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Epidemiology of Asymptomatic Bacteriuria among Diabetic Patients in Tikrit City, Iraq

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Abstract

Objectives: This study aimed to show the Epidemiology of Asymptomatic Bacteriuria among diabetic patients in Tikrit City, Iraq.

Methods: A cross sectional study was conducted in Tikrit City among diabetic and non-diabetic patients from General Salahalddin Hospital and from outpatient clinics. This study conduct 270 persons, including 155 diabetes sufferers and 115 non-diabetics. Consented subjects had their mid-stream urine collected, and each sample was examined using microscopy and culture techniques. Standard microbiological assays to determine the presence of pus cells and bacteria in urine were used to identify isolates.

Results: Asymptomatic Bacteriuria (ASB) was found in 21.5% of subjects, with diabetics having 26.4% and non-diabetics having 14.8%. ASB is higher in the age group above 51 years 29 (50%), Females 51 (88%) demonstrated a higher prevalence than males 7(12%) in both diabetic and non-diabetic groups. *Staphylococcus epidermidis* was the most common bacterium isolated from urine in both diabetics and non-diabetics (22.4%). Other bacterium isolates included *E. coli* (19%), *Enterococcus fecalis* (13.7%), *Klebsiella pneumonia* (12%), and *Enterobacter* sp (12%), *Staph aureus* (10.3%), *Staph saprophyticus* (6.8%), *Pseudomonas aerogenosa* (3.4%). The most of isolated microorganisms were resistance to gentamycin, trimethoprim and cefotrixone. Levofloxacin and ciprofloxacin were the most sensitive to uropathogens caused by bacteria.

Conclusion: Diabetic sufferers had a higher prevalence of ASB (26.4%) than non-diabetics, according to the study (14.8%). The majority of ASB was caused by *Staphylococcus* sp, indicating a shift in the aetiologic spectrum. The majority of isolates demonstrated multiple resistance in both diabetics and non-diabetics, indicating the necessity to increase antibiotic sensitization in Tikrit.

Keywords: Asymptomatic bacteriuria, diabetes mellitus, risk factors, urinary tract infections, Iraq

Introduction

Asymptomatic Bacteriuria (ASB) is a presence of bacterial species found in a clean-voided midstream urine specimen from a person who had no indications of a urinary tract infection. Diabetes Mellitus (DM) is the most common endocrine disease in the world. patients with Diabetes Mellitus are more prone to infections, Urinary Tract Infection (UTI) being the most common one. Several studies in countries have been conducted to study clinical profile of Urinary tract infection in diabetic patients. Its prevalence according to causative agent, sex, antibiotic susceptibility, frequency were the concern of such studies. As diabetic is rapidly evolving in the community, clinical pattern of UTI especially ASB in diabetic sufferers needs to be studied to prevent UTI and its complications. UTI occurs with increased frequency and severity in diabetic patients. The presence of diabetic cystopathy, neuropathy and macrovascular disease in the kidneys play a major role in the higher incidence of UTI in diabetic patients. Many risk factors such as age, sexual intercourse, duration of diabetes, glycemic control, and complications of diabetes are associated with UTI. Most of the UTIs in diabetics are relatively without symptoms, which can lead to renal failure and severe kidney damage.[1] Although it is claimed that high glucose concentrations in urine may favor the growth of harmful bacteria, the mechanism of pathogenesis underlying the relationship between diabetes mellitus and urinary tract infections is not entirely understood. Many studies have documented the association of ASB with diabetes; although, reports on the prevalence of ASB appear contradictory. Several studies reported the prevalence to be higher in patient with diabetes than individuals without diabetes.[2] Other study found no significant difference between diabetic and non-diabetic women in the prevalence of ASB ($P = 0.07$).[2] Due to a compromised host defense mechanism, the high glucose concentration in urine may act as a growing medium for harmful microbes. The high glucose concentration is responsible for causing endothelial dysfunction, oxidative stress, and elevated formation of advanced glycosylation end products, which could be play a major role in the development of diabetic complications including asymptomatic bacteriuria.[3] Some serious complications of UTI like cystitis, renal abscess, pyelonephritis, renal papillary necrosis and/or bacteraemia may be found commonly in diabetes mellitus patients.[3] Incompletely defined anomalies in cell-mediated immunity and/or phagocyte function associated with high glucose concentrations as well as reduced vascularization are the reasons for a higher frequency of infections in diabetes individuals. Diabetic people are prone to pneumonia, urinary tract infections, and skin and soft tissue infections. UTIs are caused by common bacterial germs like *E. coli*, but various yeast species, such as candida, have also been found to cause UTIs in diabetes people. Bacteriuria is more common in diabetic cystopathy patients. In persons with these infections, poor glycemic control is a common risk factor.[4]

Aim of the Study

To study the epidemiology of asymptomatic bacteriuria among patients with Diabetes Mellitus.

Objectives of the Study

To study the frequency of asymptomatic bacteriuria in diabetic patients comparing to non-diabetics. To determine the distribution of asymptomatic bacteriuria cases among diabetics according to demographical factors. To determine the distribution of asymptomatic bacteriuria cases according to types of bacteria. To determine the distribution of asymptomatic bacteriuria cases according to types of bacterial drugs sensitivity.

Subjects and Methods

This a cross sectional study involved 270 participants (155 diabetic patients and 115 non-diabetic individuals), age group from 20–80 years attending medical outpatient clinic in Salahaddin General hospital from 1st October 2020 to 30th March 2021. Diabetic individuals were involved in our study through routine visits to clinics at Tikrit City's General Salahaddin Hospital. Healthy people were recruited from the general public during a free diabetic screening program as non-diabetics. The Iraqi scientific council of family and community medicine agreed to conduct the study, which was approved by Tikrit University's ministry of higher education and scientific research. Participants were told about the study and gave their consent. A pilot study was conducted on October 2020 on 30 participants in medicine department of Salahaddin General Hospital. During this time the average number of participants attending the hospital daily was approximately 8–10 participants mostly at 9–11 AM. About 10 minutes needed for completing the questionnaire. The advantage of this study was the modifications made to the questionnaire where time consuming-opinion questions were replaced by socio-demographic, medical and surgical history. After the corrections and modifications of the questionnaires, which were done after the pilot study, data collection was begun on 1st October 2020, and about 5 participants were taken daily. The SPSS program (Statistical Package For Social Science) version 24 was used to code and enter the data into the computer for statistical analysis. Because the variables were qualitative, all data were sorted in frequencies, and associations between variables were examined using the chi-square, with a *P*-value below or = 0.05 considered significant.

Results

Table 1 shows frequency of ASB in this study was (26.4%) in diabetic patients which was more frequent than non-diabetics (14.8%). There is a significant difference.

Table 2 shows that the more frequent cases of ASB among diabetic with age group with age above 51 years (56.1%) followed with age group 41–50 years (26.8%) while the most frequent cases of ASB of non-diabetic was among age group below 40 years (53%) followed by the age group above 51 years with significant difference.

Table 3 shows that ASB cases were more frequent among diabetic (85.4%) and nondiabetic (94.1%) females than among males (14.6%) in diabetic and (5.9%) in non-diabetics without significant difference.

Table 4 shows that ASB cases were more frequent among illiterate (70.7%) than literate (29.3%) among diabetic patients without significant difference.

Table 5 shows that the distribution of ASB cases according to Body Mass Index (BMI), the ASB cases were more frequent among BMI 18–24 (53.7%) followed by BMI 25–29 (39%) and

Table 1. **Distribution of ASB in diabetic patients and non-diabetics**

Presence of DM / Presence of ASB	Diabetic %	Non-diabetics %	Total %
With ASB	41 (26.4%)	17 (14.8%)	58 (21.5%)
Without ASB	114 (73.5%)	98 (85.2%)	212 (78.5%)
Total	155 (100%)	115 (100%)	270 (100%)

*The chi-square is 5.3296. The *P*-value is .020966. The result is significant at $P < .05$.

Table 2. **Distribution of ASB in relation to age**

Presence of ASB / AGE	DM %	Non-DM %	Total of ASB %
Below 40 years	7 (17.1%)	9 (53%)	16 (27.5%)
41–50 years	11 (26.8%)	2 (11.7%)	13 (22.4%)
Above 51 years	23 (56.1%)	6 (35.3%)	29 (50%)
Total	41 (100%)	17 (100%)	58 (100%)

*The chi-square is 7.8613. The *P*-value is .019631. The result is significant at $P < .05$.

Table 3. **Distribution of ASB in relation to sex**

ASB presence / GENDER	DM %	Non-DM %	Total %
Male	6 (14.6%)	1 (5.9%)	7 (12%)
Female	35 (85.4%)	16 (94.1%)	51 (88%)
Total	41 (100%)	17 (100%)	58 (100%)

The chi-square is 0.8673. The *P*-value is .351694. The result is not significant at $P < .05$.

Table 4. **Distribution of ASB with educational level in diabetic patients**

Presence of DM / Educational Level	with ASB %	without ASB %	Total %
Literate	12 (29.3%)	52 (46%)	64 (41.2%)
Illiterate	29 (70.7%)	62 (54%)	91 (58.8%)
Total	41 (100%)	114 (100%)	155 (100%)

*The chi-square is 3.3236. The *P*-value is .068292. The result is not significant at $P < .05$.

Table 5. **Distribution of ASB cases according to BMI in diabetic patients**

Presence of DM / BMI	with ASB %	without ASB %	Total %
18–24	22 (53.7%)	51 (44.6%)	73 (47%)
25–29	16 (39%)	42 (37%)	58 (37.5%)
30–40	3 (7.3%)	21 (18.4%)	24 (15.5%)
Total	41 (100%)	114 (100%)	155 (100%)

*The chi-square is 2.9493. The *P*-value is .228865. The result is not significant at $P < .05$.

Table 6. **The frequency of ASB cases in diabetics and non-diabetics regarding to Gram +ve and Gram –ve bacteria**

Presence of ASB / Type of Gram	Diabetics %	Non-diabetics %	Total %
Gram +ve	22 (53.7%)	9 (53%)	31 (53.5%)
Gram –ve	19 (46.3%)	8 (47%)	27 (46.5%)
Total	41 (100%)	17 (100%)	58 (100%)

*The chi-square is 0.0025. The *P*-value is .960238. The result is not significant at $P < .05$.

BMI 30–40 (7.3%) among diabetic patients, without significant difference.

Table 6 shows that the distribution of Gram positive bacteria isolates were more frequent among diabetic patients (53.7%) and non-diabetics (53%) without significant difference.

Discussion

In total, 270 participants involved in our study (155 diabetic sufferers and 115 non-diabetic individuals). The prevalence of ASB was found to be 21.5% overall, 26.4% in diabetics, and 14.8% in non-diabetics in the current study. This finding is consistent with previous research, which found a frequency of 36.2 percent among diabetics[11] and 18.5 percent among non-diabetics.[5] The frequency of bacteriuria has been shown to be high in Cameroon (35.2–58.3%).[6,7] The frequency of ASB in this study, on the other hand, is higher than in some other research, which found 5.3–26 percent in diabetics and 3.5–15 percent in non-diabetics. [8-11] As a result, the subject of ASB prevalence is still up for debate. Other studies, however, have found a greater frequency of 42%[12], 47.2%[13] and 50.84%[14] respectively. According to some research, the frequency percentage is as low as 12%, 16% , 21%[15] and 26%[8] when compared to the present study report. Variations in sample size, geographical location, and culture method have all been blamed for the inconsistency.[16] In a present study, ASB is significantly difference in diabetic patients (26.4%) than non-diabetic control patients (14.8%). This is consistent with the bulk of previous studies.[17,18] Aged between 20–80 years were included in this study. Our study showed that age was a risk factor for ASB in DM patients. The more frequent cases of ASB among diabetic with age group with age above 51 years (56.1%) followed with age group 41–50 years (26.8%) while the most frequent cases of ASB of non-diabetic was among age group below 40 years (53%) followed by the age group above 51 years (35.3%). There is significant difference in this study, similar result in previous study in the Netherlands. The total of ASB is higher (50%) in aged (above 51 years) in both diabetics and non-diabetics.

Another study in India present the age group of 45–50 years had the highest percentage of ASB cases. Other some previous studies there was no significant age difference between the groups with and without ASB.[5,19]

Sex is a risk factor for ASB among diabetic patients, ASB cases were more frequent among diabetic (85.4%) and non-diabetic (94.1%) females than among males (14.6%) in diabetic and (5.9%) in non-diabetics. There is no significant difference in our study, the total of ASB is higher in females (88%) than males (12%) in both diabetics and non-diabetics which is concordance with previous studies.[2,13] Several studies suggest that women with ASB appear to have an increased risk of symptomatic UTI. In our research, there was no discernible difference, educational level is a risk factor for ASB in diabetic patients. ASB cases were more frequent among illiterate (70.7%) than literate (29.3%) among diabetic patients. ASB is higher in illiterate patients than literate patients with diabetics. This results is agreement to previous study in Iran.

In our research, there was no discernible difference. the frequency of ASB instances according to Body Mass Index (BMI), the ASB cases were more frequent among BMI 18–24 (53.7%) followed by BMI 25–29 (39%) and BMI 30–40 (7.3%) among diabetic patients, ASB is higher in BMI 18–24 (53.7%) than others in diabetic patients. The results of the study conducted by previous studies.[19] In our research, there was no discernible difference, the frequency of ASB instances according to the types of DM, the ASB cases were more frequent among type 2 DM (73.2%) than type 1 DM (26.8%) among diabetic patients. ASB is higher in type 2 DM than type 1 DM. This results similar to previous studies.[20,21] In multivariate analysis, we found that past history of UTI increased the chances of ASB by about 2.5 times.[22] The prevalent microorganisms in the present study were *Staphylococcus epidermidis* (22.4%), *Escherichia coli* (19%), *Enterococcus fecalis* (13.7), *Klebsiella pneumonia* (12%), *Enterobacter spp* (12%), *Staphylococcus aureus* (10.3%), *Staphylococcus saprophyticus* (6.8%) and *Pseudomonas aerogenosa* (3.4%). In our study was *Staphylococcus epidermidis* (22.4%) is the most common type of microorganisms isolated from urine in diabetic patients and non-diabetics, followed by *Escherichia coli* (19%). This is contrary to other studies[5,17,19] *E. coli* was the most common microorganism. It is becoming increasingly common to find organisms other than *E. coli* in the urinary tract. *Staphylococus aureus* was found to be the most common organism in diabetics and non-diabetics in a recent study in Nigeria[18] The high frequency of Staphylococcus species in ASB may be due to the fact that these micro-organisms are common skin flora that can enter the urinary tract during sexual intercourse or through contamination.[18] The high frequency of Staphylococcus species may be due to improper antibiotic use, which may promote the spread of highly resistant bacteria.[23]

While other studies have reported that Klebsiella pneumonia was more common microorganism.[24-26] The frequency of isolation of uropathogens is higher among diabetics than in non-diabetics except for Staph. saprophyticus which were similar isolated from diabetics and non-diabetics.[27] Both gram +ve and gram -ve bacteria were cultured from the urine of diabetics and non-diabetics, the distribution of Gram positive bacteria isolates were more frequent among diabetic patients (53.7%) and non-diabetics (53%), while Gram negative bacteria isolated among diabetics (46.3%) and non-diabetics (47%). Total of ASB is higher in diabetic patients with Gram +ve bacteria (53.5%) than Gram –ve bacteria (46.5%). This results is similar to previous study in Nigeria.[3] Antibiotic sensitivity of various pathogens is assessed in this study, and it is discovered that Levofloxacin is the most efficient antibiotic, with 45 isolates (77.5%) susceptible to it, followed by Ciprofloxacin, with 26 isolates susceptible to it (44.8%). Most of the isolates microorganisms from diabetics and non-diabetics were sensitive to Levofloxacin (77.5%), Ciprofloxacin (44.8%), Tobramycin (38%), Norfloxacin (36.2%)

and Vancomycin(32.7%). Hence our study suggests that levofloxacin, ciprofloxacin, tobramycin, norfloxacin and vancomycin can be considered suitable first-line medications for the treatment of ASB in diabetic individuals. Generally, high resistance was observed against gentamicin (60.3%), trimethoprim (60.3%), cefotrixone (56.8%), nitrofurantoin (48.2%) and nalidixic acid (48.2%).

Conclusion

The frequency of ASB among diabetic patients is (26.4%) against (14.8 %) among non-diabetics in this study. The more frequent cases of ASB among diabetics with age group above 51 years (56.1%), while the most frequent cases of ASB among non-diabetics with age group below 40 years (53%). ASB cases were more frequent among diabetic (85.4%) and non-diabetic (94.1%) females than among males (14.6%) in diabetic and (5.9%) in non-diabetics. ASB cases with *Staphylococcus epidermidis* being the predominant uropathogens in diabetics (19.5%) and non-diabetics (29.4%) followed by *E.coli* in diabetics (19.5%) and non-diabetics (17.6%). Levofloxacilin (77.5%) and Ciprofloxacin (44.8%) were the most effective sensitive antibiotics against most bacterial uropathogens. Gentamycin (24.1%) and Nitrofurantoin (20.6%) were the less sensitive antibiotics in Gram +ve and Gram –ve bacteria.

Recommendations

Establish health facilities that deal with people health regarding early diagnosis and management of ASB. Improve health care facilities standards about investigations and causes of ASB. In order to prevent the spread of multiresistant uropathogens in the research area, increased antibiotic sensitization is required.

Conflicts of Interest

None.

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