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Clinicopathological Evaluation of Asymptomatic Bacteriuria in Diabetes Mellitus Patients

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Abstract

Introduction: *Asymptomatic bacteriuria (ASB), or asymptomatic urinary infection, is isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen obtained from a person without symptoms or signs referable to urinary infection. Patients with diabetes mellitus (DM) have a high frequency of ASB and urinary tract infections (UTIs). High glucose concentration in the urine of DM patients may favour the growth of uropathogens. Early detection, strict glycemic control and proper treatment prevent the burden of asymptomaticbacteriuria.* ***Objectives:*** *To observe the frequency of asymptomatic bacteriuria and common isolates among diabetic patients.* ***Materials & Methods:*** *This cross-sectional study was conducted amongst diabetic patients from March 2016 to December 2016. Sample was selected by purposive sampling technique. Patients with DM were selected for study. Sample size was 72. Mid-stream urine samples collected into sterile container for urinalysis. Cultures with colony counts ≥ 105cfu/ ml were considered as significant bacteriuria. Detail demographic data were collected from the informant and recorded in structured case report form. Clinical examination and relevant investigation were done meticulously.* ***Result:*** *Mean age of patients was 56.04±18.08 yrs. Female patients were predominant, out of 72 cases 32(44%) were male and 40(56%) were female. Present study showed that ASB was present in 57(79.16%) patients and E. coli was the most common pathogen. Other isolates included Klebsiella pneumoniae 11(19.29%), Proteus sp. 6(10.52%) and Enterobacter sp. 5(8.77%).* ***Conclusion:*** *Asymptomatic bacteriuria is common in DM patients. The occurrence of ASB in the older population and females was significant in this study. ASB may lead to albuminuria and urinary tract infection, and may warrant treatment in diabetics. So it is recommend screening for detection and treatment of ASB in diabetic patients should be routinely.*

Key words: *Asymptomatic bacteriuria (ASB), UTI, Diabetes mellitus.*

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Introduction:

Urinary tract infection is a serious problem in diabetic patient, and asymptomatic bacteriuria in these patients is risk factorfor pyelonephritis and renal dysfunction. E. coli and K. pneumoniae are the most frequently isolated bacteria in these patients with ASB[1]. Diabetes causes several abnormalities of the host defense system that might result in a higher risk of certain infections, including UTI. These include immunologic impairments, such as impaired migration, intracellular killing, phagocytosis, and chemotaxis of polymorphonuclear leukocytes from diabetic patients, and neuropathic complications, such as impaired bladder emptying. In addition, a higher glucose concentration in the urine may create a culture medium for pathogenic microorganisms. Diabetes has long term effects on the incidence of UTIs and has been reported to be around three to four times high in diabetic compared with non-diabetic patients. It has been suggested that presence of static pools of urine due to dysfunctional bladders contracting poorly serves as a favorable media for bacterial growth, while others suggest that hyperglycemic urine promotes rapid bacterial growth and colonization. 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. Various risk factors for ASB with diabetes have been suggested, including sexual intercourse, age, duration, metabolic control, and complications of diabetes. The most frequently isolated uropathogens include Escherichia coli, Klebsiella pneumoniae, Streptococcus agalactiae, Enterococcus faecalis, Coagulase negative Staphylococcus and Streptococcus pyogenes. Although E. coli is known to be the most

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common uropathogen, other microorganisms are emerging with predominance in cases of ASB. Asymptomatic bacteriuria is far more common in women than in men. Also, in women, this condition is commoner in diabetics, than in those without the disease. Anatomic and physiologic factors (such as a short urethra) are responsible for the higher susceptibility of females to these infections. It is not completely clear if symptomatic UTIs are preceded by asymptomatic bacteriuria. Complications from UTI, such as bacteremia, renal abscesses and renal papillary necrosis, are seen more commonly in patients with DM than in individuals without DM[2,3]. Diabetic subjects, especially women, show high prevalence of asymptomatic bacteriuria (ASB). The aim of the study was to evaluate the frequency of ASB in diabetic patients and to find out the antibiotic sensitivity pattern of bacterial isolates. Additionally, renal involvement even without the presence of symptoms (such as subclinical pyelonephritis) is commoner in patients with DM. So, detection of UTI in diabetics becomes very important. ASB defined as persistently and actively multiplying bacteria in significant numbers (more than 10,0000 per milliliter) within the urinary tract without any obvious symptoms[4]. Asymptomatic bacteriuria is common in neonates, preschool children, pregnant women, elderly people, diabetics, catheterized patients and patients with abnormal urinary tracts or renal disease[4]. Diabetes type 2, also known as non insulin dependent diabetes (NIDDM), is one of the two major types of diabetes in which the beta cells of the pancreas produce insulin but the body is unable to use it effectively because the cells of the body are resistant to the action of insulin[5,6,7]. Patients with diabetes have an increased risk of infections, with the urinary tract being the most prevalent infection site[6,8]. Besides, the rates of complications of urinary tract infection (UTI) and upper tract involvement are much higher than in the general population. Though there is currently no consensus on treatment of asymptomatic bacteriuria in various population groups, it is advisable to treat asymptomatic bacteriuria in DM, as these patients may progress to symptomatic UTI or develop complications of UTI. This study attempts to estimate the frequency of asymptomatic bacteriuria among diabetic patients who have no exclusion criteria.

Materials & Methods:

This cross-sectional study was conducted from March 2016 to December 2016, amongst newly or previously diagnosed diabetic cases, aged 40 years and above, and who gave informed written consent for this study. Mid-stream urine sample was collected from these patients and subjected to culture. Urine was collected from the female subjects during their non-menstural periods. Culture was done using the semi-quantitative calibrated loop technique. Culture plate was read after 24 hours of incubation, and number and type of colonies were estimated in plates with growth. Plates with no growth were reincubated for an additional 24 hours, and checked again for growth. The isolate was then identified using standard microbiological techniques. Isolation of the same strain of bacterium from two consecutive samples of urine with quantitative counts greater than 105 colony forming units per millilitre in females, and growth of a single type of organism with quantitative count greater than 105 colony forming units per millilitre in males, was taken as evidence of asymptomatic bacteriuria. The data was analysed using the statistical software.

Result & Observation:

The age of participants at entry was >40years, mean age was 56.04±18.08. Participants were randomly selected on male and female subject. Female sex were significant number, sex ratio (F: M) was 1.25:1.

Table-I: Baseline characteristics of Study population (n=72)

Characteristics with Indicator	Result
Age in yr (Mean ± SD)	56.04±18.08
Sex ratio (F:M)	1.25:1
Occupation category (house wife)	29 (40.27%)
Duration of illness (yr)	>11 yr
Antiglycemic agent (injectable)	47(65.27%)
Previous history of UTI (no of episodes)	1-5 times
Major risk factors	26(36.11%)
Bacteria isolation (E.coli)	28(49.12%)

The median self-reported duration of questionnaire completion was 70 minutes (range 50–90). Baseline clinical characteristics are: Occupation category (house wife) 29 (40.27%), Duration of illness (yr) were >11 yr, injectable agent observed commonest antiglycemic drugs 47(65.27%). Among the total 72 cases of patients, previous history of UTI (no of episodes) more than 1-5 times were maximum patients, major bacteria isolation (E.coli) observed in 28(49.12%) (Table I).

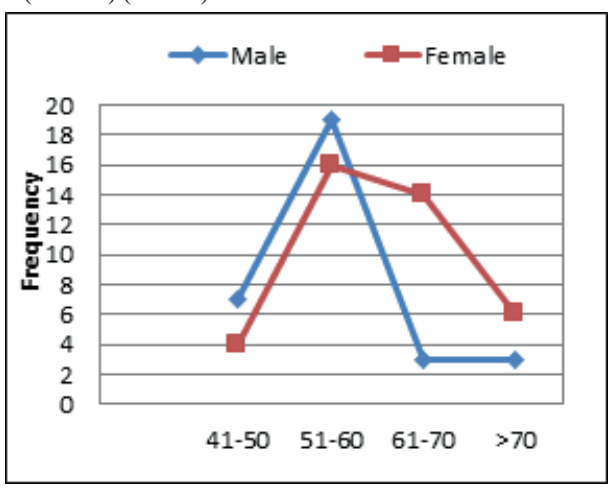

Figure- 1: Frequency of ASB in age & sex variation (n=72)

Frequency and susceptibility of asymptomatic bacteriuria in diabetes patients gradually increased with rising of age. Age ≤50 disease is insignificant. In case of female 51-70 years was highest incidence and in case of male 41 to 60 years observed peak age for asymptomatic bacteriuria (Figure-1). Diabetes treated with insulin and diabetes of longer duration were related to substantial increases in the risks of UTI and

asymptomatic bacteriuria. Higher risks of UTI and asymptomatic bacteriuria were seen the insulin-treated patients 47(65.27%) (Table II).

Table-II: Trends of Antiglycemic agent amongst the subjects (n=72)

Antiglycemic agent	Number of Patients	Percentage
Oral	25	34.72
Insulin	47	65.27

Midstream urine samples were collected from patients into sterile container for urinalysis. Cultures with colony counts ≥ 10^5cfu/ ml were considered as significant bacteriuria. The organisms were identified using standard cultural, morphological and biochemical techniques. We found that 57(79.16%) of urine samples had significant bacteriuria (Figure-2).

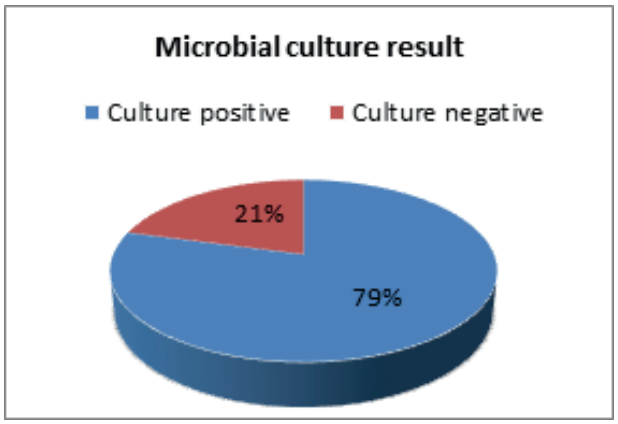

Figure- 2: Microbial culture result (n=72)

Bacteria isolated in ASB and prevalence of the organisms revealed that, E. coli was found most prevalent, present in 28(49.12%) of patients, followed by Klebsiella pneumoniae 11(19.29%), Proteus sp. 6(10.52%) and Enterobacter sp. 5(8.77%). The least prevalent organisms were Streptococcus pyogenes, E. faecalis and S. saprophyticus (Table III).

Table-III: Common isolated microorganism in ASB (n=57)

Organism	Frequency	Percentage
Escherichia coli	28	49.12
Klebsiella pneumoniae	11	19.29
Proteus sp.	6	10.52
Enterobacter sp.	5	8.77
Enterococcus faecalis	4	7.01
Staphylococcus aureus	2	3.50
Strept. saprophyticus	1	1.75

Discussion:

Present study clearly demonstrated a high occurrence of asymptomatic bacteriuria in diabetics. This is in concurrence with a meta-analysis study published in 2011, which showed a similar rate among diabetics[9]. In this series, mean age was 56.04±18.08 yrs and female – male ratio was 1.25:1. Findings are consistent with other study. A hospital-based descriptive study revealed that, 42% patients with DM were found to have asymptomatic bacteriuria. Among these, 27 (64.29%) were female and 15 (35.71%) were male. Thus, the occurrence of asymptomatic bacteriuria among female diabetics was 54%, as opposed to 30% in males[2]. Singh L et al; showed that ASB was highest in age groups 45 - 49 in males and 35 - 39 in female in their study[10]. So all findings support that asymptomatic bacteriuria is far more common in women than in men. Diabetes treated with insulin and diabetes of longer duration was related to substantial increases in the risks of UTI and asymptomatic bacteriuria. Patient taking insulin were mainly those at higher risk, possibly because of more severe diabetes, since the use of insulin may be a marker for disease severity. Risk of UTI was higher with increasing duration of diabetes. The present study showed that higher risks of UTI and asymptomatic bacteriuria were seen the insulin-treated patients 47(65.27%). Consistent with one other study, study in Group Health Cooperative of Puget Sound (GHC), revealed that higher risks of UTI and asymptomatic bacteriuria were seen in diabetic patients treated with medication, but statistical significance was observed only in the insulin-treated cases. Significantly higher risks of asymptomatic bacteriuria and UTI were seen among patients who had had diabetes for 10 or more years[11]. Persistence of illness for long-term, more chance for infection. Long time suffering of diabetes causes several abnormalities of the host defense system that might result in a higher risk of infections, including UTI. These include immunologic impairments and neuropathic complications, such as impaired bladder emptying. In addition, a higher glucose concentration in the urine may create a culture medium for pathogenic microorganisms. Concomitant subsistence of any complication or risk factors plays important role for development of immunological suppression, ultimately contributes the asymptomatic illness. In this study cultures with colony counts ≥ 10^5cfu/ ml were considered as significant bacteriuria. The organisms were identified using standard cultural, morphological and biochemical techniques. We found that 57(79.16%) of urine samples had significant bacteriuria. Study in outpatient department of Chhattisgarh Institute of Medical sciences hospital, India showed that Mid-stream urines were collected from patients aseptically into sterile wide mouth container and examined microscopically. Significant bacteriuria was observed in forty-seven (36.15%) patients in their study, among them 34 females and 13 males[10]. The present study showed that asymptomatic bacteriuria (ASB) was present in 57(79.16%) out of 72 patients with diabetes mellitus. This result was higher when compared to previous studies which showed 36.15% in India[10], 17.88% in Turkey[1], and 20% in Iran[5]. The population studies in these reports are comparable to the number of patients in this study. Some studies have even reported much lower values of between 5-15%. The variations in percentages of ASB have been attributed to factors such as geographical variations, ethnicity of the subjects and variation in the

screening test. E. coli was the most common pathogen isolated in this study 28(49.12%). This is in contrast to the report of Singh L[10] et al. where Escherichia coli (56.9%) was the most common isolates form, followed by Enterobacter sp. (12.7%), Klebsiella pneumoniae (8.5%) and Proteus sp. (6.3%). In this study other bacteria isolated include Klebsiella pneumoniae 11(19.29%), Proteus sp. 6(10.52%) and Enterobacter sp. 5(8.77%). The result of this study is consistent with the majority of reports where E. coli had been reported to be the major pathogen in ASB[1,5,10,12]. This is why in general practice most work on pathogenesis of UTI focuses on E. coli because of its high prevalence in UTI[12]. Although diabetic persons may be more susceptible to infection by uncommon organisms, we found most of their infections to be due to typical uropathogens, which suggests that diabetes facilitates the same route of infection as that for UTI in nondiabetic persons (i.e., ascending infection from the urethra). The finding that asymptomatic bacteriuria more often involved Klebsiella and Enterococcus in diabetic person suggests that defenses against these organisms may be reduced.

Conclusions:

Acute Patients with diabetes mellitus (DM) are more prone to infection, and the urinary tract is one of the most commonly affected sites. In this study a high prevalence of ASB was established in elderly aged population and mainly female's gender. The main pathogen was E. coli and this organism is beginning to acquire resistance to some of the clinically used antibiotics. Study recommends improved personnel hygiene which is likely to reduce ASB that may be complicated in UTI. The use of irrational drugs, unprescribed antibiotics and their abuse is a problem and appropriate public health programmes would help resolve this issue. Facilities for prompt and adequate treatment of DM, UTI and screening should be available in all hospitals.

Conflict of Interest: None.

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