



Recurrent Bacteria Involvement in Urinary Tract Infection among Diabetic Female Patients of Sukkur, Sindh

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Authors' contributions

This work was carried out in collaboration among all authors. Author ST developed the concept, collected and wrote the manuscript. Author AA analyzed the data and facilitated in manuscript writing. Author SFH managed the literature searches and helped in manuscript writing. Author AHS supervised the project and critically reviewed the final draft. All authors read and approved the final manuscript.

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ABSTRACT

Background: Diabetics are four times more prone to develop Urinary tract infection when compared to healthy individuals, the proposed risk factors behind this increase in susceptibility in diabetics are autonomic neuropathy resulting in incomplete emptying of bladder and glucose in urine which serves as a medium for bacterial growth. The aims of our study are to identify the frequency of recurrent UTI and to document most common prevalent organisms involved in UTI in diabetic females in tertiary care hospital of Sukkur.

Methodology: It was a cross sectional study conducted at Microbiology Department of Shah Abdul Latif University Khairpur from January to December 2020. The sample size n=54 was calculated by open epi software. Participants who contented inclusion criteria i.e., female patients of age >18 years with diabetes mellitus for more than 5 years who were presented in OPD with UTI along with history of three positive urine cultures in the previous 12 months or two episodes in the last six months were recruited by simple random sampling technique. The urine samples were collected in

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sterile containers and the growth of organisms was observed on nutrient agar and MacConkey agar plates.

Results: There was no any significant difference among occurrence of bacteria between both the groups i.e . However, the most associated microbes with uncontrolled HbA1c profile were *E. coli* (p-value = 0.004) followed by *Micrococcus lutes* (p-value = 0.021) and *Shigella* (p-value = 0.001). Table 1. Shows the frequency and percentages of bacteria associated with controlled and uncontrolled HbA1c levels.

Conclusion: Most of the participants had uncontrolled diabetic profile i.e. HbA1c > 7, the prominent pathogen at our setting were *E. Coli*, *Enterococcus* species, *Shigella* species and *Micrococcus lutes*.

Keywords: Frequency; diabetes; UTI; microorganisms; Sukkur.

1. INTRODUCTION

The Type II Diabetes mellitus (TIIDM) is a metabolic syndrome and characterized by an increase in glucose levels in plasma and decrease in insulin synthesis and sensitivity [1]. The therapeutic aim in diabetes mellitus is to keep fasting blood sugar level in between 70-140mg/dl of blood which is referred as a controlled TIIDM. However, the blood glucose level higher than 140mg/dl of blood is termed as uncontrolled TIIDM [2]. The persistent high blood glucose levels lead to numerous complications that involve multiple organ systems including immune system [3]. The effects of diabetes mellitus on immune system facilitate the pathogens to conquer the immune barriers and increase the incidence of infections in diabetics [4]. Bacteria being the leading pathogens are involved in causing multiple infections in diabetic patients and urinary tract infection (UTI) is one of the common ailments encountered by diabetics [5].

Inflammation of urinary tract caused by abnormal growth of pathogens is regarded as UTI. It is characterized by short term duration of fever, dysuria and lower abdominal pain and may progress to permanent scarring of the kidney [6,7]. The diabetic individuals are four times more prone to develop UTI when compared to healthy individuals. The proposed risk factors behind this increase in susceptibility in diabetics are autonomic neuropathy resulting in incomplete emptying of bladder and the glucose in urine that serves as a medium for bacterial growth [8,9]. It was reported by the American Diabetic Association that 9.4% people with diabetes encountered UTI when compared to individuals without diabetes i.e., 5.7% [10]. Mohsin R. et al. documented that diabetic females are more susceptible to UTI when compared to diabetic males [11].

Multiple organisms (*Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus saprophyticus*, *Enterococcus faecalis*, group B *Streptococcus* (GBS), *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Candida* species) participate in development of UTI the most prominent among all which are reported in Pakistan includes *E. coli*, *Klebsiella pneumoniae* and *Candida* [12,13]. If not dealt properly UTI may lead to serious complications such as recurrent infections, permanent kidney damage, increased risk in pregnant women of delivering low birth weight or premature infants, urethral narrowing (stricture) in men from recurrent urethritis and sepsis [11]. The irrational prescription of antibiotic for these perilous bacteria may increase the chance of resistance development therefore the aims of our study are to identify the frequency of recurrent UTI and to document most of the common prevalent organism involved in UTI in diabetic females in tertiary care hospital of Sukkur.

2. METHODOLOGY

It was a cross sectional study conducted at Microbiology Department of Shah Abdul Latif University Khairpur from January to December 2020. The sample size n=54 was calculated by open epi software. Participants who contented inclusion criteria i.e., female patients of age >18 years with diabetes mellitus for more than 5 years who were presented in OPD with UTI along with history of three positive urine cultures in the previous 12 months or two episodes in the last six months were recruited by simple random sampling technique. The set exclusion criteria were male diabetic patients and pregnant females. After taking written informed consent descriptive data regarding patient's age, duration of diabetes, history of UTI and HbA1C was recorded on proforma. A sterile container was provided to them for urine sampling and patients were explained about the protocols to avoid the

contamination in sample. The urine detailed report (d/r) of patient's sample was performed by dipstick method. The samples were marked as positive for UTI when the nitrites were observed positive in the urine. Furthermore, we inspected the pus and RBCs under the microscope. The UTI positive patients were called again on next day for midstream urine sample. All urine samples were inoculated using a calibrated inoculation needle with 1 mL of urine and each sample was inoculated on three types of media i.e., nutrient agar, MacConkey agar plates, and CLED agar. The plates were incubated at 37°C for 24–48 hours to show visible growth of microorganisms. The urine samples showing a colony count more than 10⁴ cfu/mL were considered as positive for UTI. The UTI isolates identified by following standard biochemical tests (Imvic, oxidase, catalase). For positive urine cultures, the identification of microbes was done using automated system Microscan (Walkaway 40 SI, Siemens Healthcare Diagnostics, and Sacramento, CA). The frequencies and percentages were used to represent categorical data and mean and standard deviation were calculated to represent numerical data. The Chi-square test was applied as test of significance at

95% confidence interval with p-value <0.05 as significant.

3. RESULTS

There were 54 females of different age groups and divided into groups on the basis of HbA1c %. Participants with HbA1c % less or equals to 7 were termed as controlled group and participants with HbA1c greater than 7 were termed as uncontrolled diabetics. Fig. 1 shows the distribution of study participants according to age and HbA1c. The mean HbA1c of total participants was 8.60 ± 1.7. Fig. 2 shows the mean HbA1c of controlled and uncontrolled groups.

There was no any significant difference among occurrence of bacteria between both the groups however, the most associated microbes with uncontrolled HbA1c profile were *E. coli* (p-value = 0.004) followed by *Micrococcus lutes* (p-value = 0.021) and *Shigella* (p-value = 0.001). Table 1 shows the frequency and percentages of bacteria associated with controlled and uncontrolled HbA1c levels.

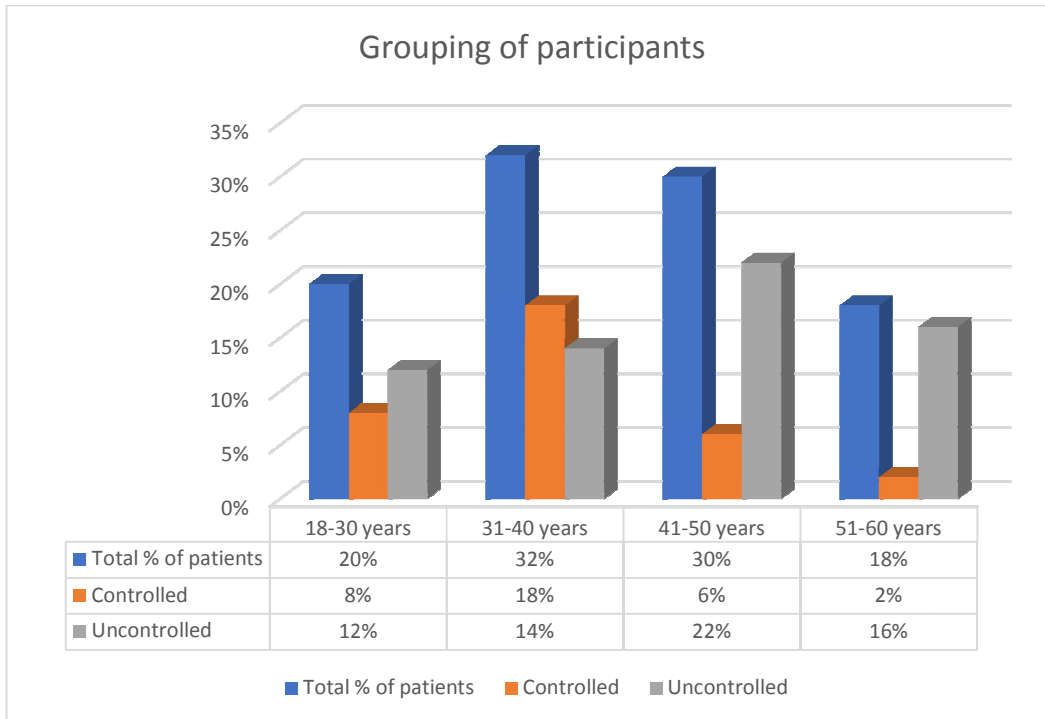


Fig. 1. Showing distribution of study participants according to age and HbA1c

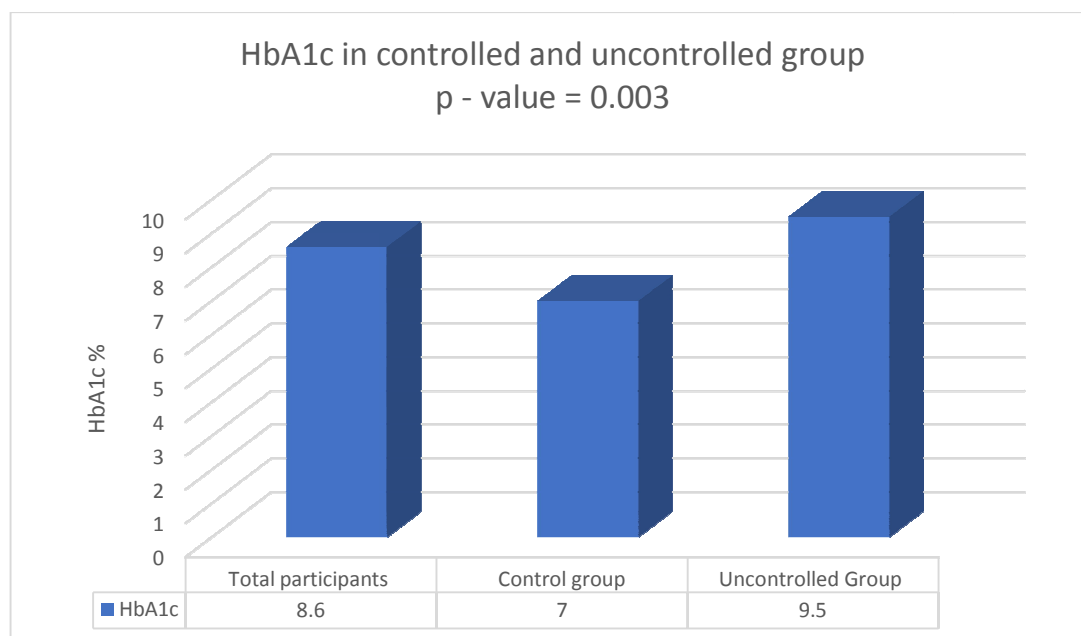


Fig. 2. Mean Hba1c of controlled and uncontrolled groups

Table 1. Identified bacteria in controlled and uncontrolled group

| Name of bacteria | Total Number (%) | Controlled (%) | Uncontrolled (%) | p-value |
|-----------------------------|------------------|----------------|------------------|---------|
| <i>Acinobacter Spp</i> | 7 (13.3%) | 3 (5.7%) | 4 (7.5%) | 0.124 |
| <i>Alcaligenes faecalis</i> | 9 (17%) | 4 (7.5%) | 5 (9.4%) | 0.362 |
| <i>ALCALigenes faecalis</i> | 2 (3.8%) | 1 (1.9%) | 1 (1.9%) | 1.000 |
| <i>E.coli</i> | 10 (18.9%) | 3 (5.7%) | 7 (13.2%) | 0.004* |
| <i>Enterococcus spp</i> | 4 (7.5%) | 1 (1.9%) | 3 (5.7%) | 0.021* |
| <i>Micrococcus lutes</i> | 8 (15.1%) | 3 (5.7%) | 5 (9.4%) | 0.042* |
| <i>S.aureus</i> | 6 (11.3%) | 3 (5.7%) | 3 (5.7%) | 1.000 |
| <i>Shigella species</i> | 7 (13.3%) | 1 (1.9%) | 6 (11.3%) | 0.001* |
| Total | 53 (100%) | 19 (35.8%) | 34 (64.2%) | |

4. DISCUSSION

Uncontrolled diabetes mellitus has been associated with impaired immune function that makes patient more vulnerable to infections [14]. Diabetes mellitus has been considered as a major risk factor for the development of UTI. Furthermore, it has been identified that urinary tract is one of the common site of infection when a person is diabetic that leads towards UTI complications [15]. Due to day by day increase in the prevalence of type II Diabetes mellitus it has become the foremost concern to healthcare providers [16]. It has been identified that the control of glycemic profile for diabetic patient is challenging and many of the patients do not follow the diet plan and due to in compliance to

instructions provided to them they lose control on glycemic profile that predisposes them to infections and leads to damage to other organ systems [17,18]. The same finding was observed in our study most of the patients that recruited as sample had uncontrolled glycemic profile i.e. HbA1c > 7. Parallel to our findings Aoyama N. et., al reported an increase in gingival infections in uncontrolled diabetic cardiovascular patients [19]. *E. Coli* were most found organisms in our study among diabetic patients and these were significantly associated with uncontrolled glycemic profile as shown in Table 1. Among diabetic patients many studies have reported its dominance on other organisms in UTI as highlighted in our study [20,21]. Similar to our findings following *E. coli*, *Enterococcus* species,

Shigella species have been seen as the most vulnerable organisms involved in UTI [22]. Along with common pathogens involved in UTI we also identified *Micrococcus lutes* which is seen to be involved in recurrent UTI and it was significantly associated with UTI among uncontrolled group. Parallel to this Ayyed. D., et al., in Iraq documented it as emerging infectious organism in development of recurrent urinary tract infection [23]. Irrational prescription without identification of organisms has led us to biological war against resistant pathogens. Awareness regarding the importance of organism identification and rationale prescription with appropriate dose and duration among general practitioners may help us in reducing the disease burden and ultimately will be helpful in decreasing the number of resistant pathogens from population.

5. CONCLUSION

Most of the participants with uncontrolled diabetic profile i.e. HbA1c > 7, the prominent pathogens were *E. coli*, *Enterococcus* species, *Shigella* species and *Micrococcus lutes* in UTI which may serve for better treatment in diabetics.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical Approval was taken from Shah Abdul Latif University Khairpur.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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