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ORIGINAL ARTICLE

Frequency of Urinary Tract Infections in Patients with Type-II Diabetes Mellitus

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ABSTRACT

Background: Diabetes mellitus has several adverse effects on the genitourinary system. Individuals with both type 1 and type 2 diabetes are at an increased risk of developing urinary tract infections. Considering the increasing incidence of UTIs over time, current study aimed to evaluate the frequency of urinary tract infections in patients with type-II diabetes mellitus.

Methods: A descriptive cross-sectional study was conducted in the Department of Medicine, Shahida Islam Medical and Dental College, Lodhran. A detailed medical history was obtained from each participant, followed by a thorough physical examination and routine laboratory investigations. Blood glucose levels and glycated hemoglobin (HbA1c) were measured to assess glycemic control. Evaluation for urinary tract infection included urine microscopy, with leukocyte quantification performed using glass slide examination. Data was analysed using SPSS version 22. The chi-square test was applied to find out the association between glycaemic status and the presence of UTI, and a p-value of ≤ 0.05 was considered statistically significant.

Results: The mean age of the study participants was 55.4 ±8.2 years. Majority of study participants (64%) were female as compared to their male counterpart. Mean duration of diabetes was 9.75 ± 3.8 years while past history of UTI was positive among 32.6% participants. Looking over the glycemic status, the frequency of UTI was positive in 85.6% poorly controlled diabetic patients and 14.4% in good glycemic controlled patients and the results were significant (p-value ≤0.05). The most commonly found pathogen was E.coli followed by proteus, staphylococcus aureus, pseudomonas aeruginosa, klebsiella, Enterobacteriaceae and clostridium albicans with frequency of 65%, 13%, 12%, 5%, 3%, 2% and 2% respectively.

Conclusion: The prevalence of urinary tract infection is higher among patients with sustained hyperglycemia or inadequate glycemic control, and *Escherichia coli* remains the most common causative organism in diabetic patients.

Keywords: Diabetes mellitus, Urinary tract infection, E.coli.

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both[1]. Persistent elevation of blood glucose leads to long-term damage, dysfunction, and failure of multiple organs, particularly the eyes, kidneys, nerves, heart, and blood vessels. In addition, diabetes is associated with impairment of the immune system, including reduced migration, phagocytosis, chemotaxis, and intracellular killing by polymorphonuclear leukocytes, which increases susceptibility to infections[2]. A cross-sectional survey conducted in rural and urban areas of Pakistan involving 5,433 individuals reported a diabetes prevalence of 19.25%[3].

Diabetes mellitus has several adverse effects on the genitourinary system. Individuals with both type 1 and type 2 diabetes are at an increased risk of developing urinary tract infections[4]. Elevated glucose levels in urine can provide a favourable environment for the growth of pathogenic microorganisms, while autonomic neuropathy associated with diabetes may result in impaired bladder emptying, further predisposing patients to infection[5]. Alterations in the chemical composition of urine in diabetic individuals can reduce its inhibitory or bactericidal properties against uropathogens[6].

Urinary tract infections (UTI) may involve the upper or lower urinary tract, or both, and can present as either asymptomatic or symptomatic infections[7]. The clinical diagnosis of UTI is based on significant bacteriuria, defined as a bacterial count exceeding 10^5 colony-forming units per millilitre of urine[8]. In both uncomplicated and complicated UTI, *Escherichia coli* remains the most frequently isolated pathogen. Experimental studies have shown that osmotic diuresis caused by glycosuria may facilitate ascending *Escherichia coli* infections[9]. Other causative organisms include *Klebsiella pneumoniae*, *Staphylococcus saprophyticus*, *Proteus mirabilis*, *Enterococcus faecalis*, group B *Streptococcus*, *Pseudomonas aeruginosa*, *Candida* species, and *Staphylococcus aureus*[10]. Patients with type 2 diabetes mellitus experience urinary tract infections more frequently and with greater severity[11]. Considering the increasing incidence of UTIs over time, current study aimed to evaluate the frequency of urinary tract infections in patients with type-II diabetes mellitus.

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MATERIAL AND METHODS

This descriptive cross-sectional study was conducted in the Department of Medicine, Shahida Islam Medical and Dental College, Lodhran, from February to July 2023. Patients aged 18 years or older, of either gender, with a documented history of diabetes mellitus for at least two years were included. Participants presented with clinical features suggestive of urinary tract infection, including fever with chills, dysuria, changes in urine colour, urethral discharge, increased urinary frequency and urgency, haematuria, suprapubic or flank pain, and associated nausea or vomiting. Patients were enrolled from the outpatient department, inpatient wards, and casualty outpatient department. Diabetic patients referred from other hospital wards with similar clinical presentations were also evaluated for urinary tract infection.

A detailed medical history was obtained from each participant, followed by a thorough physical examination and routine laboratory investigations. Blood glucose levels and glycated hemoglobin (HbA1c) were measured to assess glycemic control. Evaluation for urinary tract infection included urine microscopy, with leukocyte quantification performed using glass slide examination. Infection was defined by the presence of more than five leukocytes per high-power field and confirmed by positive urine culture and sensitivity testing. Midstream urine samples were collected in sterile containers, properly labelled, and sent to the laboratory for microbiological analysis. Patients who were uncooperative or declined to participate were excluded from the study. Informed consent was obtained from all participants or their attendants after a full explanation of the study procedures, and all

study activities were conducted in accordance with medical ethical standards.

Data was collected using a structured proforma and analysed using Statistical Package for Social Science (SPSS) version 22. Frequencies and percentages were calculated for categorical variables like urinary tract infections, associated pathogens, and gender distribution. Mean and standard deviation were computed for numerical data including age. The chi-square test was applied to find out the association between glycaemic status and the presence of UTI, and a p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The mean age of the study participants was 55.4 ±8.2 years. Majority of study participants (64%) were female as compared to their male counterpart. Mean duration of diabetes was 9.75 ± 3.8 years while obesity (BMI ≥25kg/m^2) was frequent among 58% of study participants. Most commonly noted comorbidities were hypertension (76.7%), chronic kidney disease (13.3%) and coronary artery disease (4.6%) while past history of UTI was positive among 32.6% participants as mentioned in Table 1.

Looking over the glycemic status, the frequency of UTI was positive in 85.6% poorly controlled diabetic patients and 14.4% in good glycemic controlled patients and the results were significant (p-value ≤0.05). Over all 97 (64.6%) patients were positive for UTI as reported in Table 2. The most commonly found pathogen was E.coli followed by proteus, staphylococcus aureus, pseudomonas aeruginosa, klebsiella, Enterobacteriaceae and clostridium albicans with frequency of 65%, 13%, 12%, 5%, 3%, 2% and 2% respectively as presented in Figure 1.

Table 1. Characteristics of study participants

Variables	n= 150
Age (years)	55.4 ±8.2
Gender	
Male	54 (36%)
Female	96 (64%)
Duration of diabetes (years)	9.75 ± 3.8
BMI (≥25kg/m^2)	87 (58%)
Diagnosed case of	
Hypertension	115 (76.7%)
Chronic kidney disease	20 (13.3%)
Coronary artery disease	7 (4.6%)
Past history of UTI	49 (32.6%)

Table 2. Association of glycemic status with UTI

Glycemic status	UTI		p-value
	Positive	Negative	
Poorly controlled	83 (85.6%)	6 (11.3%)	0.001
Good controlled	14 (14.4%)	47 (88.7%)	
Total	97 (100%)	53 (100%)	

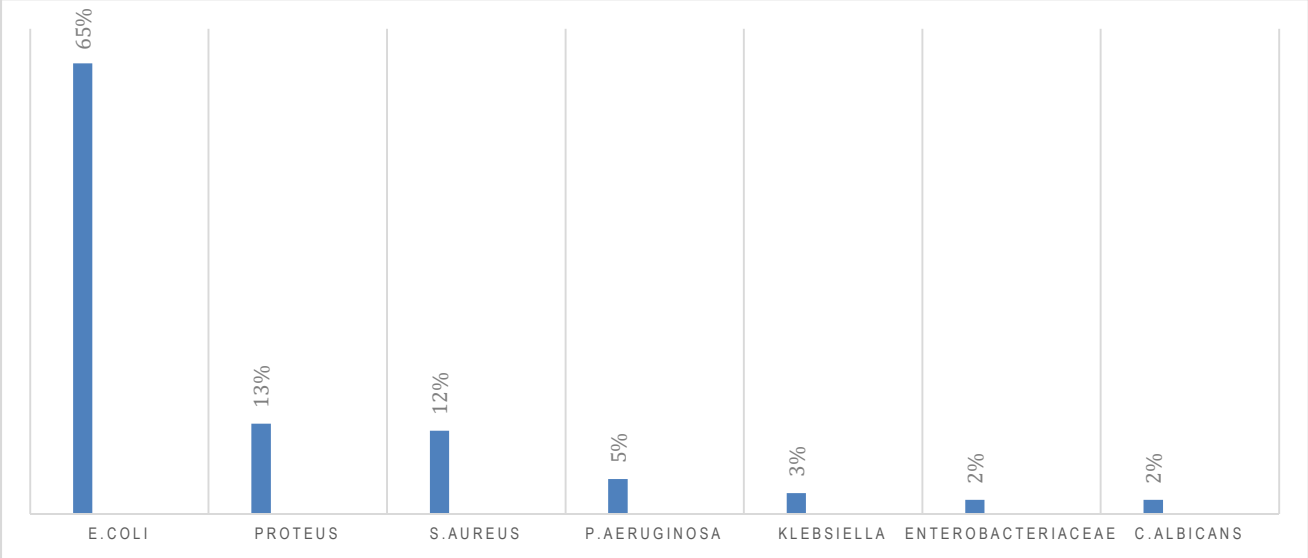

Figure 1 Pathogens found in urine culture and sensitivity

DISCUSSION

Urinary tract infections (UTI) represent a significant clinical problem among patients with diabetes mellitus, largely due to impaired immune function. Diabetic individuals are prone to a spectrum of urinary tract complications, including cystitis, ascending infections progressing to pyelonephritis, emphysematous infections, and renal or perinephric abscess formation, particularly in the presence of poor glycemic control[12]. The prevalence of UTI varies considerably with age and gender, highlighting the importance of demographic and clinical factors in guiding diagnostic evaluation. An increased risk of UTI has also been observed with longer duration of diabetes[13].

The prevalence estimates obtained in the current study provide valuable insight into the relative contribution of these risk factors. In the current study, urinary tract infection was identified in 64.6% of patients with diabetes mellitus, out of which 85.6% poorly controlled diabetic patients and 14.4% in good glycemic controlled patients with significant association. These findings are comparable to those reported by Lerman-Garber et al., who documented an overall infection prevalence of 46.5%, slightly lower than that observed in our study, but similarly demonstrating a strong association between diabetes and urinary tract infection[14]. Comparable results were also reported by Patel et al. in a 14-year prospective study involving 8,793 hospitalized patients, in which acute and chronic urinary tract infections were identified in 31.4% of individuals with diabetes mellitus[15]. Female patients constituted the majority of UTI cases in the present study, a finding consistent with the observations of Brauner et al. Additionally, he noted that the poor glycemic control has significant association with UTI affected patients[16]. Previous studies have suggested that effective glycemic control may reduce the risk of urinary tract infection, supporting the relationship between metabolic control and susceptibility to infection.

Bacteriological analyses in diabetic patients with UTI typically demonstrate a predominance of gram-negative enteric organisms as the causative pathogens urinary tract infections such as E. coli, Klebsiella species and the Proteus species[17]. In the present study, gram-negative bacilli constituted the majority of the

isolated uropathogens. Among patients with gram-negative infections, *Escherichia coli* was the most frequently identified organism, accounting for 65%. Other isolated pathogens included *Proteus* species in 13% cases, *Staphylococcus aureus* in 12% cases, *Pseudomonas* species in 5% cases and *Klebsiella* species in 3% cases. These findings are comparable to those reported by Brauner et al., who documented *E. coli* in 55% of urine cultures obtained from diabetic patients[18].

Several mechanisms have been proposed to explain the increased susceptibility of individuals with diabetes to urinary tract infections. Hoepelman suggested that reduced antibacterial activity due to glycosuria, impaired neutrophil function, and enhanced bacterial adherence to uroepithelial cells play key roles in the pathogenesis of UTIs in diabetic patients. Consequently, urinary tract infections in this population should be managed as complicated infections, requiring antimicrobial agents with good tissue penetration administered for a duration of 10–14 days[19].

The severity and duration of diabetes are major determinants of the increased risk of urinary tract infection and asymptomatic bacteriuria, reflecting a pattern similar to that observed with other diabetes-related complications such as retinopathy and neuropathy. Therefore, improved glycemic control is expected to reduce the incidence of urinary tract infections in patients with diabetes mellitus.

CONCLUSION

The prevalence of urinary tract infection is higher among patients with sustained hyperglycemia or inadequate glycemic control, and *Escherichia coli* remains the most common causative organism in diabetic patients.

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