

Study of Clinical Profile of Urinary Tract Infections in Diabetics and Non-Diabetics

Pavan Kumar D¹, Anish Reddy P², Sanjay H Kalbande 3

^{1,2} Asst. Professor

³ Professor & HOD

Department of General Medicine
Chalmeda Anand Rao
Institute of Medical Sciences
Karimnagar-505001
Telangana, India.

CORRESPONDANCE:

Dr. Anish Reddy P,
MD (Gen. Medicine)
Asst. Professor
Department of General Medicine
Chalmeda Anand Rao
Institute of Medical Sciences
Karimnagar-505001
Telangana, India.
E-mail: parpenpel88@gmail.com

ABSTRACT

Background and Aim: Diabetics are more prone for infections than non diabetics. Urinary tract infection (UTI) is the most important and most common site of infection in diabetic patients. Bacteriuria is more common in diabetics than in non-diabetics because of a combination of host and local risk factors. Hence, the study was undertaken to determine if there are differences in clinical and microbiological features and antibiotic sensitivity pattern in patients of UTI between diabetic and non-diabetic subjects.

Materials and Methods: This study was done on patients, who were admitted to Chalmeda Anand Rao Institute of Medical Sciences Hospital during a period of April 2019 to February 2020. A total of 120 diabetics (65 female, 55 male) and 80 non-diabetics (49 female, 31 male) with culture positive UTI were studied.

Results: Almost 64% of diabetic patients and 48 % of non-diabetic patients presented with fever, 46 % of diabetics and 32% of non-diabetics presented with dysuria as presenting symptom of UTI. 28% of diabetic females and 27 % of diabetic males were asymptomatic. 22% of non-diabetic females and 26 % of non-diabetic males were asymptomatic. Benign prostatic hypertrophy is the most common predisposing factor of UTI in males in both diabetics and non-diabetics. Indwelling catheter is the most common predisposing factor of UTI in females in both diabetics and non-diabetics. E.Coli is the most common organism isolated and most common cause of pyelonephritis and recurrent UTI in diabetics. E.Coli is most sensitive to meropenem in diabetic and non-diabetics followed by cefoperazone and sulbactam. Majority of diabetics with UTI had HbA1c greater than 8%. Septicemia is the most common complication of UTI in both diabetics and non-diabetics followed by AKI.

Conclusion: Fever and Dysuria are the most common presenting symptoms of UTI in diabetics and non-diabetics. Asymptomatic bacteriuria is present in almost 1/3rd of diabetics. E Coli is the most common organism isolated and is most sensitive to meropenem. Prevalance of pyelonephritis is higher in diabetics. Majority of diabetic patients with UTI had HbA1c greater than 8%.

Keywords: Urinary tract infection, asymptomatic bacteriuria, diabetic patients, E. coli

INTRODUCTION

Diabetics are more prone for infections than their non-diabetic counterparts. Infections tend to be more severe and complications are more frequent in diabetics compared to non-diabetics. Urinary tract infection (UTI) is the most important and most common site of infection in diabetic patients. Diabetic patients have been found to have 5-fold frequency of acute pyelonephritis at autopsy than non-diabetics.^[1]

Most of the urinary tract infections in diabetic patients are relatively asymptomatic. This asymptomatic infection can lead to severe kidney damage and cause renal failure.

Bacteriuria is more common in diabetics than in non-diabetics because of a combination of host and local risk factors. A number of uncommon urinary tract infection complications occur more frequently in diabetics, such as emphysematous pyelonephritis and emphysematous cystitis.^[2]

Different disturbances (low complement factor 4, decreased cytokine response after stimulation) in humoral innate immunity have been described in diabetic patients.

However, the clinical relevance of these findings is not clear. Concerning cellular innate immunity most studies show decreased functions (chemotaxis, phagocytosis,

killing) of diabetic polymorphonuclear (PMN) cells and diabetic monocytes / macrophages compared to cells of controls.

In general, a better regulation of the DM leads to an improvement of these cellular functions. Furthermore, some microorganisms become more virulent in a high glucose environment.^[3] Another mechanism which can lead to the increased prevalence of infections in diabetic patients is an increased adherence of microorganisms to diabetic compared to nondiabetic cells. This has been described for *Candida albicans*. Possibly the carbohydrate composition of the receptor plays a role in this phenomenon. Therefore, investigation of bacteriuria in diabetic patients by screening for UTI is very important to enable it to be properly treated to prevent the development of renal complications of diabetes and eventually severe renal damage and failure. The purpose of this study was to compare clinical, microbiological and antibiotic sensitivity pattern of UTI in diabetics and non-diabetics.

MATERIALS AND METHODS

Study Design

Prospective study of 120 diabetic patients and 80 non-diabetic patients to determine differences in clinical, microbiological and antibiotic sensitivity pattern of UTI in diabetic and non-diabetic patients.

Study Centre

This study was done on patients, who were admitted to Chalmeda Anand Rao Institute of Medical Sciences Hospital, Karimnagar during a period of April 2019 to February 2020.

Inclusion criteria

- Culture positive urinary tract infections.

Exclusion criteria:

The following groups were excluded from study:

- Culture negative urinary tract infections.
- Patients who were diagnosed and treated outside.

Procedure

Once patients admitted data including age, sex, occupation and symptomatology were taken and clinical examination was done. All proven diabetics with fasting venous glucose >126 mg/dl and postprandial (2h) venous glucose >200mg/dl were included in the study irrespective of reason for admission.

Patients with a history of diabetes and those who were on treatment for the same were also eligible for admission. Controls consisted of patients admitted in hospital with comparable age and sex with no history of diabetes and fasting blood sugar <110 mg/dl.

The laboratory tests included complete blood picture, renal and liver function test and urine microscopy including culture. For urine microscopy, 5ml of clean catch midstream urine was centrifuged at 3000 rpm for five minutes and centrifuge was viewed under microscope and more than five WBC per high power field was considered significant.

A fasting sugar, postprandial sugar and HbA1c were done for all diabetics. The percentages in different categories were compared using Chi square test and means were compared using Student's test. A p-value less than 0.05 were considered significant.

Ethics Approval

This study was reviewed and approved by the Institute Ethics Committee, Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar.

Table 1: Clinical characteristics - Symptoms in DM and NDM

Symptoms	DM	NON-DM	Chi-square	P value
Fever	64(53.3%)	48 (60.00%)	0.8658008658	0.3521204356
Dysuria	46(38.33%)	32 (40.0%)	0.2780352178	0.5979919057
Increased frequency	26(21.66%)	23(28.75%)	1.221883984	0.268991236
Abdominal pain	21(17.50%)	20(25.00%)	1.911589008	0.1667868558
Vomiting	28(23.33%)	15(18.75%)	0.8207070707	0.3649735161
Hematuria	6(5.0%)	3(3.75%)	0.1745200698	0.676125529
Pyuria/ turbiduria	4(3.3%)	2(2.50%)	0.1145475372	0.7350250634
Incontinence	17(14.2%)	9(11.25%)	0.36103743	0.5479306373
Increased frequency	26(21.66%)	23(28.75%)	1.221883984	0.268991236
Retention	4(3.3%)	3(3.75%)	0.02467308167	0.8751844204

RESULTS

Among 120 diabetic patients duration of diabetes greater than 10 years in 27 (22.50%), 1–10 years in 72 (60%), less than 1 year in 21 (17.50%). Mean age among diabetic and non-diabetic patients was 56.77 ± 15.22 and 56.13 ± 16.75 respectively (Table 1).

Fever and dysuria are the most common presenting symptoms of UTI in both diabetic and non-diabetic (NDM) patients. 28% of diabetic females and 27% of

diabetic males were asymptomatic. 22% NDM females and 26% of NDM males were asymptomatic (Table 2). BPH was the commonest predisposing factor in both diabetic and non-diabetic males followed by catheterization. Most common predisposing factor for UTI in females was presence of indwelling catheter and there was no significant difference among diabetic and non-diabetic females. The incidence of pyelonephritis is significantly higher in diabetic compared to non-diabetic patients. Most common organism isolated was E.coli (Table 2).

Table 2: Predisposing factors for UTI in males in DM and NDM

Predisposing condition	DM	NON-DM	Chi-square	P value
Benign Prostatic Hypertrophy	22(40.0%)	12(38.7%)	0.37798	0.5386
Indwelling Catheter	20(36.4%)	14(45.2%)	0.02362	0.8778
Hydronephrosis	5(9.1%)	5(16.1%)	0.43859	0.5078
Stricture Urethra	4(7.3%)	3(9.7%)	0.02467	0.8751
Phimosis	2(3.6%)	1(3.2%)	0.05640	0.8122
Calculi	3(5.4%)	2(6.4%)	0.21367	0.6439
Recent G.U Surgery/ Instrumentation	4(7.3%)	2(6.4%)	0.11454	0.7350
Balanoposthitis	1(1.8%)	0	0.08317	0.8217
Neurogenic Bladder	2(3.6%)	0	0.05640	0.8122

Table 3: UTI predisposing conditions in females in DM and NDM

Predisposing condition	DM	NON-DM	Chi-square	P value
Indwelling catheter	22 (33.6%)	15 (30.6%)	0.0055	0.9407 NS
Hydronephrosis	5 (7.69%)	4 (8.16%)	0.0775	0.7806 NS
Calculi	2 (3.07%)	1 (2.04%)	0.0564	0.8122 NS
Meatal stenosis	1 (1.53%)	1 (2.04%)	0.0841	0.7717 NS
Gynaecological disorders	4 (6.15%)	6 (12.24%)	1.7543	0.1853 NS
Pregnancy	9(13.84 %)	4 (8.16%)	0.4936	0.4823 NS

Table 4: Spectrum of Pathogens Causing Recurrent UTI

Spectrum of Pathogens	DM	Non DM	P value
E.coli	12	4	0.14729 NS
Klebsiella	1	2	
Enterococcus	2	2	
Pseudomonas	0	1	
Citrobacter	0	0	
Proteus	1	0	
Coagulase Negative Staph.	0	0	
Coagulase Positive Staph.	2	0	
Candida	1	0	
Total	19	9	

15.8% of diabetics and 11.2 % of non-diabetics subjects had recurrent UTI (Table 4).

Table 5: UTI and Glycemic control

Glycosylated Hb	With predisposing factors	No predisposing factors
< 6.5	20 (23.8%)	2 (5.5%)
6.5-8.0	25 (29.8%)	9(25%)
> 8.0	39(46.4%)	25 (69.4%)
Chi square	7.284743443	
P value	0.0261901545 Sig.	

The presence of Glycosylated haemoglobin <6.5% decreased the risk of UTI (Table 5).

Table 6: Level of Glycemic control and recurrent UTI

Glycosalated Hb	No. of patients	Percentage
<6.5	1	5.2%
6.5-8.0	7	36.7%
>8.0	11	57.9%

More than 50% of patients with recurrent UTI had HbA1C >8.0% (Table 6).

Table 7: Percentage of complications in UTI

	DM	NON DM
AKI	22(18.3%)	16(20%)
Recurrent UTI	19(15.8%)	9(11.2%)
Septicemia	24(20%)	18(22.5%)
Renal Papillary necrosis	2(1.6%)	0
Intra renal abscess	0	0

Septicemia is the most common complication of UTI in diabetics and non- diabetics followed by AKI (Table 7).

Table 8: Uropathogens in DM and NDM

Uropathogen	DM	NDM	Chisquare	P value
E.coli	75	43	1.5192	0.2177 NS
Klebsiella	18	17	1.2987	0.2544 NS
Enterococcus	12	5	0.8678	0.3515 NS
Pseudomonas	2	9	8.4816	0.0035 NS
Acinetobacter	2	0	0.0578	0.8256 NS
Citrobacter	1	2	0.9024	0.3421 NS
Proteus	2	1	0.0564	0.8122 NS
Coagulase negative Staph	2	2	0.1700	0.6800 NS
Coagulase Positive Staph.	3	1	0.3826	0.5361 NS
Candida	3	0	0.3945	0.5451 NS

E.coli is the most common organism causing UTI in diabetics and non-diabetics followed by klebsiella and enterococcus. E.coli and klebsiella are most sensitive to Meropenem (Table 8, 9). Enterococcus is most sensitive to Teicoplanin, Linezolid & Vancomycin (Table 11).

DISCUSSION

The present study included 120 diabetic and 80 non-diabetic patients with culture positive urinary tract infections. In this study, we have tried to determine whether there are differences in the clinical and microbiological patterns of UTI and the antibiotic

Table 9: Sensitivity of E.coli to Antibiotics

Antibiotic	DM	NON DM
Amikacin	82%	78%
Ampicillin	17%	17%
Augmentin	43%	28%
Aztreonam	24%	23%
Cefotaxime	44%	24%
Cefepime	49%	36%
Gentamycin	68%	67%
Cefoperazone-sulbactam	84%	80%
Meropenem	94%	96%
Netilmicin	76%	78%
Norfloxacin	25%	33%
Piperacillin-Tazo	68%	72%
Co-trimoxazole	38%	33%
Ceftriaxone	50%	35%

Table 10: Sensitivity of klebsiella to antibiotics

Antibiotic	DM	NON DM
Amikacin	87%	90%
Ampicillin	12%	18%
Augmentin	56%	46%
Aztreonam	39%	36%
Cefotaxime	39%	42%
Cefepime	52%	48%
Gentamycin	71%	64%
Cefoperazone-sulbactam	86%	95%
Meropenem	96%	99%
Netilmicin	81%	88%
Norfloxacin	32%	35%
Piperacillin-tazobactam	89%	74%
Cotrimoxazole	38%	31%
Ceftriaxone	47%	42%

sensitivity patterns of the pathogens concerned with diabetic and non-diabetic patients.

The study was carried-out on adult diabetic and non-diabetic patients admitted to the Chalmeda anand rao institute of medical sciences, between April 2019-February 2020. In the present study there was no significant difference between mean age among diabetic and non-diabetic patients.

There was no significant correlation between the age of patient and the incidence of UTI in both diabetic and non-diabetic patients. Mario Bonadio et al 2006^[4] also made a

Table 11: Antibiotic sensitivity of enterococcus

Antibiotic	DM	NON DM
Amikacin	62%	62%
Ampicillin	41%	53%
Augmentin	23%	41%
Ciprofloxacin	22%	11%
Linezolid	100%	99%
Gentamycin	44%	36%
Netilmicin	91%	67%
Penicillin	34%	25%
Teicoplanin	100%	100%
Cotrimoxazole	14%	13%
Vancomycin	99%	100%

similar observation in his study (73.7 years in diabetics vs 72.7 years in non-diabetic subjects). Longer duration of DM has been associated with a higher prevalence of bacteriuria.

A statistically significant longer duration of DM was recorded by Bahl /Chugh et al 1970^[5] in diabetics with bacteriuria than in those without bacteriuria. The prevalence of bacteriuria increased 1.9 fold for every 10 years of diabetes duration (Keane et al 1988).^[6]

However such a correlation was not observed in our study with maximum number (60%) having diabetes between 1-10 years. (<1 year-(17.5 %)- 21patients; 1-10 years-(60%)-72 patients; >10 years (22.5 %) - 27 patients).

In our study bladder outlet obstruction due to BPH and urethral stricture was the predisposing factor in almost 47% of males with UTI. Most of the diabetic patients developing UTI in our study had long standing DM (>5 years). This is similar to what was seen in the study by Jackson et al, indicating that these patients should be screened more intensively for the presence of bacteriuria and UTI.

Fever was found to be present in 53.3% of DM and 60% of non-diabetic subjects and was significantly associated with the presence of UTI. So the presence of fever should prompt a look at the urinary tract as a possible source of infection. There was no significant difference in clinical symptoms and signs between diabetic and non-diabetic subjects.

Diabetes mellitus for a long time been associated with increased prevalence of bacteriuria compared to non-diabetics (Sullivan et al., 1961).^[7]

In the present study there was no significant difference in incidence of asymptomatic bacteriuria in 71 females (diabetics 27.6% Vs non-diabetics 22.4%) and in males

(diabetics 27.3% Vs non diabetics 25.8%). This was in agreement with the study by Mario Bonadio et al (diabetic females 14.97% Vs non-diabetic females 13.1%) and (diabetic males 12.76% Vs non- diabetic males 11.4%). However in the study conducted by Geerlings et al (2000) the prevalence of asymptomatic bacteriuria was higher in women with diabetes than in women without diabetes (26% in diabetic subjects and 6% in controls).^[8]

The incidence of pyelonephritis is significantly higher in diabetics 10% than non-diabetics 2.5%. The mean HbA1c level of the diabetic patients at the time of admission was 8.22 % \pm 2.6 SD. In our study of diabetics with UTI majority (81.6 %) had Glyco Hb >6.5% with $p < 0.02$.

Thus it seems the occurrence of UTI in diabetics seems to be related to the glycemic control in the recent past-over a period of weeks to months.

The association between Glyco Hb (i.e degree of glycemic control) and the occurrence of UTI has been investigated in various studies. Schimmit et al in 1986^[9] analysed the correlation between asymptomatic bacteriuria and glycosylated Hb. Chung et al (2002)^[10] in their study on factors predisposing to E.Coli UTI in diabetic population have noted that a Glyco Hb > 8.1 % was associated with an increased risk for UTI.

Our study was correlating with the study done by Chung, who concluded that patients with glyco Hb > 8.1 % have a higher incidence of upper UTI and so this level was undesirable.

19 (15.8%) out of 120 diabetics and 9(11.2%) out of 80 non-diabetic subjects had recurrent UTI. In the study conducted by Kees J Gorter et al (2010)^[11] relapses and reinfections were reported in 7.1% and 15.9% of women with diabetes versus 2.0% and 4.1% of women without diabetes. KJ Gorter et al concluded that there was an independent higher risk of recurrent UTI in women with diabetes compared with women without diabetes (OR 2.0; 95% CI 1.4-2.9). Mean Glyco Hb in DM with recurrent UTI in our study was 8.98 \pm 3.92 (i.e.> 8.0)^[11].

Escherichia coli was the most frequent uropathogen isolated, responsible for UTI in 67.3% and 58.5% of diabetic males & females and 58.1% and 51.1% of non-diabetic males & females.

In the study conducted by Mario Bonadio et al the isolation rates of E.coli were: diabetics (males 32.5% vs females 54.1%) and non-diabetics (males 31.4% vs 58.2%).^[4]

The incidence of E.coli ESBL is higher in diabetics (60%) Vs non-diabetics (20%) which is almost similar to study conducted by Md. Hamzar et al in diabetics (50.6%) vs non-diabetics (9.5%).^[12]

We observed a higher isolation rate of *Pseudomonas* spp. in non-diabetic males than that in diabetic males (27.3% Vs 9.1%). Regarding the antimicrobial resistance profile of the uropathogens, we observed that the isolated *E.coli* strains were resistant at similar rates to ampicillin, norfloxacin in both diabetic and non-diabetic patients which is in agreement with Mario Bonadio et al. Considering the antimicrobial susceptibility, *E.coli* has maximum sensitivity to carbapenems in both diabetics(94%) and non-diabetics(96%). This is comparable to Md. Hamzar et al^[12] which showed that *E.coli* sensitivity was 100% in both diabetic and non-diabetic subjects.

CONCLUSION

Fever and Dysuria are the most common presenting symptoms of UTI in both diabetic and non-diabetics. An elevated glycosylated Hb correlates with occurrence of UTI. The predisposition of the diabetic to UTI, probably depend on the degree of glycemic control over a period of weeks to months. Prevalence of pyelonephritis is significantly higher in diabetics than non-diabetic subjects. *Escherichia coli* was the most frequent uropathogen responsible for UTI and recurrent UTI in both diabetics and non-diabetics. *Klebsiella* and *Enterococcus* were the other common organisms. *E.coli* and *Klebsiella* are most sensitive to carbapenem in both diabetic and non-diabetic subjects.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

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