https://doi.org/10.22502/jlmc.v3i2.66

Original Research Article

Asymptomatic Bacteriuria in Diabetic Adults

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ABSTRACT:

Introduction: Urinary Tract Infection (UTI) is a well- known complication of Diabetes Mellitus (DM). Its spectrum ranges from Asymptomatic Bacteriuria (ABU) to acute pyelonephritis. Many studies have delineated an increased prevalence of ABU in DM whereas to the same degree other studies have come to naught showing insignificant association. Hence, this study was drafted to evaluate the presence of ABU among diabetics and assess various risk factors. **Methods**: Total of 116 diabetic adults without symptoms of UTI attending medical out-patient department, Manipal Teaching Hospital were enrolled by detailed clinical history, examination and laboratorial examination as per standard set of questionnaire from February 2013 to May 2014. Data were analyzed by SPSS (17.0). **Results**: The rate of ABU in diabetic adults was 10.3% and was significantly associated with duration of DM, fasting blood glucose level and poor glycaemic control. Escherichia coli was the most frequently isolated pathogen which was sensitive to Nitrofurantoin and Imipenem. **Conclusion**: Being asymptomatic, diabetics fail to recognise ABU, however, ABU is preponderant in DM and is linked mainly with duration of DM and poor glycaemic control. Hence screening for ABU is imperative in diabetic adults if above mentioned risk factors are present.

Keywords: asymptomatic • bacteriuria • diabetes mellitus • risk factors • urinary tract infection

INTRODUCTION:

Asymptomatic bacteriuria (ABU) refers to the presence of bacteria in urine at levels often regarded as clinically significant in patients with no symptoms suggestive of Urinary Tract Infection (UTI).[1,2] It is defined as isolation of a specified quantitative count of bacteria in an appropriately collected urine specimen from an individual without symptoms or signs of UTI.[3]

The prevalence of ABU in the population varies widely with age, gender, Body Mass Index (BMI), disease status including Diabetes Mellitus (DM), previous history of UTI, sexual activity, presence of genitourinary abnormalities, previous genitourinary instrumentation, intervention or surgery, and albuminuria.[4] It is commonly believed that the incidence of infection is higher in person with DM and that such infection results in complication and death more frequently than would be anticipated in otherwise healthy individuals.[5] Moreover, UTI is a significant problem in patients with DM because of multiple effects of DM on the urinary tract and host immune system.[6]

An association between UTI and DM was first noted in an autopsy series in 1940's. Many studies have shown an increased prevalence of bacteriuria in diabetics whereas almost equal numbers of studies have failed to show a significant association.[5] There is paucity of data on prevalence of ABU in wider age group of diabetic patients in Nepalese population.[7] Hence, the aim of the present study was to evaluate the prevalence of ABU among wider age group diabetic adult patients, to assess the associated risk factors including age, gender, duration of DM, BMI, glycaemic control and identification of bacteriological profile along with antibiotic sensitivity pattern of those isolates.

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How to cite this article:
Adhikaree A, Kohli SC, Pokhrel DR, Bhatta D. Asymptomatic bacteriuria in diabetic adults. Journal of Lumbini Medical College. 2015;3(2):25-9. doi: 10.22502/jlmc.v3i2.66.

METHODS:

This was a hospital based prospective analytical study conducted from February 2013 to May 2014 at Manipal Teaching Hospital, Pokhara, Nepal. After ethical clearance, a standard set of questionnaire was prepared and a written consent taken from all participants. Diagnosis of DM was made as per history and past medical treatment in all known cases and as per American Diabetes Association (ADA) criteria in all new cases.[8] All those diabetics giving consent, age ≥ 18 years and asymptomatic individuals (without features of dysuria, frequency, urgency, strangury, fever) were enrolled. Patients with recent hospitalisation or surgery (within past four months), renal disease (serum creatinine > 1.5 mg/dl), known urinary tract abnormalities (including cystopathy or recent urinary tract instrumentation), pregnancy, and use of recent anti-microbial drugs (within the preceding 14 days) were excluded. A detailed history with special reference to symptomatology and risk factors along with clinical examinations were performed. Cases were divided into male and female group and further subdivided into different sub-groups. After careful explanation of the procedure, a Mid-Stream Urine (MSU) specimen (after washing of the perineal area in females and penile area in males) was collected in a well labelled screw capped universal container which was promptly transported to the laboratory. All urine samples were inoculated on Mac-Conkey and Blood agar plates aerobically at 37°C for 48 hours. A second urine sample was taken in males whose urine culture showed mixed growth or growth < 10^5 colony forming unit /milliliter (cfu/ml). Identification of the isolates were carried out using standard microbiological methods.[9] Semi-quantitative estimation of colony count was calculated by standard loop method.[10] Antibiotic susceptibility testing (AST) of the isolates were performed on Mueller Hinton Agar by Kirby-Bauer disc diffusion method. Selection of antibiotic discs were as per National Committee for Clinical Laboratory Standards (NCCLS) guidelines.[11] Diagnosis of ABU in male was defined as the presence of ≥ 10^5 cfu/ml of one or two bacterial species. For female, it was confirmed by a second urine culture as per Infectious Diseases Society of America (IDSA) guidelines.[4] In addition, urine routine and microscopic examination, FBS and PPBS, HbA1c, Complete Blood Count (CBC), serum urea, creatinine (Cr) were performed. The following associated risk factors i.e. age, gender, duration of DM, BMI, significant pyuria (>5 leucocyte/mm3) and glycaemic control (good control with HbA1c level < 7 % and poor control with HbA1c ≥ 7 %) were also studied.[8]

Analyses were performed using SPSS 17.0 (IL, Chicago, USA) statistical package. Data for categorical variables were expressed in number or percentage while continuous variables were expressed in mean and standard deviation. Independent sample t-test for continuous variables and Chi-square test and Fisher exact test for nominal variables were used. A binary logistic regression was used to assess the association between ABU as the dependent variable and gender, age group, duration of DM, BMI, FBS, PPBS, glycaemic control and significant pyuria as independent variables. Value of $p < 0.05$ was considered significant.

RESULTS:

Table 1 shows the baseline characteristics of the patients. Male were significantly elder than female. Other parameters were comparable between gender. Out of 116 diabetic adults, 12 diabetics (9 female, 3 male) had ABU with an occurrence of 10.3%.

Table 1*: Baseline characteristics of the patients*

Variables	Male (*N*= 55)	Female (*N*= 61)	Statistics
Age (years)	60.96 (*SD*=11.12)	56.46 (*SD*=10.48)	*t*=2.24, *df*=114, *p*=.03
Duration of DM (Years)	4.50 (*SD*=4.67)	5.40 (*SD*=5.05)	*t*=.95, *df*=114, *p*=.34
BMI (m/kg2)	24.53 (*SD*=4.58)	24.20 (*SD*=4.26)	*t*=.4, *df*=114, *p*=.69
FBS (mg/dl)	149.07 (*SD*=68.25)	148.8 (*SD*=59)	*t*=.02, *df*=114, *p*=.98
PPBS (mg/dl)	224.44 (*SD*=76.81)	232.33 (*SD*=81.36)	*t*=.54, *df*=114, *p*=.59
HbA1C (%)	6.59 (*SD*=0.96)	6.68 (*SD*=1.09)	*t*=.47, *df*=114, *p*=.63
Urea (mg/dl)	31.78 (*SD*=7.51)	30.44 (*SD*=6.87)	*t*=1, *df*=114, *p*=.32
Creatinine (mg/dl)	1.06 (*SD*=0.19)	1.02 (*SD*=0.17)	*t*=1.2, *df*=114, *p*=.23
SBP (mm Hg)	126.15 (*SD*=13.95)	129.54 (*SD*=17.66)	*t*=1.14, *df*=114, p=.26
DBP (mm Hg)	78.76 (*SD*=7.26)	79.08 (*SD*=8.68)	*t*=.21, *df*=114, p=.83
TLC	7356.36 *SD*=1686.74	7293.44 *SD*=1774.62	*t*=.2, *df*=114, *p*=.85
Significant Pyuria	6 (10.9%)	10 (16.4%)	X^2=1, *df*=1, *p*=.32
Asymptomatic Bacteriuria	3 (5.45%)	9 (14.75%)	X^2=3, *df*=1, *p*=.08

Table 2 shows the odds ratio of several variables, with ABU as dependent variable. Escherichia coli was the predominantly isolated pathogen (n=9, 75%) followed by Klebsiella pneumoniae (n=2, 16.7%) and Staphylococcus aureus (n=1, 8.3%). The antibiograms for the individual micro-organisms are shown in Table 3.

Table 2. Odds ratio (exponentiated coefficients), ABU as dependent variable.

Variables	Odds ratio	*P*
Age group (Years)		
25-39	REFERENCE	REFERENCE
40-54	1	0.99
55-69	8.08	0.53
70-84	6.25	0.6
Gender		
Male	REFERENCE	REFERENCE
Female	1.47	0.28
Duration of DM (Years)		
0-5	REFERENCE	REFERENCE
6-10	1.01	**0.01**
11-15	1.08	0.15
>15	1.31	0.40
BMI (m/kg2)		
< 18.5	REFERENCE	REFERENCE
18.5-22.9	4.03	0.99
23-24.9	2.16	0.99
25-29.9	1.50	0.99
>30	6.44	0.99
FBS (mg/dl)	2.64	**0.04**
PPBS (mg/dl)	2.71	0.85
Glycaemic control		
Good (< 7.0%)	REFERENCE	REFERENCE
Poor (≥ 7.0%)	1.06	**0.01**
Significant Pyuria		
No	REFERENCE	REFERENCE
Yes	4.28	0.73

Table 3: Antibiogram

Micro-Organisms	AMP/AMO	CEX/CEZ	GEN/AMI/NET	NOR/CIP	COT	NIT	IMI
Escherichia coli *n (%)*	5 (55.6)	5 (55.6)	8 (88.9)	8 (88.9)	6 (66.7)	9 (100)	9 (100)
Klebsiella pneumoniae *n (%)*	1 (50)	0	1 (50)	2 (100)	2 (100)	1 (50)	2 (100)
Staphylococcus aureus *n (%)*	1 (100)	1 (100)	0	0	0	0	0

AMP/AMO: Ampicillin/Amoxycillin,
CEX/CEZ: Cephalexin/Cephazolin,
GEN/AMI/NET: Gentamicin/Amikacin/Netilmicin,
NOR/CIP: Norfloxacin/Ciprofloxacin,
COT: Co-trimoxazole,
NIT: Nitrofurantion and
IMI: Imipenem.

DISSCUSSION:

This occurrence of ABU in diabetic adults of 10.3% in our study was comparable with few other studies,[12-14] while many other studies reported higher rate.[15-23] Although no definite comment can be made, different inclusion criteria in these studies might explain their high prevalence.

Duration of DM had a positive significant association in our study (Table 2). This result was supported by various other studies.[19,24-25] A contradictory finding was reported by a study which might be due to the presence of other risk factor like nephropathy in their study making ABU common even in early period of DM.[26] Similarly, patients with poor glycaemic control compared to those with good glycaemic control had significant higher prevalence of ABU in our study (Table 2). This finding was also supported by some studies,[21-22, 27] while few other studies failed to show significant relationship.[28-30]

Escherichia coli (n=9, 75%) was the most common pathogen in our study followed by Klebsiella pneumoniae (n=2, 16.7%). Various researchers have found similar findings,[14-15,17-18,20,22,24, 26-27,31-34] while few other studies reported the predominance of Klebsiella pneumoniae, Coagulase Negative Staphylococci, Enterococcus faecalis or Staphylococcus aureus respectively in their studies.[21,35-37]

This is the first study that reported the occurrence of ABU in a wider age group of diabetic adult Nepalese population. However, limited sample size, expensive cost of laboratorial tests to differentiate the types of DM was the limitation of our study. Being a hospital based study in a specific geographical area, it may not represent exact scenario of general diabetic population. Therefore, we believe that this study will be a road-map study for future researchers who would like to continue with similar studies in different parts of Nepal.

CONCLUSION:

In diabetic adults, ABU is highly prevalent and associated mainly with duration of DM and poor glycaemic control. Hence, screening for ABU is warranted in diabetics if above mentioned risk factors are present.

ABBREVIATIONS:

ABU: Asymptomatic Bacteriuria, ADA: American Diabetes Association, AST: Antibiotic Sensitivity Test, AMI: Amikacin, AMP/ AMO: Ampicillin/ Amoxicillin, BMI: Body Mass Index, CBC: Complete Blood Count, CEX/ CEZ: Cephalexin/ Cephazolin, CFU: Colony-Forming Units, CIP: Ciprofloxacin, COT: Co-trimoxazole, Cr: Creatinine, DBP: Diastolic Blood Pressure, DM: Diabetes Mellitus, FBS: Fasting Blood Sugar, GEN: Gentamicin, HbA1c: Glycosylated Haemoglobin A1c, IDSA: Infectious Disease Society of America, IMI: Imipenem, MSU: Mid-Stream Urine, NCLSS: National Committee for Clinical Laboratory Standards, NET: Netilmicin, NIT: Nitrofurantoin, NOR: Norfloxacin, PPBS: Post Prandial Blood Sugar, SBP: Systolic Blood Pressure, UTI: Urinary Tract Infection.

Conflict of Interest:

The principal author did not take part in editorial decisions.

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