A Clinical and Microbiological Profile of Urinary Tract Infection in Diabetes Mellitus Patients, a South India Perceptive

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ABSTRACT

Introduction: Asymptomatic bladder infection that is detected by a positive urine culture is also common among diabetes mellitus patient which progress to symptomatic infection and subsequent complication. Therefore it becomes essential to screen urinary tract infection in diabetes mellitus patient so that its progress to complication can be prevented. Hence present study has been designated to know the clinical, microbiological profile and antimicrobial sensitivity pattern of organism that causes UTI in diabetes mellitus patient.

Material and methods: Based on exclusion and inclusion criteria 100 patients were included in this study, A detailed history of the patient were taken with respect to duration of diabetes and its symptoms complication, type and treatment.

Result: Out of 100 patients 36 patients have bacteriuria and 64 patients were without bacteriuria. Patient with HbA1C% above 10, who were suffering from UTI were 43, out of them 21 having bacteria in urine. The P value was 0.0642 and chi-square statistic was 5.496, which is not significant. Regarding relation between FPG and UTI, those patient whose FPG was above 10, who were suffering from UTI were 43, out of them 21 having bacteria in urine. The P value was 0.0642 and chi-square statistic was 5.496, which is not significant. Regarding relation between FPG and UTI, those patient whose FPG was above 10, who were suffering from UTI were 43, out of them 21 having bacteria in urine. The P value was 0.0642 and chi-square statistic was 5.496, which is not significant.

Conclusion: Bacteriuria was more common in female then male and patient above 50 year of age are more affected then younger one. Patient with type 2 diabetes mellitus and treated with oral hypoglycaemic agent are effected more frequently. Bacteriuria was more common in patient whose glycosylated haemoglobin was more than 10% and fasting plasma glucose was more than 200mg/dl. Patients having neuropathy are more prone to UTI. Most common organism isolate were E.Coli and were sensitive to cephalosporins and aminoglycosides.

Keywords: Diabetes Mellitus, Bacteriuria, Urinary Tract Infection, Microbiological Profile

INTRODUCTION

Diabetes mellitus is a chronic disease that occurs; either when the pancreas is not able to produce sufficient insulin or body is not able to use the insulin it produces. The global prevalence of diabetes among adults over 18 yrs of age has risen from 4.7% in 1980 to 8.5% in 2014. Patient with diabetes mellitus are at higher risk of infection due to multiple abnormalities in the immune system. Patients are not only at higher risk of infection but also the course of infection is also more complicated than normal patients. Various factors are found to be responsible for abnormality in the immune system of diabetes mellitus patients. It has been found in various studies that there is deficiency of C4 compliment in diabetes mellitus. Secretion IL-1 and IL-6 are less by mononuclear cells and monocytes in diabetes mellitus patients. Increased formation of advanced glycyolysis end product reduce the expression of class I MHC and impair cell immunity. Chemotaxis of polymorphonuclear cells are also impaired, in addition to this, adherence phagocytes and killing ability of PMC are also compromised in diabetes mellitus patients. Autonomic neuropathy due to diabetes mellitus leads to dysfunction of bladder. These entire factors contribute to the pathogenesis of increase risk of urinary tract infection in diabetes mellitus patient. Asymptomatic bladder infection that is detected by a positive urine culture is also common among diabetes mellitus patient which progress to symptomatic infection and subsequent complication. Therefore it becomes essential to screen urinary tract infection in diabetes mellitus patient so that its progress to complication can be prevented. Hence present study has been designated to know the clinical, microbiological profile and antimicrobial sensitivity pattern of organism that causes UTI.
in diabetes mellitus patient. Primary objective of this study was to study the clinical pattern and risk factor of urinary tract infection and secondary objective to know the causative organism and sensitivity pattern of organism isolated.

**MATERIAL AND METHODS**

Present study was a prospective cross sectional study conducted in the department of general medicine from January 2017 to October 2019. Patients having history of diabetes with fast plasma glucose more than 126 mg/dl and post prandial plasma glucose more than 180mg/dl, with clinical and microbiological evidence of urinary tract infection were enrolled for this study.

**Exclusion criteria**

1. Catheterisation
2. Antibiotic use within 15 days
3. Anomalies of genitor urinary tract.

**Inclusion criteria**

1. Patient with DM
2. Both Sex
3. Symptom of UTI

Based on previous study considering confidence interval 95% power of the study 80% and simplification level of 5% the sample size was calculated to be 84. Before start of the study institutional ethics committee approval was taken and a written informed consent was taken from all patients before enrolling them for study.

**Method**

Based on exclusion and inclusion criteria 100 patients were included in this study. A detailed history of the patient were taken with respect to duration of diabetes and its symptoms complication, type and treatment. Regarding urinary tract infection, history was taken with respect to dysuria, burning, suprapublic pain; urgency, increased frequency and haematuria fever with chill rigor and vomiting suggestive of acute pyelonephritis. All patients were examined for sign of UTI like fever, pulse, BP, suprapubic tenderness costovertebral angle tenderness, examination of abdomen. Under all aspartic condition mid stream urine was collected and sample was sent to laboratory for routine examination and culture. Culture of urine, Mac-conkey’s agar, blood agar and chocolate agar was used and culture urine sample were incubated at 37°C for 24 to 48 hour and isolated organism were identified by colony characteristic, lactose fermentation and biochemical analysis. Kerby-Bauer disk diffusion test was used for antibiotic sensitivity of the organisation.

**Complete blood count, fasting and post prandial plasma glucose was done and USG of the patient done to know the residual volume and any other pathology associated.**

**STATISTICAL ANALYSIS**

Data was collected on excel sheet and analysed by SPSS software version 17. For analysis of data chi-square test and compared t-test was used. The p-value less than 0.05 were considered statistically significant.

**RESULT**

During this one year ten month period 100 patients were enrolled in this study based on exclusion and inclusion criteria. Out of 100 patients 36 patients have bacteriuria and 64 patients were without bacteriuria.

As per table 1 regarding relation between the patients of urinary tract infection with bacteriuria and without bacteriurea, in relation to sex, out of 50 male, 16 have UTI with bactriurea and 34 having UTI without bactriurea. In female patients, 20 have bactriurea and 30 have UTI without bactriurea. This finding is not significant statistically as P value is 0.4046. In present study, 4 patients having bactriurea were below 40yrs of age and 4 patients have UTI without bactriurea were below 40 years old, and 36 patients had UTI without bactriurea.
As per selection criteria one hundred patients were enrolled for present study, out of them 36 patients have bacteriuria and 61 to 70 yrs were 32, out of that 12 have bacteriuria and 20 were without bacteriuria. Patients with UTI between 61 to 70 yrs were 32, out of that 12 have bacteriuria and 20 were without bacteriuria. Total ten patients were above 70 yrs of age out of that 2 having bacteriuria and UTI and 8 having UTI without bacteriuria. Regarding type of diabetes and its relation to UTI, out of 100 patients 14 were diagnosed as type-1 out of that 8 having UTI with bacteriuria and 6 have UTI without bacteriuria. Type 2 diabetes patients were 64, out of that 26 were suffering from UTI and having bacteriuria, and, 58 having UTI without bacteriuria. In relation to type of treatment 14 patients who were treated with insulin have developed UTI out of that 8 have bacteriuria and 6 have not bacteriuria. Oral hypoglycemic were used by 76 patients having UTI out of that 24 patient have bacteriuria in remaining patient there was no bacteriuria. Insulin and oral hypoglycemic agent both were used in 10 patients out that 4 patients have bacteriuria. This finding was not significant statistically as P value was 0.1799. Patient with HbA1C value from 6.6% to 10% were 52. Out of than 14 have bacteriuria and, 38 have no bacterium in urine. Ischemic heart diseases was present in 24 patients who has diabetic food ulcer as well. Out of than 18 have bacterium in urine and 6 were without bacteriuria. Retinopathy was present in 24 patients with UTI out of then, 14 have bacteriuria and 10 have no bacteria in urine. Ischemic heart diseases was present in 24 patients with UTI, out of that 10 have bacteria in urine and 14 have no bacteriuria. As per table-2, regarding relation between complication of DM and urinary tract infection neuropathy was present in 58 patients. Out of that 24(66.67%) patient have bacteriuria and 34(53.12%) patient have no bacteria in urine. Nephropathy was present in 20 patients with UTI out of that 12 have bacteria and 8 patients have no bacteria in urine. There were 24 patients with UTI who has diabetic food ulcer as well. Out of than 18 have bacteria in urine and 6 were without bacteriuria. As per table -2, regarding relation between complication of DM and urinary tract infection neuropathy was present in 58 patients. Out of that 24(66.67%) patient have bacteriuria and 34(53.12%) patient have no bacteria in urine. Nephropathy was present in 20 patients with UTI out of that 12 have bacteria and 8 patients have no bacteria in urine. There were 24 patients with UTI who has diabetic food ulcer as well. Out of than 18 have bacteria in urine and 6 were without bacteriuria. Retinopathy was present in 24 patients with UTI an out of them, 14 have bacteriuria and 10 have no bacteria in urine. Ischemic heart diseases was present in 24 patients with UTI, out of that 10 have bacteria in urine and 14 have no bacteriuria. From table-3, E coli was found in 16 patients that is (44.45%). Klebsiella SPP was found in 8 patients that is (22.23%). Out of 36 bacteriuria patients, 4 patients have Enterococcus in urine, pseudomonas was isolated from 4 sample that is (11.22%). Acinetobacter was present in two samples and Candida was isolated from renaming two samples. Regarding resistance to antimicrobial among organism isolated as per table-3, 10 out of 18 E. Coli isolated were sensitive to fluoroquinolones, 6 were sensitive to pipercilline, and, 12 were sensitive to pipercillin + tazobactam. Sensitivity to meropenem was found in 14 samples. Klebsiella SPP isolated was sensitive to meropenen, imipinam, ceftriaxone, ceftazidime, aminoglycosides, pipercillin and Fluoroquinolones. Enterococcus were sensitive to imipinam and linazolid. Pseudomonas was sensitive to Fluoroquinolones, imipinam, meropenen. Acinatobactar were sensitive to aminoglycosides.

**DISCUSSION**

As per selection criteria one hundred patients were enrolled for present study, out of them 36 patients have bacteriuria

| Complications | With bacteriuria | Without bacteriuria |
|---------------|-----------------|---------------------|
| Neuropathy    | 24(66.6%)       | 34(53.12%)         |
| Nephropathy   | 12(33.34%)      | 8(12.5%)           |
| Diabetic foot | 18(50%)         | 6(9.37%)           |
| Retinopathy   | 14(38.9%)       | 10(15.62%)         |
| IHD           | 10(27.8%)       | 14(21.8%)          |

**Table-2: Relation between complication of diabetes mellitus and UTI**

| Bacteria       | Number | %    |
|----------------|--------|------|
| E.coli         | 16     | 44.45|
| Klebsiella SSP | 8      | 22.23|
| Enterococcus   | 4      | 11.12|
| Pseudomonas    | 4      | 11.12|
| Acinetobacter  | 2      | 5.5  |
| Candida        | 2      | 5.56 |

**Table-3: frequency and type of organism isolated.**

| E.coli | Klbsiella SSP | Enterococcus | Pseudomonas | Acinetobactaria |
|--------|--------------|--------------|-------------|-----------------|
| 10     | 4            | 1            | 2           | 1               |
| 4      | 2            | 1            | 1           | 0               |
| 6      | 2            |              |             |                 |
| 6      | 4            |              |             |                 |
| 10     | 5            |              | 1           | 1               |
| 12     | 4            | 1            | 3           | 1               |
| 14     | 4            |              | 3           | 1               |
| 13     | 6            | 3            | 3           | 1               |
|       |              |              |             |                 |
| 2      | 2            |              |             |                 |

**Table-4: Sensitivity to antimicrobial among organism isolated.**

40 yrs of age. Twenty two patients were between 41 to 50 yrs of age out of that 8 patients have UTI with bacteriurea and 14 patients have UTI without bacteriuria. Number of patients between 51 to 60yrs were 28, out of that 10 have bacteriurea 18 having UTI without bacteriurea. Patients with UTI between 61 to70yrs were 32, out of that 12 have bacteriurea and 20 were without bacteriurea. Total ten patients were above 70 yrs of age out of that 2 having bacteriurea and UTI and 8 having UTI without bacteriurea. Regarding type of diabetes and its relation to UTI, out of 100 patients 14 were diagnosed as type-1 out of that 8 having UTI with bacteriuria and 6 have UTI without bacteriurea. Type 2 diabetes patients were 64, out of that 26 were suffering from UTI and having bacteriuria, and, 58 having UTI without bacteriuria. In relation to type of treatment 14 patients who were treated with insulin have developed UTI out of that 8 have bacteriuria and 6 have not bacteriuria. Oral hypoglycemic were used by 76 patients having UTI out of that 24 patient have bacteriuria in remaining patient there was no bacteriurea. Insulin and oral hypoglycemic agent both were used in 10 patients out that 4 patients have bacteriurea. This finding was not significant statistically as P value was 0.1799. Patient with HbA1C value from 6.6% to 10% were 52. Out of than 14 have bacteriuria and, 38 have no bacterium in urine. Ischemic heart diseases was present in 24 patients who has diabetic food ulcer as well. Out of than 18 have bacteria in urine and 6 were without bacteriuria. Retinopathy was present in 24 patients with UTI an out of them, 14 have bacteriurea and 10 have no bacteria in urine. Ischemic heart diseases was present in 24 patients with UTI, out of that 10 have bacteria in urine and 14 have no bacteriuria. As per table-2, regarding relation between complication of DM and urinary tract infection neuropathy was present in 58 patients. Out of that 24(66.67%) patient have bacteriuria and 34(53.12%) patient have no bacteria in urine. Nephropathy was present in 20 patients with UTI out of that 12 have bacteria and 8 patients have no bacteria in urine. There were 24 patients with UTI who has diabetic food ulcer as well. Out of than 18 have bacteria in urine and 6 were without bacteriuria. Retinopathy was present in 24 patients with UTI an out of them, 14 have bacteriurea and 10 have no bacteria in urine. Ischemic heart diseases was present in 24 patients with UTI, out of that 10 have bacteria in urine and 14 have no bacteriuria. From table-3, E coli was found in 16 patients that is (44.45%). Klebsiella SPP was found in 8 patients that is (22.23%). Out of 36 bacteriuria patients, 4 patients have Enterococcus in urine, pseudomonas was isolated from 4 sample that is (11.22%). Acinetobacter was present in two samples and Candida was isolated from renaming two samples. Regarding resistance to antimicrobial among organism isolated as per table-3, 10 out of 18 E. Coli isolated were sensitive to fluoroquinolones, 6 were sensitive to pipercilline, and, 12 were sensitive to pipercillin + tazobactam. Sensitivity to meropenem was found in 14 samples. Klebsiella SPP isolated was sensitive to meropenen, imipinam, ceftriaxone, ceftazidime, aminoglycosides, pipercillin and Fluoroquinolones. Enterococcus were sensitive to imipinam and linazolid. Pseudomonas was sensitive to Fluoroquinolones, imipinam, meropenen. Acinatobactar were sensitive to aminoglycosides,
and 64 patients have UTI without bacteriuria. This finding is supported by the work of Kalpana D.V. et al and Viswanath et al. Bacteriuria was more common in female than male but it was not significant statistically. This finding is supported by the work of Bissong ME et al. Urinary that infection is common between 50 to 70yrs of age and UTI without bacteriuria is more common than bacteriuria. This is supported by the work of Banerjee m et al. We have observed that UTI is common with type-2 Dm then type-1 and is associated with oral therapy more commonly. But this finding is not significant statistically which corroborates with the study of Nitzan o et al.

Regarding glycemic control and UTI with bacteriuria, patients with glycoylated haemoglobin from 6.6% to 10% and above have more incidence of bacteriuria. Similar patient with FPG above 200 have UTI and bacteriuria 111mg/dl. This finding is not significant statistically. Our finding is supported by the work of lenher sm et al. Regarding complication of diabetes mellitus and urinary tract infection with, or without bacteria, diabetics neuropathy, detroser instability and urothelial dysfunction is major cause of UTI, out of bacteriuria patients 66% has nephropathy and in without bacteriuria group 53.12% has nephropathy. This finding is supported by study of Golbidis et al. Out of 100 patient 20 have nephropathy, and bacteriuria is more common, this finding corroborates with the study of Zhanhel 64 et al and Papazafropoulou A et al(16,17)

Bacteriuria was common finding in patients with other complication of diabetes also, that is diabetic foot, retinopathy and IHD. In diabetic foot and retinopathy patient bacteriuria was more common and in IHD patient UTI without bacteriuria was more common. This finding is supported by the work of Vejlsgaard R et al. In present study out of 36 patients with bacteriuria, most common organism isolated was E.coli followed by Klebsiella. Other organisms isolated were Acinatobactor, pseudomonas, Enterococci and Candida. This finding is supported by the work of Kumar R et al but Kiranmala K et al has found that Enterococcus is second most common organism after E.coli. Most of the E.coli were sensitive to meropenem, imipiname and pipercarilin, Klebsiella were also sensitive to cefazidime, meropenem, pipercarilin, but there is variation in the sensitivity pattern for antimicrobial agent by various author. Gutema T et al has reported that E.coli was highly sensitive to Ceftriaxone and Klebsiella was highly sensitive to Ceftriaxone. Mama M et al has reported that E.Coli are highly sensitive to amoxicilin and chlorphenicol but Klebsiella was sensitive to trimethoprim and erythromyc.

CONCLUSION

To conclude bacteriuria was more common in female then male and patient above 50 year of age are more affected then younger one. Patient with type 2 diabetes mellitus and treated with oral hypoglycemic agent are effected more frequently. Bacteriuria was more common in patient whose glycoylated haemoglobin was more than 10% and fasting plasma glucose was more than 200mg/dl. Patients having neuropathy are more prone to UTI. Most common organism isolate were E.Coli and were sensitive to cephalosporins and aminoglycosides.

REFERENCES

1. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. Part 1: Diagnosis and Classification of Diabetes Mellitus (WHO/NCD/ NCS/99/2). Geneva: World Health Organization; 1999.
2. Sarwar N, Gao P, Seshasai SR, et al. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. Emerging Risk Factors Collaboration. Lancet. 2010; 26;375(1):2215-2222
3. Casqueiro J, Casqueiro J, Alves C. Infections in patients with diabetes mellitus: A review of pathogenesis. Indian J Endocr Metab [serial online] 2012;16(3):27-36.
4. Suzanne E. Geerlings, Andy I.M. Hoepelman, Immune dysfunction in patients with diabetes mellitus (DM), FEMS Immunology & Medical Microbiology 1999;26(3-4):259–265.
5. Valerius NH, Ef C, Hansen NE, Karle H, Nerup J, Saeberg B, Sørensen SF. Neutrophil and lymphocyte function in patients with diabetes mellitus. Acta Med Scand. 1982;216(6):463–7.
6. Hosking DJ, Bennett T, Hampton JR. Diabetic autonomic neuropathy,Diabetes. 1978; 27(10):1043–55.
7. Aswani SM, Chandrashekar U, Shivashankara K, Pruthvi B. Clinical profile of urinary tract infections in diabetics and non-diabetics. Australas Med J. 2014;7(1):29–34.
8. Jan Haudicke, Kirby-Bauer Disk Diffusion Susceptibility Test Protocol, American Society for Microbiology © 2016, Tuesday, 08 December 2009.
9. Kalpana Devi Venkatesan, Senthil Chander, Karthiga Loganathan, Kalavathy Victor. Study on asymptomatic bacteriuria in diabetic patients. International Journal of Contemporary Medical Research 2017;4(2):480–483.
10. Viswanath S, Sarda R, D’Souza AO, Mukhopadhyay C. Asymptomatic Bacteriuria among patients with Diabetes mellitus at a tertiary care center. National Journal of Laboratory Medicine. 2013;2(6):16-19.
11. Bissong ME, Fon PN, Tabe-Besong FO, Akenji TN. Asymptomatic bacteriuria in diabetes mellitus patients in Southwest Cameroon. Afr Health Sci. 2013;13(3):661–666.
12. Banerjee M, Majumdar M, Kundu PK, Maisnam I, Mulkerjee AK. Clinical profile of asymptomatic bacteriuria in type 2 diabetes mellitus: An Eastern India perspective. Indian J Endocr Metab [serial online] 2019 2019;23(5):293-7.
13. Nitzan O, Eliai M, Chazan B, Saliba W. Urinary tract infections in patients with type 2 diabetes mellitus: review of prevalence, diagnosis, and management. Diabetes Metab Syndr Obes. 2015;8(1):129–136.
14. Lenherr SM, Clemens JJ, Bragett BH, et al. Glycemic Control and Urinary Tract Infections in Women with Type 1 Diabetes: Results from the DCCT/EDIC. J Urol. 2016;196(4):1129–1135.
15. Golbidi S, Laher I. Bladder dysfunction in diabetes mellitus. Front Pharmacol. 2010;1:136. Published 2010
16. Zhanel GG, Harding GKM, Guay DRP. Asymptomatic Bacteriuria: Which Patients Should Be Treated? Arch Intern Med. 1990;150(7):1389–1396.
17. Papazafiropoulou A, Daniil I, Sotiropoulos A, et al. Prevalence of asymptomatic bacteriuria in type 2 diabetic subjects with and without microalbuminuria. BMC Res Notes. 2010;3(5):169.
18. Vejlsgaard, R. Studies on urinary infection in diabetics. I. Bacteriuria in patients with diabetes mellitus and in control subjects. Acta Med Scand 1966;179(4):173–182.
19. Kumar R, Kumar R, Perswani P, et al. Clinical and Microbiological Profile of Urinary Tract Infections in Diabetic versus Non-Diabetic Individuals. Cureus 2019;11(8): e5464.
20. Kiranmala K, Johnson R, Savio J, Idiculla J. Microbiologic profile and clinical practices in urinary tract infections in a tertiary care center in Southern India. J Family Med Prim Care 2019;8(5):2888–92.
21. Gutema T, Weldegebreal F, Marami D, Teklemariam Z. Prevalence, Antimicrobial Susceptibility Pattern, and Associated Factors of Urinary Tract Infections among Adult Diabetic Patients at Metu Karl Heinz Referral Hospital, Southwest Ethiopia. Int J Microbiol. 2018;2018:7591259.
22. Mama M, Manilal A, Gezmu T, Kidanewold A, Gosa F, Gebresilasie A. Prevalence and associated factors of urinary tract infections among diabetic patients in Arba Minch Hospital, Arba Minch province, South Ethiopia. Turk J Urol. 2018;45(1):56–62.

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