Association of Urinary Tract Infection with Diabetic Patients

Sudhir Chandra Jha[1], Kumud Kumar[2], Santosh Kumar[3]

[1]Associate Professor, Department of General Medicine, Darbhanga Medical College & Hospital, Laheriasarai Darbhanga, Bihar, India
Hospital, Laheriasarai Darbhanga, Bihar, India
[2]PG-Student, Department of General Medicine, Darbhanga Medical College & Hospital, Laheriasarai Darbhanga, Bihar, India
[3]PG-Student, Department of General Medicine, Darbhanga Medical College & Hospital, Laheriasarai Darbhanga, Bihar, India

Abstract

Background and Aims: The primary objective of the current study is to investigate the clinical, microbiological, and characteristic differences of urinary tract infections between diabetic patients and non-diabetic patients, as well as the influence of diabetes on the spectrum of URO pathogens and the antimicrobial resistance in patients with urinary tract infections.

Methods: The current research is being carried out at Department of General Medicine, Darbhanga medical College & Hospital, Laheriasarai Darbhanga, Bihar, India. during the months of 12 months. There are a total of 100 diabetics and 100 people who do not have diabetes in this study. An exhaustive inquiry and historical assessment was carried out. SPSS, a statistical tool, was used to do the final analysis on the data. The chi square test was used to compare the percentages of participants in the various groups, and the student t test was used to compare the means.

Results: The patients with diabetes had a mean age of 60.2+/-13.79 years, whereas the patients without diabetes had a mean age of 53.47+/-18.56 years. The majority of patients will first come with a fever. In both diabetes and non-diabetes, BPH was the most prevalent predisposing factor, and indwelling catheterization was the second most common; however, there was no statistically significant difference between the two. The majority of diabetic patients diagnosed with UTI (87.14 percent) had glyco HbA1c levels that were more than 6.5 percent, and this difference was statistically significant. In diabetics, the incidence of recurrent UTI is greater than in non-diabetic populations; nevertheless, there was no statistically significant difference between the two groups. In both diabetics and those without diabetes, the risk of recurrent UTI is greater in females. When compared with those who do not have diabetes, the prevalence of E. coli in diabetics is much greater. The antimicrobial resistance pattern in E. coli was the same in both diabetes and non-diabetic people, with the greatest sensitivity to meropenem and the least sensitivity to ampicillin, and there was no statistically significant difference between the two groups.

Conclusion: The presence of diabetes, inadequate glycemic management, fever, and female genital sex were the host variables that were shown to be related with urinary tract infections (UTIs). Age, length of diabetes, and type of diabetes therapy were not shown to have any link with one another. The presence of a urinary tract infection is correlated with an increased HbA1c. Escherichia coli, sometimes known as E. coli, was shown to be the most common

uropathogen. People who have diabetes as well as patients who do not have diabetes have comparable levels of uropathogens that are resistant to antibiotics.

Introduction

People who have diabetes are more likely to get infections than people who do not have diabetes. When compared with those who do not have diabetes, diabetics are more likely to get serious infections and more often experience consequences.

In diabetic individuals, the most significant and prevalent location of infection is urinary tract infection. At autopsy, diabetes individuals were shown to have a 5-fold higher prevalence of acute pyelonephritis than non-diabetics. [1] The majority of urinary tract infections in diabetes people remain asymptomatic. Diabetes predisposes to far more severe infections, particularly in individuals with poor diabetic control, acute ketoacidosis, or diabetic sequelae such nephropathy, vasculopathy, and neuropathy. This asymptomatic infection has the potential to cause serious kidney damage and renal failure.

Bacteriuria affects diabetics more than non-diabetics due to a combination of host and local risk factors. A variety of unusual urinary tract infection consequences, such as emphysematous pyelonephritis and emphysematous cystitis, are more prevalent among diabetics. [2]

In diabetic individuals, several abnormalities (low complement factor 4, lower cytokine response following stimulation) in humoral innate immunity have been observed. [3] However, the clinical significance of these observations is unknown. In terms of cellular innate immunity, most studies reveal that diabetes polymorphonuclear cells and diabetic monocytes/macrophages have lower functions (chemotaxis, phagocytosis, killing) than control cells. In general, improved diabetes mellitus control leads to an improvement in these cellular processes.

As a result, investigating bacteriuria in diabetic patients by screening for urinary tract infection is critical in order to correctly treat it and avoid the development of diabetic renal problems and, finally, serious renal damage and failure. [4]

But there are disagreements about the incidence, prevalence, and microbiological differences between diabetics and people who don't have diabetes. 514 diabetic outpatients and 405 non-diabetic controls were used to study the prevalence of bacteriuria, as well as the virulence and host factors of the bacteria. Researchers found that the number of diabetic women with bacteriuria (15/239, or 6.3%) was not significantly higher than the number of non-diabetic women with bacteriuria (8/236, or 3.4%). [5] Men with and without diabetes had the same rate, but it was lower than in women.

Hence the study was planned to compare clinical, microbiological and predisposing features of UTI in diabetics and non-diabetics.

Methods

This Prospective study duration 12 months. Detailed history including age, sex, occupation and symptomatology were taken. Detailed general and systemic clinical examination was done. 100 diabetics (58 females and 42 males) and 100 nondiabetics (52 females and 48 males) admitted in Department of General Medicine, Darbhanga medical College & Hospital, Laheriasarai Darbhanga, Bihar,

India. during the months of 12 months were studied randomly.

All proven diabetics (fasting venous glucose > 126 mg/dl and postprandial (2 hr.) venous glucose >200 mg/dl were included in the study irrespective of reason for admission. All patients with history of diabetes and those who are on treatment were also eligible for admission.

Inclusion criteria

Culture positive urinary tract infections

Exclusion criteria

Culture negative urinary tract infections, Age <18 years, Patients.

Controls were taken from patients admitted in hospital with comparable age and sex who were proven not be diabetic (absence of history of diabetes and anti-diabetic drugs and fasting blood sugar <110 mg/dl).

Investigation done in all patients included hemoglobin, total WBC count, differential count, ESR, urine for protein, sugar, ketones and microscopy.

A fasting, post prandial sugar and glycosylated hemoglobin was done for all diabetics. Diabetes was diagnosed by history of diabetes, intake of anti-diabetic drugs and newly detected diabetics

Urine culture and gram stain done using Blood agar plate, MacConkey agar plate (MAC) (or another selective/ differential media), anaerobic blood agar plate (for suprapubic, cystoscopy and nephrostomy specimens)

Patients with positive urine cultures underwent appropriate investigations in the form of ultrasound abdomen, X ray, and CT abdomen to look for the predisposing conditions and to aid in the clinical management

Data analysis

Data was analyzed using statistical package SPSS. The percentages in different categories were compared using chi square test and means were compared using student 't' test. A p value less than 0.05 was considered significant.

Observation

Table 1: Age distribution among diabetics and non-diabetics

Age distribution	Diabetics	Non-Diabetics
20-29 years	3	20
30-39 years	9	16
40-49 years	29	18
50-59 years	24	19
60-69 years	24	10
70-79 years	10	15
>80 years	1	2
Total	100	100
mean±SD	56.89±12.56	51.36±11.53

The mean age among diabetic and non-diabetic patients was 56.89±12.56 years and 51.36±11.53 years. Among 20-29 years there are 3% diabetics and 20% non-diabetics, 30-39 years there are 9% diabetics and 16% non-diabetics, 40-49 years there are 29% diabetics and 18% non-diabetics, 50-59 years there are 24% diabetics and 19% non-diabetics, 60-69 years there are 24% diabetics and 10% non-diabetics, 70-79 years there are 10% diabetics and 15% non-diabetics, among more than 80 years there are 1% diabetics and 2% non-diabetics.

Table 2: Symptoms among diabetics and non-diabetics. Symptoms

	Diabetes	Non diabetes	p-value
Fever	89	71	>0.05
vomiting	44	23	>0.05
dysuria	75	50	>0.05
Abdominal pain	40	25	>0.05
hematuria	8	4	>0.05
incontinence	26	15	>0.05

Fever is the most common presenting symptom. Fever is seen among 89% cases of diabetics and 71% cases of non-diabetics, dysuria in 75% of diabetics and 50% of non-diabetics. Vomiting in 44% of diabetics and 23% of non-diabetics, abdominal pain among 40% of diabetics and 25% of non-diabetics, incontinence among 26% of diabetics and 15% of non-diabetics.

Table 3: Isolation of different uropathogens in diabetes and non-diabetes.

Organism	Diabetes	Non-diabetes	p-values
E. coli	89	70	<0.05
Klebsiella	20	15	>0.05
Enterococcus	18	10	>0.05
Pseudomonas	3	10	>0.05
Acinetobacter	2	0	-
Citrobacter	2	1	-
Proteus	3	1	-
Coagulase negative *Staphylococcus*	2	3	-
Coagulase positive *Staphylococcus*	3	1	-
Candida	4	0	-

The presence of *E. coli* is significantly higher in diabetics compared to non-diabetics *E. coli* is seen among 89% diabetic patients and 70% among non-diabetic patients, *klebsiella* is seen among 20% diabetics and 15% non-diabetics, enterococcus is seen among 18% diabetics and 10% non-diabetics, pseudomonas is seen among 3% diabetics and 10% non-diabetics, *Acinetobacter* is seen among 2 % diabetics and 0 non diabetics.

Table 4: Complications of UTI.

Complication	Diabetes	Non-Diabetes	p Value
AKI	30	15	>0.05
Recurrent UTI	15	6	>0.05
Septicemia	16	29	>0.05
Renal papillary necrosis	2	0	>0.05

AKI as complication is seen among 30% of diabetics with 15% among non-diabetics, recurrent UTI is seen among 15% of diabetics and 6% of non-diabetics, septicemia is seen among 16% of diabetics and 29% of non-diabetics and renal papillary necrosis is seen among 2% of diabetics and 0% of non-diabetics.

The antimicrobial resistance pattern was similar in both diabetic and no-diabetic subjects in *E. coli* with maximum sensitivity to meropenem and least to ampicillin and there is no statistically significant difference. The antimicrobial resistance pattern was similar in both diabetic and no-diabetic subjects in *Klebsiella* with maximum sensitivity to

meropenem and least to ampicillin and there is no statistically significant difference. The antimicrobial resistance pattern was similar in both diabetes and non-diabetes with maximum susceptibility to linezolid, teicoplanin, vancomycin in *Enterococcus*. A higher rate of *Pseudomonas* in non-diabetic than diabetic therefore many of the non-diabetic patients had a history of a previous instrumentation of urinary tract. Amikacin has higher sensitivity among diabetics and netilmycin among non-diabetics for pseudomonas. Only 3 cases of *Acinetobacter* were isolated and all of them among diabetic patients and highest sensitivity is noted among cefoperazone sulbactum, meropenem, netilmycin and least sensitivity is for norfloxacin and ampicillin. 5 cases of coagulase positive staphylococcus were isolated. Among them 4 patients were diabetics and 1 patient were non-diabetic. 2 cases are MRSA isolates which are sensitive to vancomycin and linezolid. Among them 1 case was positive for MRSA carrier state. 5 cases of candida species were identified all in diabetes patients.

Discussion

The present study included 100 diabetic and 100 non-diabetic patients with culture positive urinary tract infections.

In this study, authors have tried to determine whether there are differences in the clinical and microbiological patterns in UTI and the antibiotic sensitivity patterns of the pathogens concerned with diabetic and non-diabetic patients.

There was no significant correlation between age of patient and the incidence of UTI in both diabetic and non-diabetic patients. A similar observation in this study (73.7 years in diabetics vs 72.7 years in non-diabetic subjects). [6]

UTIs are more common in type 2 DM than in type 1 DM. The small number of people with type 1 diabetes in this study makes it impossible to draw such a conclusion. [7]

We found a strong link between how long someone has had diabetes and how often they have bacteriuria. Every 10 years that a person had diabetes, the number of people who had bacteriuria went up by 1.9 times. [8,9,10] This is probably because people with long-term diabetes are more likely to have autonomic neuropathy, which makes it hard for the bladder to empty completely. But our study didn't find such a link, and the most people with diabetes (60%) were between 1 and 10 years old.

Several studies have looked into the link between Glyco HBA1C and the development of UTI. The correlation between asymptomatic bacteriuria and glycosylated Hb was looked at, and there was no statistically significant link between the amount of control over blood sugar and the UTI. He thought that people with UTI were more likely to have high blood sugar, but he didn't think that high blood sugar was a cause of UTI. [11,12,13]

Study on factors predisposing to *E. coli* UTI in diabetic population have noted that HBA1C >8.1% was associated with an increased risk for UTI. Our study supports the findings of chung. [14] In the study, recurrent UTI is seen among 15% of diabetics and 6% of non-diabetics.

The prevalence of *E. coli* is significantly higher in diabetics vs non-diabetics. The isolation rates of ECOLI was higher in both diabetics and non-diabetics in our hospital compared to study conducted by in diabetics (50.6%) vs non-diabetics (9.5%). [15,16]

The prevalence of fungal UTI in diabetic population varies depending on the patient subset under study being more common in patients with prolonged hospital stay, catheterization and prolonged parenteral antibiotic use. [17,18]

Conclusion: The host factors found to be associated with UTI are presence of diabetes, poor glycemic control, presence

of fever. An elevated HBA1C correlates with occurrence of UTI. *Escherichia coli* (*E. coli*) was the most frequent uropathogen. The resistance of uropathogens to antibiotics are similar in patients with and without diabetes and non-diabetes.

References

1. Robbins SL, Tucker Jr AW. The cause of death in diabetes: a report of 307 autopsied cases. New England J Med. 1944;231(26):865-8.
2. Paterson JE, Andriole VT, Bacterial urinary tract infections in diabetes. Infectious Diseases Clinics of North America. 1997;11(3):735-50.
3. Geerlings SE, Hopelman AI, Immune dysfunction in patients with diabetes mellitus. FEMS Immunol Med Microbiol. 1999;26(3-4);259-65.
4. Wheat LJ Infection and diabetes mellitus diabetic care 1980:187-97.
5. Brauner A, Flodin u, Hylander B, Ostenson CG. Bacteriuria, bacterial virulence and host Fctors in diabetic patients. Diabetic Med. 1993;10(6): 550-4.
6. Mario Bonadio, Silvia cosatarelli, giovanna Morelli and tiziana tarataglia Infectious diseases. 2006;6(7):17-28.
7. Zhanel GG, Nicolle LE, Harding GK. prevalence of asymptomatic bacteriuria and associated host factors in women with diabetes mellitus, the mantoba diabetic urinary infection study Group Infect Dis. 1995;21:316-22.
8. Bahl AL, Chugh RN, Sharma KB. Asymptomatic bacteriuria in diabetics attending a diabetic clinic. Indian J Med Scienc. 1970;24(1):1-6.
9. Keane EM, Boyko E, Reller LB, Hamman R. Prevalence of symptomatic bacteremia in subject with type 2 dm in san Luis valley of colrado diabetic care. 1988; 11:708-12.
10. O'sullivan DJ, Fitzgerald MG, Meynell MJ, Malins JM. Marin Urinary infection a comparative study in the diabetic and general population. Br Med J. 1961;1(5228):786-8.
11. Mittendorf R, Williams MA, Kass EH. Prevention of preterm delivery and low birth weight associated with asymptomatic bacteriuria. Clinical Infectious Diseases. 1992;14(4):927-32.
12. Geerlings SE, Stolk RP, Camps MJ, Netten PM, Hoekstra JB, Bouter PK, et al. asymptomatic bacteriuria might be considered a diabetic complication in women with diabetes Diabetic care 2000;23(8):744-9.
13. Schmitt JK, Fawcett CJ, Gullickson G. Asymptomatic bacteriuria and hemoglobin A1. Diabetes care. 1986;9(5):518-20.
14. Chin-chung tseng jiunn-jong wu ming-cheng wang host and bacterial virulence factor predisposing to upper and lower urinary tract infection Am J Kid Diseases. 2005; 46:1262-71.
15. Gorter KJ, Hak E, Zuithoff NP, Hoepelman AI, Rutten GE. Risk of recurrent acute lower urinary tract infections and prescription pattern of antibiotics in women with and without diabetes in primary care. Family practice. 2010;27(4):379-85.
16. Saber MD, Barai L, Haq JA, Jilan SA, 1, 2 Bangladesh J Med Microbiol. 2010;04(1):6-8.
17. Joshi N, Caputo GM, Weitekamp MR, Karchmer AW. Caputo karchmer, Infections in patients with diabetes mellitus N Eng J Med. 1999;341 (16):1906-12.
18. Sierra, D. R., Miranda, L. Y., Morales A, E. C., Jiménez González, A., & Caballero, A. D. Susceptibility of Enterococcus Faecalis to the Antibacterial Effect of Various Metabolites of the Mammea Americana Seed. Journal of Medical Research and Health Sciences, 2022;5(1):1658–1662.