

Original Article

Prevalence of Asymptomatic Bacteriuria and Associated Host Factors in Women with Type 2 Diabetes in Shahre-kord, Iran; 2005

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ABSTRACT

Objective(s): Asymptomatic bacteriuria (ASB) is common among diabetic women. The aim of this study was to determine the prevalence and risk factors for ASB in women with diabetes.

Design: Prospective cross-sectional study

Setting: Chahar-Mahar province, Iran

Subjects and Methods: One hundred women with type 2 diabetes and 100 normal women (control) who had no abnormalities of the urinary tract were recruited. Demographic data and information regarding previous history of urinary tract infections (UTIs), duration of diabetes and presence of pyuria was collected. Baseline serum creatinine and fasting blood sugar levels (FBSL) were measured.

Main outcome measure(s): Prevalence and risk factors for ASB in normal and type 2 diabetic women.

Intervention: The prevalence of ASB and related risk factors in the two groups and the rate of ASB progressing to symptomatic UTI in a six-month period were evaluated.

Results: The prevalence of ASB was 20% in diabetics and 4% in control group ($p < 0.05$). Pyuria was present in 80% of diabetics with ASB. Symptomatic UTI in previous year was the only risk factor for ASB ($p < 0.05$). During a follow-up of six months, 40% diabetics with ASB developed to symptomatic UTI.

Conclusions: The prevalence of ASB is increased in women with diabetes. We recommend screening for detection and treatment of ASB in diabetic women.

KEY WORDS: asymptomatic bacteriuria, diabetes type 2, pyuria

INTRODUCTION

Asymptomatic bacteriuria (ASB) is defined as the presence of at least 10^5 colony-forming units (CFU) / ml of one or two bacterial species in clean-voided midstream urine sample from an individual without symptoms of a urinary tract infection (UTI)^[1]. Patients with diabetes have an increased risk of infections, with the urinary tract being the most prevalent infection site^[2,3]. Besides, the rates of complications of UTI and upper tract involvement are much higher than in the general population. ASB in diabetic patients carries an increased risk of symptomatic UTI^[4,5]. The prevalence of ASB is about three times higher in diabetic women (ranging from 15 to 30%) than in non-diabetic women (less than 10%)^[1,6-8]. Local secretion of cytokines and increased adherence of uropathogens to uroepithelial cells have been proposed to account for the greater prevalence of bacteriuria in diabetic persons^[6,9]. The prevalence of pyuria in young nondiabetic women with ASB is about 32%. The same rate in diabetic women is estimated to be about 70-80%^[10,11].

Various risk factors for ASB in women with diabetes have been suggested, including sexual intercourse, age, duration, metabolic control, and complications of diabetes^[4,8,10,12,13]. Some studies showed that, the number of symptomatic UTI in the previous year increased the risk of developing ASB in diabetic women^[14]. Mendusa and coworkers^[7] postulated that there is no association between fasting glucose concentration and ASB in diabetic women.

Escherichia coli, in diabetic patients, as in others is the most common uropathogen^[7,10]. Other Enterobacteriaceae including *Proteus*, *Klebsiella*, *Enterobacter* and *Citrobacter* spp., *Pseudomonas aeruginosa*, *Enterococcus* spp., *Gardnerella vaginalis*, *Streptococcus* and *Staphylococcus* spp., *Candida albicans* and other fungi have been reported^[7,10,15]. The probability of a more severe course of the infection and the proportion of resistant pathogens is also higher in diabetic patients than in non-diabetics^[4,6,16].

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There is a trend in clinical practice to treat patients with diabetes who have ASB^[4]. Some studies have not recommended antibacterial treatment in ASB for prevention of UTI complications in diabetic patients^[4,6,17]. In contrast, other reports have suggested at least one course of appropriate antibiotic therapy in an effort to eradicate the pathogen or the postulated pathogen from the urinary tract^[1,11,15,18], although in some reports, this is based solely on empiric evidence^[18].

Some studies^[19] have reported that decreasing renal functional tests is a consequence of ASB in diabetic patients. Geerlings^[20] showed that 23% of patients with diabetes type 2 and ASB progressed to symptomatic UTI within two months and postulated that ASB is the most important risk factor for developing UTI in diabetic women. It is known that more UTI related complications (e.g. bacteremia, renal abscesses, renal papillary necrosis) are seen in patients with diabetes versus individuals without diabetes^[21]. There are no published studies about ASB, the relationship between ASB and UTI and the need to initiate empiric therapy, especially in diabetic patients in Iran. The present study was undertaken to resolve these issue with reference to the women diabetic population in Shahre-kord city of Iran.

MATERIALS AND METHODS

In an analytical cross-sectional study, 100 nonpregnant women between the ages of 31-81 years with diabetes (type 2) but without any abnormalities of the urinary tract and 100 women without diabetes (as control group) were recruited. The groups were well-matched demographically. ASB was defined as the presence of at least 10⁵ CFU/ml of one or two bacterial species in a culture of clean-voided midstream urine from an individual without symptoms of UTI. Urine samples were kept at 4 °C for up to two hours before culture. The urine was plated onto 5% sheep blood agar (Difco, USA) and MacConkey agar (Difco, USA) plates. A calibrated loop designed to deliver 0.01 milliliter of urine was used for urine inoculation. The plates were streaked by touching the loop to the center of the plate, from which the inoculum spread in a line across the diameter of the plate. Then, loop was drawn across the entire plate, crossing the first inoculum streak numerous times to produce isolated colonies. Once plated, urine cultures were incubated at 35 °C aerobically. The results were read after 24 hours. Colonies were counted on each plate. The number of CFUs was multiplied by 100 to determine the number of microorganisms per milliliter in the original specimen^[22]. The presence of WBCs $\geq 10/\text{mm}^3$ of urine was considered as significant pyuria^[22]. Microorganisms were identified according to standard bacteriologic procedures^[22].

Exclusion criteria were pregnancy, recent hospitalization or surgery within the past four months, known urinary tract abnormalities or recent urinary tract instrumentation, symptoms of a UTI such as dysuria, frequency or urgency, abdominal discomfort or fever, or the use of antimicrobial drugs during the previous 14 days. A consent form was filled in by the patient at the beginning of the study. The patients who developed symptomatic UTI were referred to an urologist for further evaluation and initiation of therapy. All patients were interviewed during the first visit of the study and their medical history was obtained using a standardized questionnaire. The questionnaire included age, duration of diabetes, and urinary tract surgery during the previous years and UTI during the past year. Laboratory values for serum creatinine, pyuria and fasting glucose concentration were also obtained. During follow-up for six months, any progression of ASB into symptomatic upper or lower urinary tract infections were determined. Risk factors were analyzed according to the differences between patients with and without ASB. Differences between patients with and without ASB were tested with the Mann-Whitney test for continuous variables (age and duration of diabetes). Chi-square test was used for variables like pyuria and number of UTIs during the past year. P-value < 0.05 was considered to be statistically significant. SPSS statistical software for windows (version 11) was used.

RESULTS

Out of the total study group with type 2 diabetes (n = 100), 20% had ASB. Only 4% of nondiabetic patients (control group) had ASB (p < 0.05). Pyuria was present in 80% of diabetic and 25% of nondiabetic patients with ASB (p < 0.05). *Escherichia coli* was isolated in 55% patients with ASB. Other isolated microorganisms included coagulase-negative *Staphylococci* (20%), *Enterococcus* spp. (15%), *Klebsiella pneumoniae* (10%).

Eighty percent of diabetic women with ASB and 17.5% of those without ASB had pyuria (p < 0.05). Besides, 40% percent of diabetic women with ASB had history of symptomatic UTI in the past year. There was no correlation between age, fasting glucose concentration, duration of diabetes and the presence of ASB in diabetic women. In contrast, significant association was evident between symptomatic UTI during the past year and the presence of ASB in patients (p < 0.05, Table 1). Chi-square test showed that no association was evident between past history of UTI and presence of pyuria. During a follow-up of six months, 40% (eight patients) of diabetic women with ASB had at least one episode of symptomatic UTI; five (62.5%) developed symptomatic lower UTI (cystitis) and

Table 1: Risk factors for women with diabetes type 2 (n = 100)

Risk factors	ASB +ve Diabetics	ASB -ve Diabetics	p-value
No. of patients (%)	20 (20)	80 (80)	
Age in years - Median (range)	65 (40- 81)	63 (31-80)	0.14
Duration of diabetes in months - Median (range)	60 (1-280)	48 (1-360)	> 0.05
History of UTIs during the previous year	40%	5%	< 0.05
Fasting glucose concentration (range)	175 mg/dl (88-400)	154.5 mg/dl (60-400)	0.165

ASB = asymptomatic bacteriuria, UTIs = urinary tract infections

Table 2: Risk factors associated with progression to symptomatic urinary tract infection (UTI) in ASB positive diabetic women

Risk factors	ASB+ patients developed UTI (range)	ASB+ patients not developed UTI (range)	p-value
Median age in years -	61.5 (40- 70)	66.5 (57- 81)	0.048
Median duration of diabetes in months -	12 (1- 280)	66 (1- 240)	0.56
Fasting glucose concentration	145 mg/dl (100- 300)	195 mg/dl (114- 400)	0.27

ASB = asymptomatic bacteriuria

three (37.5%), symptomatic upper UTI (pyelonephritis). In diabetic patients without ASB, symptomatic lower UTI was detected in only five (6.3%) patients ($p < 0.05$). Upper UTI was not found in these patients. There was an association between age and progression from ASB to symptomatic UTI in our patients ($p = 0.048$). No association was found between duration of diabetes, fasting glucose concentration and development of UTI in diabetic patients with ASB (Table 2). Besides, in our study, no association was found between serum creatinine and presence of ASB in diabetic women.

DISCUSSION

In this study, we found that the prevalence of ASB was higher in diabetic than in nondiabetic women. Also, *Escherichia coli* was the predominant microorganism isolated from diabetic patients. These findings were confirmed by other reports^[1,4,6,8,10,15]. Makuyana and coworkers^[11] isolated groups B and D *Streptococci*, *Staphylococcus aureus*, and *Pseudomonas* spp. from diabetic women with ASB. In our study, such isolates were not prevalent.

Although, age has also been postulated as the most important risk factor for ASB in type 2 diabetic patients in some reports^[14,23], in the current study we could not find an association between age and the presence of ASB in diabetic women. In contrast, as shown in Table 2, age of patients was an important risk factor for developing UTI in diabetic women with ASB. It was shown in this study that, the average age in diabetic women with UTI was lower than patients without UTI. Therefore, it can be concluded that, other factors such as sexual activity and menstrual period in young diabetic women may be included as predisposing factors

for progression of ASB to symptomatic UTI. This is worth further future study and investigation.

Another risk factor for ASB in type 2 diabetic patients in this study was at least one episode of UTI during the previous year. Previous UTI as a risk factor for ASB indicates that bacteriuria can be present with or without symptoms in the same patient. In some reports^[14,23,24,25] the presence of UTI during past year, has also been postulated as important risk factor for ASB in diabetics. It can be concluded that, the colonization of uropathogens in urinary tract of diabetics after episodes of UTI, local secretion of cytokines and increased adherence of bacteria to uroepithelial cells in these patients, can accelerate the prolonged release of bacteria from urinary tract resulting in bacteriuria.

Some studies^[26] found that diabetic women with ASB have lower urinary cytokine concentrations and therefore, decreased urinary leukocyte numbers compared with nondiabetic women with ASB. But, in our study, 80% of women with type 2 diabetes and ASB had pyuria compared to 25% in nondiabetic women. The correlation between pyuria and ASB has also been reported by other studies^[7,10,11,15]. Meiland and associates^[19] have reported that decreasing renal functional tests is a consequence of ASB in diabetic patients and therefore, they recommended regular screening of diabetic patients for ASB. Geerlings^[20] showed that 34% of diabetic women with ASB had impaired renal functional tests. In our study, we did not find any association between patients' serum creatinine and presence of ASB.

Some reports^[4,7,8,10,27] have shown that the duration of diabetes is associated with ASB in diabetic patients. In the present study, we could not find

any association between duration of diabetes and presence of ASB in diabetes type 2 women. Meiland *et al*^[14] have also reported that this relationship was not present in patients with diabetes type 2 and only was found between ASB and diabetes type 1.

Geerlings^[20] showed that 23% of patients with diabetes type 2 and ASB developed to symptomatic UTI within two months and postulated that ASB is the most important risk factor for developing UTI in diabetic women. These findings have been confirmed by Ooi and coworkers^[4]. In this study, after a six months follow-up of diabetic women with ASB, a considerable percentage of patients progressed to symptomatic UTI. Therefore, we can conclude that ASB could be considered an essential risk factor for developing UTI in diabetic patients.

No consensus exists regarding the treatment of ASB in diabetic patients. Many experts recommend treating ASB in diabetic patients because of the frequency and severity of upper UTIs^[6,23,28]. On the other hand, some studies believe that the benefit of treatment is doubtful^[4,29]. This contrast is believed to be due to a lack of follow-up studies of diabetic women with untreated ASB. In this study, as mentioned above, after a six months follow-up of diabetic women with ASB, 40% developed symptomatic UTI. Therefore, although a further investigation about approach in diabetic patients with ASB is suggested, based on our findings, we recommend screening and treatment of ASB in diabetic women.

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