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Original Research Article

Prospective Research to Compare Urinary Tract Infections Between Diabetics and Non-Diabetics

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Abstract

Aim: the aim of the present study to evaluate the urinary tract infections in diabetics and non-diabetics patients.

Methods: This prospective, comparative study was conducted in the Department of General Medicine, Vardhman institute of medical sciences, Pawapuri, Nalanda, Bihar, India. All patients were screened for UTI through a midstream 5-ml urinary sample. Urinary culture analysis, for identification of the pathogen, was performed only for patients who were found to be infective on urine microscopy. During the study period, 100 diabetic patients were recruited. For every diabetic patient, a non-diabetic patient was included.

Results: Among 100 patients in the diabetic group, there were 44 (44%) males and 56(56%) females. Their mean age was 57 ± 10 years. Non-diabetic patients were relatively younger with a mean age of 49 ± 11 years. There were more women (n = 63; 63%) than men (n = 37; 37%) in the non-diabetic group. In diabetes group, 20 (20%) patients were identified with culture positive UTI as compared to 10 (10%) participants in non-diabetic group. In both groups, UTI was more common in female gender. Diabetic group had an overall twice risk of UTI (p = 0.01; OR: 2.24; CI: 1.13, 3.81) and female gender in diabetic group had a risk of almost five times (p = 0.01; OR: 5.11; CI: 1.22, 21.16) that of the non-diabetic group of developing urinary tract infection. Almost 30% patients in the diabetic group with culture-proven UTI were asymptomatic as compared to only 10% in the non-diabetic group (p = 0.04; OR: 7.89; CI:

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0.82, 65.18). *E. coli* was the most commonly identified microorganism in both diabetic and non-diabetic groups. *P. aeruginosa* was identified in 15% of diabetic cases. Other organisms included *Klebsiella* species and *Enterobacter* species.
Conclusion: The frequency of UTIs is higher in the diabetic population as compared to their non-diabetic counterparts. UTIs are more common among females in both groups. Clinical presentation in the two groups is also similar.
Keywords: UTI, diabetics, microorganism

Introduction

Diabetics are more prone for infections than their nondiabetic counterparts. Infections tend to be more severe and complications are more frequent in diabetics compared to non-diabetics.
Urinary tract infection 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. The presence of diabetes predisposes to much more severe infections, especially in patients with poor diabetic control, acute ketoacidosis or diabetic complications such as nephropathy, vasculopathy and neuropathy. This asymptomatic infe3ction can lead to severe kidney damage and cause renal failure.[2]
Bacteriuria is more common in diabetics than in non-diabetics because of a combination of host and local risk factors.[2] 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.(3) 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 cells and diabetic monocytes/macrophages compared to cells of control. In general, a better regulation of diabetes mellitus 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 non-diabetic cells. This has been described for candida albicans. Possibly the carbohydrate composition of the receptor plays a role in this phenomenon.[3]

In wheat's review of the issue of infections and diabetes from 1980, 72% of 22 patients with emphysematous pyelonephritis, 80% of 19 patients with emphysematous cystitis, 57% of 250 patients with papillary necrosis, 36% of patients with prenephrotic abscess and 10% of 130 patients with metastatic infection had diabetes.[4]

Therefore, investigation of bacteriuria in diabetic patients by screening for urinary tract infection 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. However, controversies do exist with respect to incidence, prevalence and microbiological features between diabetic and non-diabetic patients.[5] Hence the study was planned to compare clinical, microbiological and predisposing features of UTI in diabetics and non-diabetics.

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Materials and Methods

This prospective, comparative study was conducted in the Department of General Medicine, Vardhman institute of medical sciences, Pawapuri, Nalanda, Bihar, India.

Methodology

Consecutive non-probability sampling technique was adapted. All patients of type II diabetes mellitus, of both genders and age 18 years and above, were recruited after informed consent. All patients were screened for UTI through a midstream 5-ml urinary sample. The presence of bacteria, positive leukocyte esterase, and white blood count (WBC) >5 per high power field (HPF) were taken as diagnostic for UTI. Pyuria was defined as WBC >10/HPF, and hematuria was defined as red blood cells >5/HPF. Urinary culture analysis, for identification of the pathogen, was performed only for patients who were found to be infective on urine microscopy. Clinical and demographic characteristics included in the study were as follows: age, gender, and HbA1c for both groups. For the diabetic group, duration of diabetes, diabetes-related complications, and the presence of diabetic kidney disease were also noted. Patients who had taken antibiotics within the last two weeks for any reason were not included in this study. Patients with anatomical and neurologic urinary tract abnormalities, pregnant women, cases of complicated UTI (including pylonephritis), and patients with acute and/or chronic renal failure were also excluded.

During the study period, 100 diabetic patients were recruited. For every diabetic patient, a non-diabetic patient was included. The non-diabetic control group was selected from the attendants of the diabetic group to align their sociodemographic characteristics. By the end of the study, there were 100 records in the diabetes group and 100 records in the non-diabetes group. Their data was managed using SPSS for Windows version 21.0 (IBM Corp., Armonk, NY). The mean and standard deviation were calculated for continuous variables such as age, duration of diabetes, and HbA1c levels. Frequency and percentages were calculated for categorical variables. The incidence of UTI was compared for the diabetic and non-diabetic groups. Chi-square was applied for comparison. *P*-value ≤0.05 was taken as significant. Odds ratio (OR) and confidence interval (CI) were calculated.

Results

Among 100 patients in the diabetic group, there were 44 (44%) males and 56(56%) females. Their mean age was 57 ± 10 years. Non-diabetic patients were relatively younger with a mean age of 49 ± 11 years. There were more women (*n* = 63; 63%) than men (*n* = 37; 37%) in the non-diabetic group. Demographic and clinical characteristics of both study groups are compared in Table .1

Table 1: Demographic and clinical characteristics of participants in the diabetic group (n = 100) and non-diabetic group (n = 100)

Patient Characteristics	Diabetic Group (n = 100)	Non-diabetic Group (n = 100)
Gender		
Male	44 (44%)	37 (37%)
Female	56 (56%)	63 (63%)
Age in years		
Mean	57 ± 10	49 ± 11
Less than 40 years	15 (15%)	29 (29%)
40-60 years	45 (45%)	36 (36%)

Above 60 years	40 (40%)	35 (35%)
Duration of diabetes in years		
Mean	8.1 ± 4.1	Not applicable
Less than 5 years	30 (30%)	
5-10 years	38 (38%)	
More than 10 years	32 (32%)	
Diabetic complications (any)		
Yes	46 (46%)	Not applicable
No	54 (54%)	
Diabetes-related kidney disease		
Yes	13 (13%)	Not applicable
No	87 (87%)	
Glycosylated haemoglobin A1c (%)		
Mean	8.1 ± 3.1	5.1 ± 1.5
Less than 7%	18 (18%)	100 (100%)
7%-8.5%	52 (52%)	Not applicable
More than 8.5%	30 (30%)	

In diabetes group, 20 (20%) patients were identified with culture positive UTI as compared to 10 (10%) participants in non-diabetic group. In both groups, UTI was more common in female gender. Diabetic group had an overall twice risk of UTI (p = 0.01; OR: 2.24; CI: 1.13, 3.81) and female gender in diabetic group had a risk of almost five times (p = 0.01; OR: 5.11; CI: 1.22, 21.16) that of the non-diabetic group of developing urinary tract infection (Table 2).

Table 2: Incidence of urinary tract infection in the diabetic group (n = 100) and non-diabetic group (n = 100)

	Diabetic Group (n = 100)	Non-diabetic Group (n = 100)	P-value	Odds Ratio	Confidence Interval
Total	20 (20%)	10 (10%)	0.01	2.24	1.13, 3.81
Male	2/20 (10%)	4/10 (40%)	0.01	0.3	0.05, 0.93
Female	18/20(90%)	6/10 (60%)		5.11	1.22, 21.16

Almost 30% patients in the diabetic group with culture-proven UTI were asymptomatic as compared to only 10% in the non-diabetic group (p = 0.04; OR: 7.89; CI: 0.82, 65.18). There was no other significant difference between the presentations of UTI in the two groups, as shown in Table.3

Table 3: Clinical and incidence of urinary tract infection in the diabetic group (n = 100) and non-diabetic group (n = 100)

Signs / Symptoms	Diabetic Group (n = 20)	Non-diabetic Group (n = 10)	P-value	Odds Ratio	Confidence Interval
No signs / symptoms	6 (30%)	1 (10%)	0.04	7.89	0.82, 65.18
Fever	13 (65%)	6 (60%)	0.83	0.85	0.3, 3.16
Dysuria	10 (50%)	6 (60%)	0.28	0.77	0.18, 1.81
Increased frequency (≥5/day)	7 (35%)	4 (40%)	0.80	0.83	0.28, 2.89
Dribbling	5 (25%)	3 (30%)	0.77	0.88	0.21, 3.14
Abdominal / flank pain	5 (25%)	3 (30%)	0.77	0.88	0.24, 3.34
Pyuria	4 (20%)	1 (10%)	0.31	2.2	0.35, 11.51
Vomiting	2 (10%)	1 (10%)	0.87	1.13	0.15, 4.25

Urinary retention	2 (10%)	1 (10%)	0.87	1.13	0.15, 5.25
Hematuria	1 (5%)	1 (10%)	0.88	1.13	0.08, 11.19

E. coli was the most commonly identified microorganism in both diabetic and non-diabetic groups. *P. aeruginosa* was identified in 15% of diabetic cases. Other organisms included *Klebsiella* species and *Enterobacter* species (Table.4).

Table 4: Microorganisms identified in the diabetic group (n = 20) and non-diabetic group (n = 10) on urine culture

Organisms	Diabetic Group (n = 20)	Non-diabetic Group (n = 10)	P-value	Odds Ratio	Confidence Interval
Escherichia coli	10 (50%)	7 (70%)	0.31	0.52	0.15, 1.88
Klebsiella species	3 (15%)	1 (10%)	0.51	1.56	0.4, 9.28
Enterobacter species	2 (10%)	1 (10%)	0.62	1.49	0.13, 15.52
Coagulation-positive Staphylococcus	1 (5%)	1 (10%)	0.45	0.42	0.05, 3.56
Candida albicans	1(5%)	----	Not applicable		
Pseudomonas aeruginosa	3 (15%)	----			

Discussion

This study compared the incidence of UTIs in demographically comparable groups of diabetic and non-diabetic individuals. There was an overall significantly higher incidence of UTIs in the diabetic group; these individuals had twice the risk as compared to non-diabetics. Females also showed a significantly higher incidence of UTIs in the diabetic group. Females had an overall five-time higher risk of developing UTI in the diabetic group. There were no stark differences in the clinical and microbiological profiles of these patients; however, the diabetic group showed significantly more patients with asymptomatic UTI.

This study has provided substantial evidence to the comparatively higher risk of UTI in diabetic patients. However, it has its limitations too. This study was conducted in the OPD and only included clinically stable outpatient cases; hence, many cases with complicated UTI must have been missed. This study did not include the antibiotic sensitivity profile for both groups.

Previous studies reported the incidence of UTI in Pakistani diabetic patients to be 50% to 53%.[6-8] These figures are higher than those obtained in our study (20%). In a Romanian study, the prevalence of UTIs in patients with DM was 12%.[9] An Indian study deduced the prevalence of asymptomatic bacteriuria to be significantly higher (28%) among diabetic patients as compared to non-diabetics (7.5%; $p = 0.001$).[10] Higher incidence of UTI among females in the diabetic group as wells as in the general population has been reinforced in various studies.[6-10] In a study that compared the pattern of UTI in diabetic and non-diabetic females, it was seen that uncontrolled diabetes was associated with increasing severity of UTI. *E. coli* was the most commonly isolated pathogen in both groups. *Candida* was only seen in diabetic females group.[11] *E. coli* remained the most common pathogen in both groups of this study. Only 5% of cases of *Candida* were reported in the diabetes group. *Pseudomonas* was also only reported in the diabetes group in this study. Diabetics individuals are in a immunosuppressed state, hence at a greater risk of contracting *Pseudomonas* infection. Compared to the incidence of *Pseudomonas* in this study (15%), other studies from Pakistan have reported varied incidence. Ijaz et al. reported that among diabetics, 72% urinary samples were positive

for *Pseudomonas;* Bashir et al. reported that 1% cases of *Pseudomonas* were isolated, and Zahra et al. 6% cases of *Pseudomonas* were isolated from non-diabetic urinary samples and none from the diabetic population.[6-8] In non-diabetic Pakistanis, 5% urinary samples were found to be positive for *Pseudomonas*[12] In an Indian diabetic sample of 651 culture-positive UTI, the frequency of *Pseudomonas* was 2.7%; similar to our study, *E. coli* was also the most commonly isolated pathogen (69%).[13] Asymptomatic pyuria was significantly more common in the diabetic group as compared to non-diabetic in this study (20% vs. 10%; $p = 0.031$). In an Indian study, asymptomatic bacteriuria was found in 40% of urinary samples in a diabetic population. Hematuria was reported in 4% of their samples, as compared to 5.7% in our diabetic samples. The most common isolate in their study was also E. coli.[14] In a Sudanese diabetic sample, the frequency of UTI was 19.5%. Asymptomatic bacteriuria was present in 21% of these patients.[15] Clinical presentation of UTI in both groups was comparable in our study. Similarly, no significant difference was seen in the clinical presentation in Aswani et al.[16] Even the frequency of asymptomatic bacteriuria was similar (30%) in both diabetic and non-diabetic groups in their analysis.[16] According to the Infectious Disease Society of America (IDSA) guidelines, diabetic patients should not be screened or treated for asymptomatic bacteriuria.[17] When clinical signs are present, UTIs are to be treated as per the culture and sensitivity report.

Conclusion

The frequency of UTIs is higher in the diabetic population as compared to their non-diabetic counterparts. UTIs are more common among females in both groups. Clinical presentation in the two groups is also similar. Asymptomatic bacteriuria is a more common entity in diabetic patients and does not require any treatment.

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