Original Research Article

Prevalence of urinary tract infection in type 2 diabetic patients at Government Hospital, Chengalpattu District

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Abstract

Introduction: Diabetes is a polygenic disease characterized by abnormally high glucose levels in the blood. There is evidence that patients with diabetes have an increased risk of Urinary Tract Infections (UTIs). UTI is the most common bacterial infection in diabetic patients. They are also more often caused by resistant pathogens. Various impairments in the immune system, poor metabolic control, and incomplete bladder emptying due to autonomic neuropathy may all contribute to the enhanced risk of urinary tract infections in these patients.

The aim of the study: To determine the clinical characteristics, risk factors, causative organisms and antimicrobial susceptibility in diabetics.

Materials and methods: This was an observational study conducted in the medical unit of a tertiary care hospital over a period of 6 months. A total of 100 type 2 diabetic subjects were studied. History, clinical examinations, and the duration of diabetes were recorded in all patients at admission. Diabetes was diagnosed based on the WHO criteria. An immunoturbidimetric method was used to estimate glycosylated hemoglobin (HbA1CDiagnosis of UTI was made from Midstream urine samples of patients if the urine cultures have>103 to >105 colony forming units (CFU)/mL of a pathogen. A pure culture of *Staphylococcus aureus* was considered to be significant regardless of the number of CFUs.

Results: Gram-negative bacilli were isolated from 129 (87.2%) patients which included E. coli in 75 (50.7%), Klebsiella in 30 (20.3%), Pseudomonas species in 12 (8.1%) and Citrobacter in 12 (8.1%). Gram-positive cocci were responsible for UTI in 15(10.1%) of subjects including Enterococcus in 13 (8.9%) and Staphylococcus in 2 (1.3%). Gram-negative bacilli including E. coli, the Klebsiella species,

Pseudomonas and Citrobacter had a good response to piperacillin-tazobactam, cefoperazone-sulbactam, imipenam, and amikacin. Gram-positive cocci (Enterococcus and Staphylococcus) responsible for UTI showed good susceptibility to vancomycin (81 and 94% respectively) but a high resistance to ciprofloxacin and tetracyclines (68 and 57% respectively).

Conclusion: There is no indication to treat diabetic patients with asymptomatic bacteriuria. *Escherichia coli* is the most common isolate in the community and hospital-acquired infections in non-diabetics, while *Escherichia coli* was common in community-acquired infection and *pseudomonas* was the predominant isolate in hospital-acquired the infection in diabetics.

Key words

Diabetes Mellitus, Urinary Tract Infection, *Escherichia Coli,* Ciprofloxacin, Vancomycin.

Introduction

Urinary tract infections (UTIs) have been associated with diabetes for over a century [1]. Asymptomatic bacteriuria, acute pyelonephritis and the complications of UTI are reported to be more common in patients with diabetes [1]. During the course of a lifetime with diabetes, UTIs would be ranked among the top ten concurrent or complicating illnesses by most experts and patients. [2]. Diabetes is one of the top ten causes of death in the world and this fact is due especially to its complications. With the growing number of diabetic patients, the prevalence of urinary tract infections has also increased [3]. Hyperglycemia and hypertension is the major risk factors for initiation of chronic kidney disease but other factors, such as repeated episodes of acute kidney injury (infections, drugs, or nephrotoxins) can also contribute to its progression [4]. In diabetic patients, it is generally accepted that infections are frequent causes of morbidity and mortality. Immunologic defects contribute to the increased risk for infection: impaired neutrophil function, low levels of prostaglandin E, thromboxane B2, leukotriene B4, decreased T cell-mediated immune response, Other conditions such as incomplete bladder emptying due to autonomic neuropathy and high glucose concentration in the urine allow urinary colonization by microorganisms [5]. Diabetic patients are at a high risk of development of UTIs, so it is recommended that special attention is paid to them especially for the management of bacterial UTIs [4]. Various risk factors such as sexual intercourse, age, duration of diabetes, glycemic control, and complications of diabetes are associated with UTI [5]. Hyperglycemia facilitates the colonization and growth of variety of organisms [6].

Antimicrobial therapy should be guided both by in vitro sensitivity and clinical response. Resistance pattern for antibiotics in diabetic patients differ from non-diabetic patients [7].

Materials and methods

This was an observational study conducted in Chengalpattu District for a period of 8 months from August 2017 to March 2018. A total of 100 patients with type 2 diabetic subjects were studied during the period. Written informed consent was obtained from all the study subjects. History, duration of diabetes and clinical examinations, were recorded in all patients at admission. Diabetes was diagnosed based on the who criteria.6 an immunoturbidimetric method was used to estimate glycosylated hemoglobin (hba1c%).

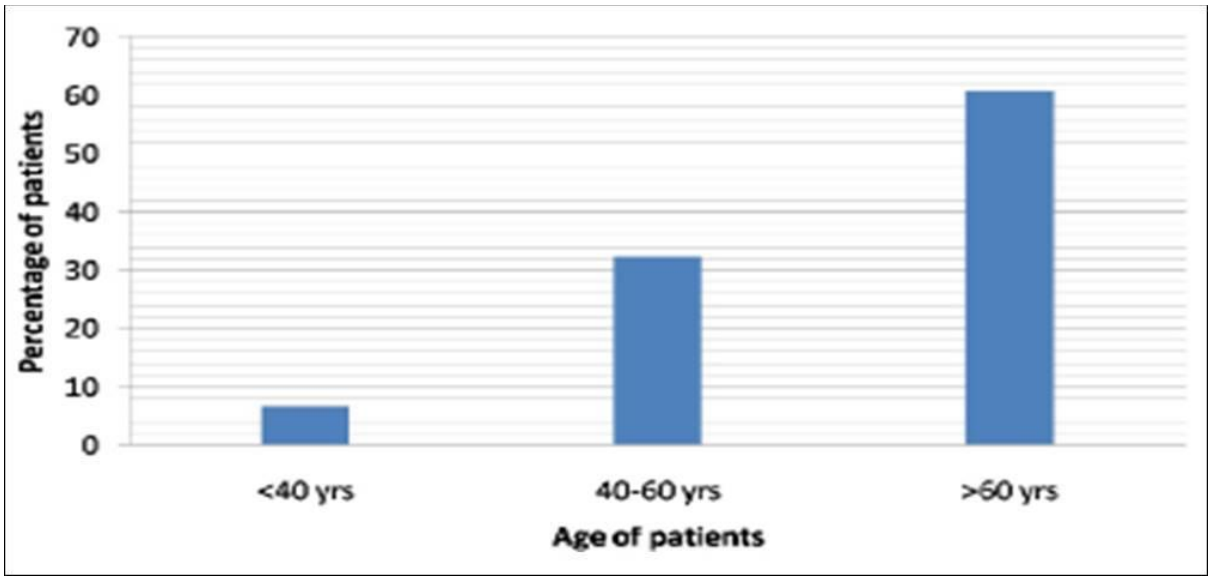
Diagnosis of UTI was made from midstream urine samples of patients if the urine cultures have>103 to >105 colony forming units (cfus)/ml of a pathogen. A pure culture of *Staphylococcus aureus* was considered being significant regardless of the number of cfus. Presumptive Identification of Uropathogens from Urine Samples was done. All urine samples were plated with 100 µl of urine sample using standard pour plate technique on Hi Chrome UTI Agar

(Himedia Pvt. Ltd., India) and incubated at 37 °C overnight for visible growth. Urine samples showing colony count more than 10,000Cfu/ml was considered to be significant for UTI. UTI isolates were identified following standard biochemical tests. Results were not considered for more than three clinical isolates obtained on isolation and the sample was considered to be contaminated. SPSS (Statistical Package for the Social Sciences) was used for data analysis. Chi-square test was applied to find the significance of the difference between two proportions and a P value of less than 0.05 was considered to be statistically significant.

Results

This observational study was conducted in the patients who were admitted to the medical ward of a tertiary care hospital in Chengalpattu District for a period of 6 months. Among the 100 diabetic patients, 28 patients had pus cells in urine but 72 patients had an insignificant colony count. The male to female ratio was 0.54:1.00. Females with diabetes had a higher prevalence of urinary tract infection than men ($\chi 2$ = 10.4303, P 0.00124) which was statistically significant. The majority patients 105 (72.4%) were symptomatic at presentation. Age and sex distribution were as per **Graph – 1** and **Graph – 2**.

Graph – 1: Age distribution of urinary tract infection patients with diabetes.



Graph - 2: Sex distribution of urinary tract infection patients with diabetes.

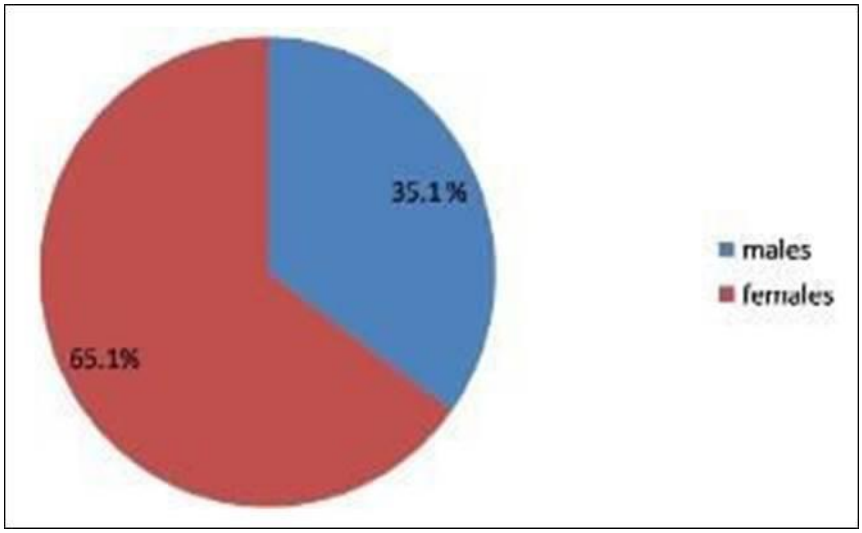
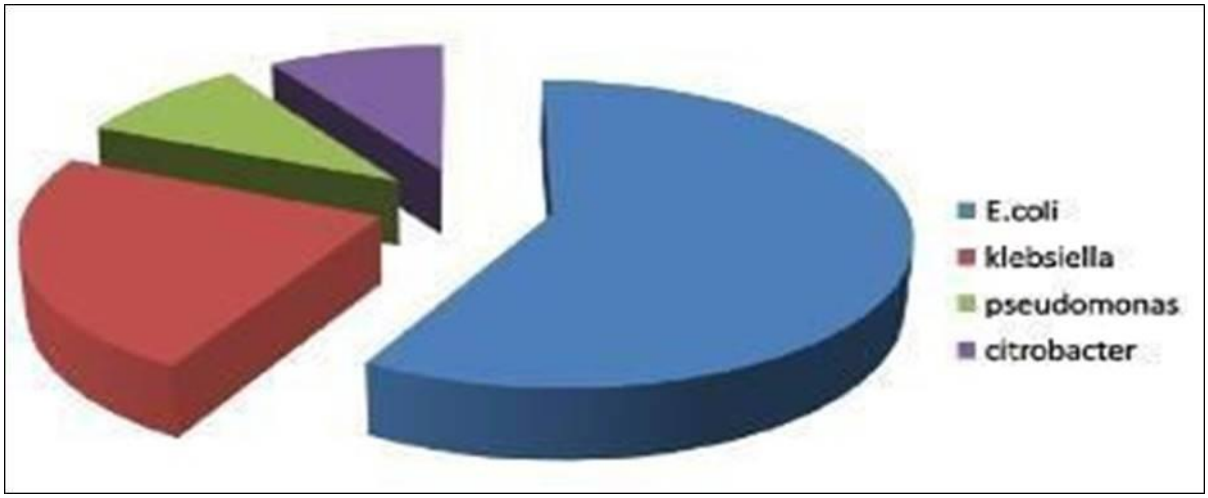


Figure - 3: Distribution of gram-negative bacilli causing urinary tract infection in diabetes.



Gram-negative bacilli were isolated from 129 (87.2%) patients which included *E. coli* in 75 (50.7%), *Klebsiella* in 30 (20.3%), *Pseudomonas* species in 12 (8.1%) and *Citrobacter* in 12 (8.1%) (Gram-positive cocci were responsible for UTI in 15 (10.1%) subjects including enterococcus 13 (8.9%) and staphylococcus in 2 (1.3%). *Candida* was isolated from 4 (2.7%) patients (**Graph – 3**).

E. Coli species was found sensitive to piperacillin-tazobactam combination in 55 (73.3%), ceftazidime in 40 (53.3%), cefoperazone-sulbactam in 59 (78.7%), imipenam in 68 (90.7%), amikacin in 60 (80%) and ciprofloxacin in 30 (40%) subjects studied. *Klebsiella* was found sensitive to piperacillin-tazobactam combination in 17 (56.7%), ceftazidime in 12 (40%), cefoperazone - sulbactamin 19 (63.3%), imipenamin 24 (80%), amikacin in 21 (70%) and ciprofloxacin in 10 (33.3%) subjects studied. *Pseudomonas* and *Citrobacter* species were found sensitive to piperacillin-tazobactam (86 and 94% respectively), imipenam (89 and 97% respectively) and amikacin (83 and 79% respectively) in the majority of the subjects studied. Gram-positive cocci enterococcus and staphylococcus responsible for UTI showed good susceptibility to vancomycin (81 and 94% respectively) but a high resistance to ciprofloxacin and tetracyclines (68 and 57% respectively).

Discussion

Acute pyelonephritis is a common presentation of UTI in patients with diabetes. During the pre-antibiotic era, 7.6% of 307 autopsied patients with diabetes died pyelonephritis compared to 1.6% of 2000 non-diabetic patients, and pyelonephritis ranked sixth in ‘cause of death [8]. The increased risk of acute pyelonephritis diabetes had not been quantitated until recently. The role of the urinary catheter as a risk factor for acquisition of UTI was clearly confirmed in our study in both diabetics and-diabetics [9]. It is advisable that indwelling urinary catheters should be inserted only when absolutely necessary, removed as soon as possible and insertion of catheters should be performed by properly trained staff using aseptic techniques [10]. Differentiation between colonization and infection are very important as patients with indwelling urinary catheters are liable to develop repeated episodes of bacteriuria and this may result in repeated administration of antibiotics with the emergence of highly resistant bacteria. [11]Gram-negative enteric organisms commonly cause urinary tract infections, such as *E. coli*, the *Klebsiella* species, *Pseudomonas* and the *Proteus* species.

Gram-negative bacilli were isolated from 129 (87.2%) patients which included *E. coli* in 75 (50.7%), *Klebsiella* 30 (20.3%), *Pseudomonas* species in 12 (8.1%) and *Citrobacter* 12 (8.1%). Gram-positive cocci were responsible for UTI in

15 (10.1%) of subjects including Enterococcus in 13 (8.9%) and *Staphylococcus* in 2 (1.3%) [12]. Thus in our study Gram- negative bacilli were found to be associated with the majority of the cases of UTI. *E. coli* was the most commonly grown organism (64.3%), followed by *Staphylococcus aureus* (21.4%), and *Klebsiella pneumonia* (14.3%) in an Indian study [13]. Appropriate antibiotic therapy with effective diabetic management is prudent in diabetic patients with UTI. The higher incidence of complications and involvement of upper urinary tract makes the management of UTI in diabetic patients difficult. Knowledge regarding the local sensitivity pattern of the infecting organisms is essential for proper selection of antibiotics [14]. We found that gram-negative bacilli including *E. coli*, the *Klebsiella* species, Pseudomonas and *Citrobacter* had a good response to piperacillin-tazobactam, cefoperazone-sulbactam, imipenam, and amikacin. Our patients with gram-negative bacilli UTI had an increased resistance to ampicillin and fluoroquinolones. Gram-positive cocci like Enterococcus and *Staphylococcus* responsible for UTI showed good susceptibility to vancomycin (81 and 94% respectively) but a high resistance to ciprofloxacin and tetracyclines (68 and 57% respectively) in our study group. In an Indian study amongst the Gram-positive isolates, *Enterococcus faecalis* was the most commonly isolated organism with 3.2 percent resistance to vancomycin [15]. Staphylococcus isolates were highly resistant to ciprofloxacin and tetracyclines but showed good susceptibility to vancomycin. Enterococci could be a consequence of nosocomial UTI Enterococcus feacalis was found to be the cause of 35% of UTI in hospital patients or results showed a close similarity with the above study. 31.4% of diabetic male subjects and 29.1% females had UTI as a consequence of Enterococci spp. in the lower socioeconomic status.

This also signifies the prevalence of community-acquired UTI [16]. The prevalence of uropathogens was considerably less in patients with DM of the higher socioeconomic status. The occurrence of E.coli was high in patients with DM type 1 when compared with the type 2 diabetic results. Patients with DM type 1 have a risk of acquiring bacteremia, with UTI as the most prevalent infection [17]. This also exposes diabetic patients to higher mortality in community-acquired infections when compared with patients without DM. This pattern of distribution of uropathogens could be incidental in nature with more confounding factors involved in the pattern of colonization, and additional investigations should be put forward to understand the biodiversity of UTI pathogens in patients with DM type1 and type 2 [18, 19, 20].

Conclusion

In addition, considering the high prevalence of asymptomatic bacteriuria in diabetics, this condition could represent one of the causes leading to an unexplained worsening of the glycosuria in some patients. This study confirms that diabetes predisposes humans to the risk of urinary tract infections due to the changes in bladder function and in circulation.

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