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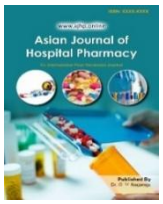

PREVALENCE OF URINARY TRACT INFECTIONS IN HOSPITALIZED DIABETIC PATIENTS: INSIGHTS FROM A GUNTUR-A CASE STUDY

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Abstract

Background: The existence of evidence was always given when diabetes predisposes individuals to a higher likelihood of experiencing asymptomatic bacteriuria and urinary tract infections. Urinary tract infections (UTIs) are highly prevalent among individuals with diabetes, emerging as the foremost type of bacterial infection within this demographic.

Objective: This study was done to establish the prevalence of urinary tract infections in hospitalized diabetics and the most common causative strains.

Materials and Methods: The research samples are consisted of 649 individuals diagnosed with 373 being women and 276 being men. These patients were admitted to the Government General Hospital (GGH), Guntur in various departments such as Urology, Nephrology, and the general ward between January and December 2023. We gathered individuals' personal medical information and conducted urine cultures. For statistical analysis we used Graph Pad Prism 10.2.3; the significance of the difference between the percentage values was assessed using Fisher's exact test.

Results: Among the patients studied, 110 (17%) had positive urine cultures. Of these 110 urinary tract infections, 86 (78.3%) were cases of asymptomatic bacteriuria. Escherichia coli were the most commonly identified bacterium, responsible for 68.9% of the infections.

Conclusion: Urinary tract infections are prevalent among diabetic individuals. Given the significant number of asymptomatic cases, it is advisable to conduct urine cultures for all hospitalized diabetic patients.

Keywords: Urinary tract infection, Diabetes patient, Asymptomatic bacteria, Escherichia coli.

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Introduction

Diabetes is the most frequent endocrine disorder over the past few decades. It has changed due to changes in human behavior and the accession of elements of the way of life, and specialties, especially on the level of some Low and Middle-income Developing Countries [1,2]. Diabetes has been on the rise in recent years. According to the data made on the basis of the 2017 "Global Burden of Disease", currently more than 462 million people suffer from type 2 diabetes mellitus from its common human incidence which is 6.2 % of the World's population. Thus the share of patients varies with the age of patients – among 15-49 years old, 50 years old, and over 70 years of age, accounted for 4.4 %, 15 %, and 22 %, average, respectively, per 10,000 population 6059 sick [3]. The occurrence of most type 2 diabetes individuals appear to be more susceptible to the onset of infections, with urinary tract infections being affected the most [4,5, 6,7]. Moreover, it is a risk factor for several distinct pathological processes and health problems, including circulatory system diseases, eye and visual disease amputations, renal system disease, foreign diseases, etc. [8, 9,10,11].

Due to poor regulation of blood glucose levels among diabetic patients, the risk of infection is increased. As a result, such patients are required to take more precautions to primarily avoid infections [12,13]. According to these studies, a urinary tract infection is one of the most common medical problems and accounts for 1–6 percent of physician referrals. A urinary tract infection consists of infections in the bladder and kidney [14]. The research showed that urinary tract infection is a prevalent infectious illness in diabetes patients. Urinary tract infection and its consequences are a common cause of one hundred and fifty million people's deaths [15,16].

According to the reviewed evidence, patients with diabetes exhibit a relatively high incidence of asymptomatic bacteriuria and UTI [9,17], and an infection of the urinary tract represents one of the most frequent types of bacterial infection seen in such patients.[19]. Furthermore, it is vital to diagnose and treat UTIs in diabetic patients because they often have serious evolutionary outcomes. It is problematic to heal UTI in diabetics because it often relapses, which increases healthcare expenditures for both the patient and the system [17, 18, 20, 41].

First, this study set out to document the empirical incidence of UTI among diabetic inpatients and the most common bacteria responsible.

Materials and Methods

Study Population: The present study was designed as a hospital-based study performed at the Guntur Government Hospital, Guntur; we included the patients who were admitted in 2023 (January–December). The ethical approval for the study was obtained from the hospital's Ethics Committee.

We gathered a total of 490 urine samples for urine culture from 649 hospitalized diabetic patients; 373 were women, while 276 were men admitted with type 1 diabetes mellitus and type 2 diabetes mellitus. The urine samples obtained for culture were from the patients who had signs or symptoms suggestive of UTI such as dysuria, urgency, frequency, suprapubic pain or tenderness, and a prior history of recurrent UTI. Fever was also included in the urine samples that had nitrite, leukocyte esterase, and more than 5 white blood cells/WBC per high power field and upper UTI symptoms. We also collected the personal histories of patients.

***Definitions*:** Bacteriuria was defined as at least 105 CFU/mL; bacteriuria in the presence of fever or urinary symptoms constituted symptomatic UTI. In this study, we considered bacteriuria as a symptomatic UTI if it was associated with fever. Otherwise, a fever or bacteriuria without fever was referred to as asymptomatic bacteriuria.

Dysuria, urgency, frequency of urination, suprapubic pain, or tenderness were associated with the *Lower Urinary Tract Infection (Cystitis*). The presentation of an *Upper Urinary Tract Infection (Pyelonephritis)* included fever, either with or without a clear etiology, and the same symptoms.

We collected urine in sterile uricols as clean-catch midstream samples and transported it to the laboratory within an hour of collection. A calibrated loop was used to measure the amount of urine that was used. This known volume was then added to culture media by quantitative bacterial culture of a urine sample. We measured and expressed the quantitative isolation of germs in CFUs throughout the collection period. The germs were identified based on the colonial appearance and biochemical properties. Finally, biome Rieux France, which is a product of the automated Vitek2 Compact System did the germ identification.

All statistical parameters were recorded using an Excel spreadsheet database. The software program used for *statistical analysis* is Graph Pad Prism 10.2.3 version. The presented prevalence is a percentage of the developed population having the given condition. Fisher's exact test was conducted to determine the achieved significance between percentages. Statistical differences are demonstrated when P <0.05.

Results

We measured the incidence and microbial patterns of urinary tract infections in hospitalized diabetic patients who were part of the population in the research. In the overall cohort of patients admitted to the hospital, 110 patients, 17%, were diagnosed with a urinary tract infection.

Data from Table 1 were used in our research to analyze the UTI rate difference in T1DM and T2DM patients. The UTIs were primarily caused by *E. coli* – 68.9% and *Klebsiella spp*. – 17.2%.The current study's results showed that the prevalence of UTIs among T1DM and T2DM patients is 15.5% and 17.4% respectively. Despite that, the obtained difference is not statistically significant, p = 0.69.

Table.1: The rate of UTI varies with the type of diabetes

	Type 1 DM	**Type 2 DM**	**Total**
Non-infected patients	20 (15.5%)	90 (17.4%)	110
Infected patients	109 (84.5%)	430 (82.6%)	539
Total no. of patients	***129***	520	649

As for the differentiation by gender revealed that 24.6% of women and only 6.6% of men had UTIs. Almost every six times between men and women, there was a highly significant difference; (p <0.00001) [Table 2].

Table 2: The rate of UTI varies with the gender

	Women	**Men**	**Total**
Non-infected patient	281 (75.4%)	258 (93.4%)	539
Infected patient	92 (24.6%)	18 (6.6%)	110
Total no. of patients	***373***	276	649

There were 16 (14.5%) UTIs classified as lower UTI, 8 (7.2%) as upper UTI, and 86 (78.3%) as *Asymptomatic Bacteriuria* (ASB) out of 110 urinary tract infections.

For a total of 649 patients with DM who were treated in the hospital, 2.5% of patients had *lower urinary tract infections*, 1.2% had *Acute Pyelonephritis* and 13.2% had ASB. Distinctive features of the localization of UTI in

patients with type 1 DM and type 2 DM were not significant. [Table 3]

Table 3: The rate of UTIs with the site of infection and type of diabetic

	Type 1 DM %	Type 2 DM %	p-value
Lower UTI Patients	3.9	3.7	0.76
Upper UTI patients	1.5	3.1	0.07
ASB patients	***10.1***	10.6	0.82
Total patient %	***15.5***	17.4	

The prevalence of *lower UTI*, *upper UTI*, and ASB in women was: 5.1%, 4.2%, and 15.3%, respectively. In men, the proportions were: 1.5%, 1.2%, and 3.9%, respectively [Table 4]. The modesty of gender may be linked to physical differences in the urinary system, making urinary tract infections and UTIs less common among males than females. A UTI in a male is expected to present signs if the individual is struck. Still, asymptomatic bacteriuria ASB is an unusual condition.

Table 4: The rate of UTIs with the site of action and by gender

	Women %	Men %	p-value
Lower UTI Patients	5.1	1.5	0.0002
Upper UTI patients	4.2	1.2	0.0003
ASB patients	***15.3***	3.9	<0.00001
Total patient %	***24.6***	6.6	

When identifying the main bacteria responsible for UTIs, the data presents 76 cases; 68.9% were *E. coli*, and 5 (13.9%) were *Klebsiella spp*., whilst the other were from the rest of the microorganisms. These were 7 cases (6.4%); and 4 cases of *Proteus spp.* (3.8%), 3 cases of each *Enterococcus spp.,* and *Streptococcus spp*. as well as 2 cases of *Pseudomonas spp*.[Figure 1].

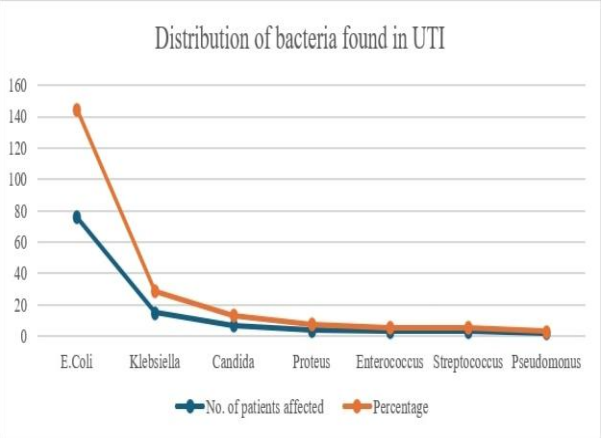

Figure 1: The distribution of bacteria associated with UTI

Regarding the 76 UTIs with E. coli, 10 (13%) were lower UTI, 7 (10%) were upper UTI, and 59 (77%) ASB. From the total number of 110UTIs with Klebsiella spp. 4(22.8%) were lower UTI,1 was upper UTI(4.5%)and11 (72.7%) were ASB.

E. coli accounted for 10 cases (71.4%) of the overall lower urinary tract infections, whereas Klebsiella spp. was responsible for 4 cases (28.6%) (p = 0.229). Upon analyzing 8 instances of upper urinary tract infections, it was shown that E. coli was the causative agent in 7 cases (87.5%), whereas Klebsiella spp. was responsible for 1 case (12.5%) (p = 0.704). These two bacteria were responsible for all the urinary tract infections (UTIs) seen in the investigated group. Out of the whole population of ASB, E. coliaccounted for 59 cases (84.2%) whereas Klebsiella spp. accounted for 11 cases (15.8%) with a p-value of 0.4

Discussion

The purpose of the study is to investigate the status of UTIs among diabetes patients and create an understanding of other studies in the Guntur region. As per our study, the prevalence of UTI was 78.3%in contrast to prior studies prevalence rate is higher. Until 45.7%, 53.8%, 65.4%, and 37.3% in India [21, 22, 23, 24].

The samples' most common infected bacteria registered in our investigation were E. coli, 68.9%. These results are in agreement with several comparable other published studies in which E. coli occurred at an incidence of 97.0, 92.6, 74.0, 55.0, 49.3, 41.9, and 40.0%.[27, 25, 28, 29, 30, 31, 32, 33].

Most studies have recorded that the infection of UTIs is more dependent on sex factors, particularly for women [21, 25, 26]. Similarly, my findings were that women were more infected by UTIs (24.6%) than men (6.6%). Due to the shortness of the female urethra, the nearness of the urethral meatus to the anus, sexual activity, urinary incontinency, and lack of proper toilet hygiene may be liable as well as men-related factors, such as the greater length of the urethra, the greater distance between the urogenital meatus and the anus, and the antibacterial properties of the prostatic fluid [21,40]. Another study tells that as expected, females were more affected, which can be explained by the specific structure of the woman's body, the intake of contraceptives, and the aging signs of menopause. Accordingly, it was realized that the number of diabetic patients who were diagnosed with urinary tract infections. These data coincide with a recent study by Kumar et al. conducted in 2019 [34].

Urinary tract infection is the most widespread bacterial infection in women and presents in postmenopausal women [36]. The microorganisms that usually cause UTI are E. coli at 68.9% and Klebsiella spp. at 17.2%. This data is congruent with the results obtained by Boyko et al., who analyzed 218 diabetic postmenopausal women.E. coli is the main pathogen in 74.4%, and Klebsiella spp. is 7% [17]. In a recently conducted control-case study in New Delhi, India, 155 diabetic patients were observed with UTI for its occurrence and renal scarring. The most common

organism found was E. coli 64.3%, and second to it was Klebsiella spp. 14.3%[35].

In our study, the prevalence of asymptomatic bacteriuria (ASB) among diabetic patients was 10.3%, with a higher rate in women (15.5%) than in men (3.9%). This is comparable to the findings of Georgia et al. (2023), which showed an overall ASB prevalence of 20.1%, with 27% in women and 9.4% in men. [37]. Separate research in Manitoba, Canada, covered diabetic patients among women, which showed a 7.9% prevalence of ASB [38]. This research was conducted at The University Hospital of Pisa, Italy, a total number of 10,221 patients were analyzed including both diabetic and non-diabetic women, the prevalence of ASB in diabetic women was 14.97% [39]

A potential weakness of this research is that urine culture was not conducted for all hospitalized patients, which might have resulted in the omission of some positive findings and hence underestimated the true frequency of urinary tract infections (UTIs).

Conclusion

People with diabetes frequently experience urinary tract infections (UTIs). Although Escherichia coli is the most common pathogen, diabetic individuals are at a higher risk of fungal infections. Many UTIs in diabetic patients are asymptomatic, especially in women. Diabetes often leads to recurrent UTIs. Given the high rate of asymptomatic bacteriuria (ASB) and its importance in diabetic care, it is recommended to perform urine cultures on all hospitalized diabetic patients. ASB's strong association with diabetes may also help identify undiagnosed diabetes and instances of random glycemic decompensation.

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Conflict of Interest

Not Declared

Informed Consent

All the information was gathered by the informed consent by the patients.

Ethical Statement

Not required

Author Contribution

All authors are contributed equally.

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