that patients with good glycemic control exhibited better clinical outcomes

in terms of UTI management compared to those with poor control. Specifically, the duration of diabetes and associated renal complications were critical factors contributing to poor glycemic control and higher susceptibility to UTIs. This finding highlights the need for effective diabetes management strategies, including regular monitoring of blood glucose levels, patient education on self-care, and timely medical interventions.

In graph 1, Out of the 100 patients selected for this study, 57% had good control and 43% had poor control of their DM with no significant discordance among the sexes ($P = 0.7$). Also, 10% of patients had Type 1 DM and 90% had Type 2 DM.

In table 1, It was observed that patients with duration < 1 year (Newly diagnosed cases) and those with duration > 10 years (Long standing cases) had poorer control (47.7% and 53% respectively) than those who had duration of DM between 1-10 years (only 38.8%). ($P = 0.51$). in



table 2, the 100 patients, 19 were on Insulin therapy, 69 were on OHAs and 12 were not on any drugs. Most of the patients on OHAs (68.1%) were found to have Good control, but much lesser number of patients on Insulin (26.3%) were having Good control ($P=0.002$). In table 4, 88% of the patients had symptomatic UTI. 15% of the patients had Urinary incontinence, and this was found to be much more common in patients with poor control ($P=0.001$). No significant statistical difference was seen between the groups for all the other symptoms. In table 5, 12% of the patients had ASB: 8 Females and 4 Males ($P=0.42$). Also, 8 of the patients had Good control, whereas 4 had Poor control. In table 6, 8 different bacterial species were isolated. *Candida* was also isolated in 4 of the patients. *E. coli* was the most common pathogen seen with 70% of the cases isolating it. In Table 7, Antibiotic susceptibility testing showed that *E. coli* and other GNBs were maximally susceptible to Aminoglycosides (72% & 83%). Among GPCs, susceptibility to Nitrofurantoin was 100% and to Amoxicillin was 72%. Uniformly, resistance to Ampicillin was high among all isolates.

The most frequently isolated pathogen in this study was *Escherichia coli*, consistent with existing literature. The high resistance of *E. coli* to commonly used antibiotics such as Ciprofloxacin and Gentamicin is alarming and suggests the necessity for routine antimicrobial sensitivity testing. This practice can guide the selection of appropriate antibiotics, thereby improving treatment outcomes and preventing the development of multi-drug-resistant organisms.

V. CONCLUSION

Glycemic control in UTI patients was seen to be better in those whose drug dosages had been titrated over time and those who had been educated about need for adherence to treatment and follow-up.

Urinary incontinence and renal angle tenderness were associated with poor glycemic control.

E. coli was the most common organism isolated and the majority of the infections were by GNBs. Enterococcus was commonest among GPCs.

Nitrofurantoin, Amikacin and Ceftriaxone were good candidates for empirical treatment, while Ampicillin and Ciprofloxacin should probably be avoided till culture sensitivity results are available.

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