

IJBHS 2015026/12104

Urinary Tract Infection Among Pre-menopausal Diabetic Women in Bida, Niger State, Nigeria

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(Received October 16, 2015; Accepted January 12, 2016)

ABSTRACT: Study show overall prevalence of 48.8% (n=61) asymptomatic bacteriuria with *Escherichia coli* as predominant uropathogen ($P < 0.029$ significant). Prevalence of asymptomatic bacteriuria was significantly different in non-diabetic to diabetic n=38(74.5%) vs n=13(25.5%) $P < 0.000$ significant respectively. *Staphylococcus aureus* n=15(78.9%) vs n=4(21.1%) $P < 0.008$ significant. Coagulase negative *Staphylococcus* (0) vs n=4(100%) *Candida albican* n=2(28.6%) vs n=5(71.4%) $P > 0.02$ not significant. Isolate were poorly sensitive to the readily available antibiotics (Ampicilin, Nalixidic Acid, Amoxycilin and Cotrimoxazole). Large proportions were sensitive to Gentamycin, Pefloxacin and Ceftriazone, while sensitive to Nitrofurantoin and Ciprofloxacin were moderate.

Keywords: *Diabetes mellitus, Urinary tract infection.*

Introduction

Diabetes mellitus (DM) is the most common endocrine disorder. It exhibits a variety of multi system complications involving the blood vessels, skin, eye, kidney and the nervous system during the course of the disease process. Also abnormal carbohydrate metabolism, other altered metabolic pathways, atherosclerosis, microangiopathy, neurone degeneration, and impaired host mechanisms all play roles. (Mahajan *et al*, 2003). High glucose concentration in urine serves as a medium for pathogenic micro-organisms to grow well in urine. An increased prevalence of asymptomatic bacteriuria has been described in women with diabetes in Europe and America (Schmidt *et al*, 1986, Keane *et al*, 1988 and Geerlings *et al*, 2000).

About 16 million people with diabetes mellitus in the United States, predispose to UTI (Viberti *et al*, 1994 and Patterson *et al*, 1997). The presence of asymptomatic bacteriuria is most strongly correlated with variables consistent with duration of diabetes, rather than with control of diabetes (Zhanel *et al*, 1995). The prevalence of asymptomatic bacteriuria among school girls is about 1-2% and increases likelihood of experiencing acute symptomatic bacteriuria is uncommon in healthy men until about 65 years of age, when the impact of prostatic hypertrophy leads to increase prevalence. About 5-10% of men older than 70 years have bacteriuria at any time (Nicolle, 1997).

In studies carried out in Canada with oral glucose tolerance survey conducted in a few localities, in 2 Algonquin reserves in north eastern Quebec (Delisle *et al*, 1995, Delisle and Ekoe, 1993) and among the Oji-Cree of Sandy Lake, in north western Ontario, (Haris *et al*, 1997), the prevalence of diabetes reached as high as 25% among all

adults and 80% among women aged 50-64 years. New cases detected by oral glucose tolerance screening account for 40% of all diabetes cases. (Haris *et al*, 1997).

Diabetes increases the susceptibility to infection. In Manitoba, aboriginal women are admitted to hospital 5 to 20 times more frequently for acute pyelonephritis than non-aboriginal women. (Nicolle *et al*, 1996).

The major behavioral factors promoting the occurrences of recurrent UTI in premenopausal women are sexual activities and contraceptive use (Hooton, *et al* 1996, and Foxman, 1990). There is an increased frequency of acute cystitis with increased frequency of sexual intercourse. In addition, the use of spermicide for birth control is a major risk factor for UTI. The impact of spermicide use is mediated through changes in vaginal flora, with loss of the normal lacto-bacilli that maintain a vaginal acid pH and replacement by potential uropathogens, such *E. coli* (Gupta *et al* 2000).

Study carried out by Edward *et al*, 2005 in Washington, among post menopausal diabetic and non diabetic women, UTI incidence per 100 people was 12.2% for diabetic women and 6.7% for non-diabetic women. Asymptomatic bacteriuria incidence per 100 people was 6.7% for diabetic women and 3% for non-diabetic women. The increased risk of UTI occurred mainly in women taking insulin, and in women with longer diabetes duration of 10 years compared with non diabetic women.

Alebiosu *et al*, 2003 at Olabisi Onabanjo Teaching Hospital Sagamu, Nigeria, one hundred and twenty four diabetes with 55 males and 69 females submitted midstream urine specimen for culture. Thirty three patients had significant bacteriuria (9 male and 24 female), showing occurrence of asymptomatic bacteriuria to be 26.6%. The most common organism isolated was *Klebsiella pneumoniae* at 42.4%. Isolate were poorly sensitive to the readily available antibiotics (Ampicillin, Tetracycline and Cotrimoxazole), but a large number of organisms were susceptible to (Nitrofurantoin, Gentamycin, Ciprofloxacin and Ofloxacin). Susceptibility to Erythromycin, Nalidixic acid and Cefuroxime were moderate. According to Omoriege *et al*, (2008) showed significant difference in the prevalence of asymptomatic bacteriuria between non-diabetic and diabetic patients (24.4% vs 59.0%). Type of diabetes did not affect the prevalence of asymptomatic bacteriuria (Type1:53.03%, Type2:61.87% $p>0.05$). *Staphylococcus aureus* was the most common uropathogens (26.03%) as well as in both genders of diabetic and non-diabetic patients. An overall prevalence of 30.29% of asymptomatic bacteriuria was found, and *Staphylococcus aureus* was the predominant uropathogen in both gender of outpatient.

This work is aimed to study whether DM is a predisposing factor to urinary tract infection among premenopausal women with a view to provide a guideline of clinical and laboratory methods for effective management of the disorder in Nigeria.

Materials and Methods

Study Area

The study was carried out in Federal Medical Centre Bida, a tertiary health institution and referral centre in Niger State. This health institution is located in Bida South Local Government area of Niger state, origin of Nupe kingdom with a population of over 1 million people located in the North Central area of Nigeria.

Sample Size

A total of 120 samples were collected for a prospective study carried out between January 2009 and June 2010. Subjects comprise of pre-menopausal diabetic mellitus females. Volunteers were randomly selected, from a pool of known diabetics attending the general out-patient clinic, with \leq fasting blood glucose and 2 hour post prandial. Two groups constitute the study, a study group and a control group. The study group consists of 60 individual who satisfied the inclusion criteria, while the control group was made up of 60 non diabetic individuals.

Informed consent was taken from the Department of Human Resources, Federal Medical Centre Bida. Volunteers were properly briefed and informed about the nature and scope of the study, as well as the immediate and remote benefits they will gain by taking part in the study.

Procedure:

During the study period, all the urine samples were analyzed manually for culture and sensitivity using the semi quantitative calibrated loop method. Urine was inoculated on to blood agar and MacConkey agar plates. The plates were incubated overnight. Next morning, a colony count was done, and interpreted according to our local interpretation guidelines. Bacteria were isolated and identified based on biochemical tests (Cheesbrough, 1991)

Antimicrobial susceptibility testing by disc diffusion was done according to the Clinical and Laboratory Standard Institute guidelines (Cheesbrough, 1991).

Results

It was observed that presence of pyuria plays a vital role in the growth rate of all isolates (Table 1). The study show overall prevalence of 48.8%(61) asymptomatic bacteriuria, with *Escherichia coli* as the most common uropathogen ($P < 0.029$ significant) (Table 2).

The prevalence of asymptomatic bacteriuria was significantly different in non-diabetes to diabetic patients. The control sample with 38(74.5%) vs 13(25.5%) of test with $P < 0.000$ significant respectively (Table 3). Isolate were poorly sensitive to the readily available antibiotics (Ampicillin, Nalidixic acid, Amoxycilin and Cotrimoxazole). Large proportions were susceptible to Gentamycin, Pefloxacin and Ceftriazone, while sensitive to Nitrofurantoin and Ciprofloxacin were moderate.

Table 1: Relationship between Pyuria in Study Sample and Control Sample

Group	WBC (<3)	Pyuria (>3 & above)	Yielded Growth
CONTROL	43(61.4%)	21(38.2%)	64(51.2%)
TEST	27(38.6%)	34(61.8%)	61(48.8%)
TOTAL	70(56.0%)	55(44.0%)	125(100%)

$$X^2 = 6.66 \quad df = 1 \quad P < 0.008$$

$P < 0.05$ significant

$P \geq 0.05$ non significant

$P < 0.008$ significant

Table 2: Percentage of Escherichia Coli Isolated In Study Sample and Control

GROUP	POSITIVE	NEGATIVE	TOTAL
CONTROL	38(74.5%)	26(35.1%)	64(51.2%)
TEST	13(25.5%)	48(64.9%)	61(48.8%)
TOTAL	51(40.8%)	74(59.2%)	125(100%)

$$X^2 = 18.73 \quad df = 1 \quad P < 0.000 \text{ significant}$$

Table 3: Percentage Bacteriuria in Study Sample and Control That Yielded Growth

GROUP	% POSITIVE	% NEGATIVE	% TOTAL
CONTROL	3(60.7%)	27(42.2%)	64(51.2%)
TEST	24(39.3%)	37(57.8%)	48.8%
TOTAL	61(48.8%)	64(51.2%)	125(100%)

$$X^2 = 4.26 \quad df = 1 \quad P < 0.029 \text{ significant}$$

Discussion

Out of 120 pre-menopausal women randomly selected, sixty (60) individuals were from known diabetes out-patient register (study group). Sixty (60) healthy individuals without history of diabetes mellitus were randomly selected as the control group. Duration of diabetes and type—were not considered as factors. The isolated organisms and antibiotic susceptibility pattern of test and control organisms were considered as co-factors. Mid-stream urine samples were submitted for specimen culture. Sixty-one (61) patients had significant bacteriuria (control 37 and study 24), showing occurrence of asymptomatic bacteriuria to be 61(48.8%). The percentage growth pattern of control and test sample study group was shown in Table 2 with *Escherichia coli* as the most common organism in 38(74.5%) vs 13 (25.5%). This is contrary to Alebiosu *et al* (2003), with *Klebsiella pneumoniae* as the most predominant isolate of 42.4%. *Staphylococcus aureus* was 15(78.9%) vs 4(21.1%). Also, coagulates negative *Staphylococcus* was (0%) vs 4(100%) and *Candida albicans* 2(28.6%) vs 5(71.4%).

Kaplan and Walter (2005) stated that the spectrum of organisms causing UTI varies by clinical syndrome. In acute uncomplicated cystitis, the etiological agents are highly predictable. *Escherichia coli* accounts for 75-90% of isolates, *Staphylococcus saprophyticus* accounts for 5-15% of isolate (particularly in young women), and *Klebsiella* species, proteus species, Enterococci, and other organisms account for 5-10% of isolates.

In complicated UTIs, *E. coli* remains the predominant organisms, but other aerobic gram-negative rods such as *Klebsiella* species, proteus species, and *Pseudomonas aeruginosa* are also implicated. *Acinetobacter* species, Morganella species are also frequently isolated. Gram positive bacteria such as Enterococci, *Staphylococcus aureus* and *Staphylococcus epidermidis* as well as yeast cell are also important pathogens in complicated UTI.

Geerlings *et al*, (2000), found that the incidence of infection and true pyelonephritis appears to be increased in hospitalized diabetic patients, particularly in those with multiple organ complications, partly because of poor bladder function and urinary catheterization. Other clinical conditions causing obstruction in urinary flow or incomplete voiding also predispose diabetic patients to infection.

In this study, it was observed that percentage pyuria that yielded growth as shown in Table 1, was 43(61.4%) vs 27(38.6%) of 70 individuals (56.0%) with $P < 0.008$ significant. Yeast cells present in both control and study groups were 13(86.7%) vs 2(13.3%) of 15 individual with $P < 0.003$ significant.

Conclusion

Foxman (2002), naturally 50-80% of women in the general population acquire at least one UTI during their lifetime. Most of these infections are uncomplicated cystitis. In women, colonization of the vaginal introitus with organisms from the fecal flora, usually *Escherichia coli*, is the critical initial step in the pathogenesis of UTI. Sexual intercourse and the use of a diaphragm with spermicide alone are strongly associated risk of *Escherichia coli*; also vaginal colonization and bacteriuria, probably because of alteration in the normal vaginal flora. Women with dysuria and pyuria who have $< 10^2$ bacteria/ml may have urethritis caused by *Chlamydia trachomatis*, *Neisseria gonorrhea* or herpes simplex virus, or vulvo vaginitis caused by *Trichomonas vaginalis* or *Candida* species. (Hooton and Stamm, 1997).

In these studies, it was observed that asymptomatic bacteriuria is predominant among young age women between the age of 25-29yrs, than in elderly people and this may be as a result of active sexual activities, multiple sexual partners and hygiene. It was observed that properly controlled glucose is not a predisposing factor to UTI. Duration of diabetes mellitus is an important predisposing factor to UTI. High glucose concentration in the urine serves as a medium for pathogenic microorganisms to grow well in urine. (Schmidt *et al* 1986, Keane *et al*, 1988 and Geerlings *et al*, 2000).

Recommendations

Treatment of asymptomatic bacteriuria is recommended for patients with frequent episodes of symptomatic UTI, pregnancy, after renal transplantation and prior to urological intervention; but there are no substantial benefits from treating asymptomatic bacteriuria (Andriole, 2002). These studies show that asymptomatic bacteriuria is predominant among sexually active individuals and *Escherichia coli* are the most predominant isolate from faecal origin. It is advisable not to treat asymptomatic bacteriuria in diabetes except symptomatic to the patient. This will prevent unnecessary burden on the patient as a result of cost implication of drugs.

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