

Asymptomatic Bacteriuria among Type 2 Diabetic Females

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Background: Asymptomatic bacteriuria (ASB) is a risk factor for pyelonephritis and renal dysfunction in diabetic patients.

Objective: To investigate the prevalence of and risk factors for ASB among type 2 diabetic female patients.

Setting: Chronic Diseases Clinic, Abha Polyclinic, Abha, Saudi Arabia.

Design: A Prospective Controlled Study.

Method: Two hundred forty-six type 2 diabetic females attending the Chronic Diseases Clinic screened for ASB. Personal characteristics, duration and glycosylated hemoglobin (HbA1c) level were recorded. Four hundred ninety-two age-matched, non-diabetic and apparently healthy females registered at the same polyclinic were used as controls. All participants were followed-up every three months for one year for the development of symptomatic UTI.

Result: The mean age of type 2 diabetic females was 50.3±16.2 years, and 50.4±15.1 years for non-diabetic (P-Value=0.976). ASB was detected in 31 (12.6%) diabetic patients and in 32 (6.5%) controls (P-Value=0.005). *E. coli* was the most common organism in diabetic patients (18/31, 58.1%) and control subjects (23/32, 71.9%). Risk factors for ASB among type 2 diabetic females were older age, marriage, duration of diabetes and elevated HbA1c. During the follow-up period, symptomatic UTI developed in 25/31 (80.6%) diabetic patients compared to 39/215 (18.1%) without ASB (P-Value<0.001).

Conclusion: Type 2 diabetic females are at a high risk of developing ASB. Risk factors for ASB include older age, marriage, longer duration of diabetes and high HbA1c.

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Asymptomatic bacteriuria among type 2 diabetics is a significant risk factor for the development of urinary tract infections. *E. coli* and *K. pneumoniae* are the most common isolated organisms in the Saudi community. Among type 2 diabetic females, the prevalence of asymptomatic bacteriuria significantly increases with age, duration of diabetes and elevated HbA1c level. Treatment of asymptomatic bacteriuria could decrease the incidence of symptomatic urinary tract infections among type 2 diabetic females.

Type 2 diabetes increases the risk of urinary tract infection (UTI)^{1,2}. Deficiencies in the immune system of diabetics, poor metabolic control of the disease, and early autonomic neuropathy leads to incomplete bladder emptying and promote the pathogenesis of UTIs among diabetics³⁻⁵.

Asymptomatic bacteriuria (ASB) is a form of UTI, diagnosed by the isolation of a specified quantitative count of bacteria in urine specimen obtained from an asymptomatic person. The usual quantitative definition is ≥ 10 cfu/mL in two consecutive urine specimens^{5,6}.

ASB is highly prevalent among females, mainly due to anatomical reasons, such as the short urethra and the closeness to the warm and moist vulva and perianal areas, which are usually colonized with enteric bacteria⁷⁻⁸.

Harding et al reported that bacteriuria usually persists or recurs among diabetic females and could hardly be eradicated⁹. Nicolle et al stressed that in diabetic patients it is not indicated to treat ASB since there are no short or long-term benefits^{10,11}. Moreover, Nitzan et al reported that some females with ASB who receive antibiotic therapy may develop antibiotic resistance⁵.

UTIs and their complications occur more commonly in patients with type 2 diabetes mellitus¹². Symptomatic UTI occurs more frequently in bacteriuric females than in non-bacteriuric. Moreover, long-term cohort studies indicated that, at initial screening, there is an increased frequency of symptomatic UTI among females with ASB¹³.

The aim of this study is to evaluate the prevalence and risk factors of ASB among type 2 diabetic females.

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METHOD

Two hundred forty-six females with type 2 diabetes attending the Chronic Diseases Clinic were included in this study. Personal characteristics, duration and HbA1c were recorded. Four hundred ninety-two control group age-matched apparently healthy non-diabetic females registered at the same health care center were enrolled.

Exclusion criteria were those who had urinary symptoms, diabetics with disease duration less than one year and those with current renal or genitourinary tract disease or immune deficiency.

The diagnosis of ASB was based on Nicolle et al¹⁰. Bacteriuria was defined as two consecutive voided urine specimens with the isolation of the same bacterial strain in quantitative counts $\geq 10^5$ cfu/mL. UTI was diagnosed according to Bates: the development of symptoms and results of urinalysis and bacterial culture¹⁴.

Informed consent was obtained from all participants; all participants were screened for asymptomatic bacteriuria and were followed-up every three months for one year for the development of urinary symptoms. Those who developed symptomatic UTI received antibiotics according to the results of microbial culture and sensitivity testing.

RESULT

Table 1 shows that the mean age of diabetics was 50.3±16.2 years while that of control subjects was 50.4±15.1 years. Most diabetic 210 (85.4%) and non-diabetic participants 435 (88.4%) were married. The age or marital status difference between participants in both groups were not statistically significant.

Table 1: Personal Characteristics of Study Sample

Personal Characteristics	Diabetic (n=246)	Non-Diabetic (n=492)	P-Value
Age	50.3±16.2	50.4±15.1	0.976
Marital Status	Single 36 (14.6%)	57 (11.6%)	0.239
	Married 210 (85.4%)	435 (88.4%)	
Total	246	492	

Table 2 shows that asymptomatic bacteriuria was significantly higher among diabetics than non-diabetics (12.6% and 6.5%, respectively, P-Value=0.005). In both groups, *E. coli* was the main organism (58.1% and 71.9%, respectively). Moreover, few participants in both groups had *K. pneumoniae* (12.9% and 12.5%, respectively). During the follow-up period, the incidence of urinary symptoms was significantly higher among diabetics compared to non-diabetics (18.7% and 10.6%, respectively, p<0.001).

Table 2: Results of Bacteriological Study of Urine in Diabetic and Non-Diabetic Participants

Characteristics	Diabetic (n=246)	Non-Diabetic (n=492)	P-Value
Asymptomatic Bacteriuria	Absent 215 (87.4%)	460 (93.5%)	0.005
	Present 31 (12.6%)	32 (6.5%)	
Isolated Organisms	<i>E. coli</i> 18 (58.1%)	23 (71.9%)	0.420
	<i>K. pneumoniae</i> 9 (29.0%)	5 (15.6%)	
	Others 4 (12.9%)	4 (12.5%)	
Development of Urinary Symptoms	64 (18.7%)	52 (10.6%)	<0.001

Table 3 shows that diabetics with asymptomatic bacteriuria were significantly older than those with no asymptomatic bacteriuria (56.3±9.3 years and 49.5±16.7 years, respectively, P-Value=0.028). Diabetics with asymptomatic bacteriuria had significantly longer disease duration than those with no asymptomatic bacteriuria (28.9±10.4 years and 19.6±11.0 years, respectively, P-Value=0.041). Diabetic females with asymptomatic bacteriuria had significantly elevated HbA1c than those with no asymptomatic bacteriuria (8.7±0.7 and 7.9±0.8, respectively, P-Value<0.001). Married females were more among diabetics with asymptomatic bacteriuria than diabetics with no asymptomatic bacteriuria (93.5% and 84.2%, respectively). However, the difference was not statistically significant. During the follow-up period, the development of symptomatic urinary tract infection was significantly higher among diabetics with asymptomatic bacteriuria than those with no asymptomatic bacteriuria (80.6% and 18.1%, respectively, P-Value<0.001).

Table 3: Risk Factors for Asymptomatic Bacteriuria among Diabetics

Characteristics	Asymptomatic Bacteriuria		P-Value
	Present (n=31)	Absent (n=215)	
Age	56.3±9.3	49.5±16.7	0.028
Duration of diabetes (in years)	23.9±10.4	19.6±11.0	0.041
HbA1c	8.7±0.7	7.9±0.8	<0.001
Marital Status	Single 2 (6.5%)	34 (15.8%)	0.168
	Married 29 (93.5%)	181 (84.2%)	
Development of Symptomatic UTI	25 (80.6%)	39 (18.1%)	<0.001
Total	31	215	

DISCUSSION

This study revealed that the prevalence of ASB among diabetic females was 12.6%, which was significantly higher than that among non-diabetic females. *E. coli* was the main isolated organism among more than half of participants in both groups.

These findings are similar to other studies which reported a significantly higher prevalence of ASB among diabetic patients, ranging from 8% to 26%^{4,15,16}. In a prospective study of inpatients, Aswani et al reported a prevalence of ASB as high as 30% among diabetic patients¹⁷. In addition, a meta-analysis of 22 studies, Renko et al found a prevalence of 12.2% of ASB among diabetics compared to 4.5% among healthy control subjects¹⁸.

Nicolle et al stated that among females with ASB, *E. coli* is the most common organism that could be isolated¹⁰. However, Svanborg et al found that *E. coli* strains isolated from females with ASB are characterized by their lower virulence than those isolated from females with symptomatic UTI¹⁹. *K. pneumoniae*, Staphylococci, Enterococcus species, Streptococci and *G. vaginalis* are also frequent among females with ASB.

This study showed that, during the one-year follow-up period, development of urinary symptoms and UTI was significantly higher among diabetics than non-diabetics; UTI was significantly higher among those with ASB than those with no ASB.

In a prospective longitudinal study, Tencer et al reported that symptoms of urinary infections occurred at least once in more than half of females who had ASB at enrollment compared with only 10% among those without ASB¹³. They found that females who were bacteriuric at enrollment were more likely to be bacteriuric at follow-up, irrespective of any given antimicrobial therapy.

This study showed that diabetics with ASB were significantly older than those with no ASB. Moreover, ASB was significantly more prevalent among diabetics with longer disease duration and those with elevated levels of HbA1c. In addition, married females with ASB are more than those with no ASB.

Our findings are similar to Geerlings et al who found various risk factors for ASB in females with diabetes including sexual activity, older age, duration of diabetes and poor metabolic control of diabetes¹⁵.

Nicolle et al found that the prevalence of ASB among healthy females increases with advancing age, from 1% among young health females to more than 20% among healthy females aged (\geq) 80 years or more²⁰. ASB is usually correlated with duration of diabetes. It is also associated with females' sexual activity; it is higher among premenopausal married females (4.6%) compared with only 0.7% among age-matched nuns.

Wang et al suggested that the higher prevalence of ASB among diabetics with poorly controlled diabetes is due to elevated glucose concentrations in urine, which promotes bacterial growth²¹. Boyko et al found that elevated HbA1c constituted a risk factor for UTI in diabetics².

Hooton et al found that the prevalence of symptomatic UTI was significantly higher in females with ASB than in those with no ASB²². Nicolle et al found that long-term cohort studies revealed increased frequency of symptomatic UTI in females identified with ASB at initial screening¹⁰. Moreover, MacIsaac et al reported that ASB is a risk factor for the subsequent decline in renal function and increased incidence of UTI among diabetic females²³.

CONCLUSION

Type 2 diabetic females are at a high risk of developing ASB. Risk factors for ASB include older age, marriage, longer duration of diabetes and elevated HbA1c.

It is important to routinely screen for asymptomatic bacteriuria among type 2 diabetic females in the Saudi community. Screening should not overlook those who are above 50 years old, married with elevated HbA1c. Early management of type 2 diabetic females with asymptomatic bacteriuria is important to prevent development of symptomatic urinary tract infections.

Potential Conflicts of Interest: None.

Competing Interest: None. **Sponsorship:** None.

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