



### Asymptomatic Bacteriuria among an Obstetric Population in Ibadan

#### *La bactériurie asymptomatique dans une population obstétricale à Ibadan*

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#### ABSTRACT

**BACKGROUND:** Asymptomatic bacteriuria in pregnancy is the major risk factor for symptomatic urinary tract infection during pregnancy. Screening and identification of bacteriuria during pregnancy have been recommended.

**OBJECTIVE:** To determine the prevalence and pattern of asymptomatic bacteriuria associated with pregnancy.

**METHODS:** The study was a descriptive, cross sectional survey of pattern of asymptomatic bacteriuria among consecutive patients presenting for the first antenatal visit at a University College Hospital, during a period of two months. Relevant information obtained from all the patients recruited for the study included age, parity, educational level, gestational age and occupation of participant. Haemoglobin electrophoresis patterns were also retrieved and recorded. Main outcome measures were prevalence of asymptomatic bacteriuria, bacterial isolates and their antibiotic sensitivities.

**RESULTS:** There were 205 eligible participants with a mean age of  $30.6 \pm 4.3$  years and a mean gestational age at booking of  $20.9 \pm 7.0$  weeks. The prevalence of asymptomatic bacteriuria was 22(10.7%). The isolated pathogens were predominantly coliforms (*Klebsiella* and *E. coli*) accounting for 45.5% and *Staphylococcus saprophyticus* (27.3%). Only gentamycin, nitrofurantoin and ofloxacin demonstrated high efficacy against these uropathogens with antibiotic sensitivity rates of 72.7%–81.8%.

**CONCLUSION:** Prevalence of asymptomatic bacteriuria in this centre is relatively high. This underscores the need for routine screening of pregnant women for bacteriuria. *WAJM* 2011; 30(2): 89–93.

**Keywords:** Asymptomatic bacteriuria, Pregnancy, Prevalence, Bacterial isolates, Antibiotic sensitivity.

#### RÉSUMÉ

**CONTEXTE:** La bactériurie asymptomatique au cours de la grossesse est un facteur de risque majeur pour l'infection des voies urinaires. La dépistage et l'identification de la bactériurie est recommandée pendant la grossesse.

**OBJECTIF:** Déterminer la prévalence et le profil de la bactériurie asymptomatique au cours de la grossesse.

**METHODES:** Il s'agissait d'une étude transversale, descriptive portant sur une série consécutive de patientes, reçues pour la première consultation prénatale au Centre hospitalier Universitaire, sur une période de deux mois. Les informations pertinentes obtenues à partir de ces patientes recrutés pour l'étude comprenaient l'âge, la parité, le niveau d'instruction, l'âge gestationnel, et la profession. Le résultat de l'électrophorèse de l'hémoglobine retrouvé était noté. Les données les plus importantes ont porté sur la recherche d'une bactériurie asymptomatique, des germes isolés, ainsi que leur sensibilité aux antibiotiques.

**RESULTATS:** Un total de 205 patientes a été recruté. La moyenne d'âge était de  $30.6 \pm 4.3$  ans et la moyenne d'âge gestationnel était de  $20.9 \pm 7.0$  ans à l'inclusion. La prévalence de la bactériurie asymptomatique était de 10,7% (22 patientes). Les germes isolés étaient constitués de colibacilles (*Klebsiella* et *E. coli*) pour 45,5% et de *Staphylococcus saprophyticus* pour 27,3%. Seules la gentamycine, la Nitrofurantoin, et l'ofloxacine ont montré une certaine efficacité pour ces germes uropathogènes avec des taux de sensibilité variant de 72,7% à 81,8%.

**CONCLUSION:** La prévalence de la bactériurie asymptomatique dans ce centre est relativement élevée. Ceci met en évidence la nécessité d'un dépistage en routine de la bactériurie chez la femme enceinte. *WAJM* 2011; 30(2): 89–93.

**Mots Cles:** Bactériurie asymptomatique, Grossesse, Prévalence, Isolats bactériens, Sensibilité aux Antibiotiques.

## INTRODUCTION

Bacteriuria is considered to be a common and important complication of pregnancy.<sup>1</sup> Asymptomatic bacteriuria is present when there are persistent, actively multiplying bacteria within the urinary tract without symptoms.<sup>2</sup> Bacteriuria is said to be significant when there are at least 10<sup>5</sup> bacteria colonies of a single pathogen per milliliter in a freshly voided urine collected by the mid-stream clean catch technique.<sup>3</sup> The original criterion for diagnosis required bacteria counts of  $\geq 10^5$ /ml on two consecutive clean catch samples. However, the detection of 10<sup>5</sup> bacteria/ml or more in a single voided midstream urine sample is accepted as adequate and more practical alternative.<sup>4,5</sup>

Globally, the overall prevalence of bacteriuria in pregnancy varies from 4–7%, although a range of 2–11% has been reported.<sup>2,6</sup> The prevalence rate among pregnant Nigerian women has been variously reported to be between 4–23.9%.<sup>7–10</sup> Bacteriuria is typically present at the time of first pre-natal visit and only approximately 1–2% of pregnant women develop bacteriuria after a negative screening early in pregnancy.<sup>1,3</sup>

Pregnant women with asymptomatic bacteriuria are at a high risk for a number of complications for both mother and the unborn child. Maternal complications include overt urinary tract infection in 30–40% of patients as pregnancy advances.<sup>11,12</sup> Whether or not symptomatic urinary tract infection ensues, the foetus is still at risk for prematurity, low birth weight and even foetal wastage.<sup>12</sup> The condition is detectable and largely treatable. Its consequences are also preventable. Hence, screening for asymptomatic bacteriuria is justifiable and ultimately cost-effective<sup>13</sup> and has therefore been recommended.<sup>14,15</sup>

Generally, in many of our maternity units in Nigeria, routine screening for asymptomatic bacteriuria is not practised despite overwhelming evidence clearly demonstrating its benefits in preventing symptomatic urinary tract infection and the associated adverse pregnancy outcome.<sup>16,11</sup> Screening has been reported to be cost-effective when prevalence of bacteriuria is above 2%.<sup>16</sup> Bacteriuria in pregnancy was previously investiga-

ted in Ibadan over 30 years ago with a prevalence of 9.7% obtained.<sup>17</sup> However, the current pattern is not precisely known.

This study was designed to determine the current prevalence of asymptomatic bacteriuria among obstetric patients at the University College Hospital Ibadan, identify bacterial pathogens responsible for the condition and evaluate their antibiotic sensitivity pattern.

## SUBJECTS, MATERIALS, AND METHODS

The study was a descriptive, cross-sectional, survey of healthy pregnant women presenting for the first antenatal (Booking) visit at the University College Hospital, Ibadan between 1<sup>st</sup> of April and 31<sup>st</sup> of May 2006.

### Ethical Consideration

Ethical approval was obtained from the joint Institutional Review Board (IRB) of University of Ibadan / University College Hospital Ibadan, Nigeria, before the commencement of the study.

All consecutive patients presenting for the first antenatal visit (booking) during the period of study were adequately counselled about asymptomatic bacteriuria and those who gave written informed consent to participate in the study and willing to come for follow up if necessary were recruited into the study. Relevant information was obtained from all the patients recruited for the study included age, parity, educational level, gestational age and occupation of participants were also subsequently retrieved and recorded. (Haemoglobin electrophoresis pattern).

History of index pregnancy was explored to exclude symptoms of acute urinary tract infection and current or previous use of antibiotics. Gestational age of the index pregnancy was calculated from the first day of last menstrual period or where necessary by early ultrasound scan. The mobile telephone numbers of the patients were obtained and recorded in the proforma.

Pregnant women who had symptoms of acute urinary tract infection and those who were on, or had been on antibiotic treatment in index pregnancy prior to booking were excluded from the

study. Others excluded were those known to have underlying renal disease and those who did not give informed consent.

### Sample Collection and Processing

On presentation at booking antenatal clinic, the patients were instructed adequately by the nursing staff on how to collect clean catch mid-stream urine. After initial cleaning of the perineum with running water, the first part of the urine was voided and about 10mls of the mid-stream urine was collected into the sterile universal bottles which had been correctly labelled and distributed to them.

The urine samples in the sterile universal bottles were transported to the laboratory for processing within one hour and where immediate processing was not possible, the samples were promptly refrigerated at 4°C to avoid multiplication of bacteria at room temperature. They were subjected to routine microscopy, culture and sensitivity using to standard methods. Microscopy involved centrifugation of about 3mls of urine sample in a test tube at 1500 revolutions per minute. The sediment was poured on a clean slide and observed under a microscope for casts, pus cells and red blood cells.

Culture of the urine was carried out by inoculating a portion of the urine samples which had been well mixed into cystein-lactose-electrolyte deficient (CLED) or MacConkey Agar plate using standard wire loop. The specimens were well streaked on the plate to allow for discrete colonies. Inoculated agar plates were incubated at 37°C overnight and read after 24 hours to assess growth for significant bacteriuria. Suspected pathogens were identified using standard biochemical and sugar utilization tests.<sup>18</sup>

Following identification, the isolates were subjected to antibiotic sensitivity testing using disc diffusion technique.<sup>66</sup> A small antibiotic wafer was placed in a plate upon which bacteria are growing. If the bacteria are sensitive to the antibiotic, a clear ring or zone of inhibition is seen around the wafer indicating poor growth.

**Follow-up**

All the study participants were requested to come back after one week to review the results of microbiological culture. Patients with positive culture result were contacted by telephone to come for follow up treatment.

Those who were positive for significant bacteriuria from urine culture were treated based on the sensitivity pattern. They were re-evaluated with a repeat urine culture for clearance of bacteriuria after completion of a 10-day course of appropriate antibiotics and were subsequently followed up throughout pregnancy with monthly urine microscopy and culture till delivery.

**Definitions:**

**Bacteriuria:** Presence of bacteria in a urine specimen that is not due to contamination. **Significant bacteriuria** refers to presence of at least  $10^5$  pathogenic bacteria colonies per milliliter of urine. **Asymptomatic bacteriuria** occurs when there is significant bacteriuria without clinical features of urinary tract infection.

**Data Management and Statistical Analysis**

The data obtained from the microbiological culture as well as the participants' demographic parameters were entered into a proforma and fed into the computer. Frequency tables were then generated and percentages calculated. Statistical analysis was done using SPSS version 11.

**Pattern of Asymptomatic Bacteriuria:**

Indicates the way bacteriuria occur or the form taken in a given population. This included the prevalence, predictors or risk factors, the causative organisms and their antibiotic sensitivities.

**Antibiotic Sensitivity:** describes the susceptibility of bacteria to specific antibiotic. This is usually obtained by carrying out an Antibiotic Susceptibility/ Sensitivity Testing.

**Efficacy** of a drug refers to the capacity of the drug to produce beneficial change or therapeutic effect. **Antibiotic efficacy** is the capacity of a given antibiotic to

inhibit the growth or multiplication of bacteria. Antibiotic efficacy is usually obtained indirectly from antibiotic sensitivity testing.

**RESULTS**

During the study period, 245 women presented for booking for antenatal care at the University College Hospital, Ibadan. Out of these women, 229 were counselled on asymptomatic bacteriuria and informed about the study. Sixteen patients declined to participate in the study and eight were excluded because they were either taking antibiotics or had used antibiotics in the index pregnancy. Therefore, two hundred and five patients participated in the study. Significant bacteriuria was found in 22 patients giving a prevalence of 10.7%.

The mean age of patients involved in this study was  $30.6 \pm 4.3$  years with a range of 19–43 years (Table 1). The parity of the patients ranged from 0 to 7 with para 0 being the modal parity. The mean gestational age at booking during this study was  $20.9 \pm 7.0$  weeks with a range of 6–40 weeks (Table 2). The prevalence of asymptomatic bacteriuria in this study increased with gestational age with

corresponding rates of 6.5%, 11.2% and 12.2% in first, second and third trimesters respectively.

The bacterial pathogens isolated from urine of bacteriuric women in this study were mostly Gram negative organisms (*E. coli* and *Klebsiella*), accounting for 10 (over 45%) of the isolates. *Staphylococcus saprophyticus*, a coagulase negative staphylococcus was the second commonest organism isolated in this study (Table 3).

Table 4 shows the overall antibiotic sensitivity pattern of the bacterial isolates from the urine of bacteriuric women in this study. Ofloxacin demonstrated highest in vitro efficacy against the pathogens closely followed by gentamycin. Amoxycillin and amoxycillin-clavulanic acid combination had the least efficacy against the urinary pathogens isolated from this study.

Table 4 also shows the antibiotic efficacies against specific pathogens. (Sensitivity of specific pathogen to each antibiotic). While nitrofurantoin, gentamycin and ofloxacin demonstrated high level of efficacy (between 50% – 100%) against most of the isolates, amoxycillin and augmentin had 33.3% efficacy

**Table 1: Characteristics of Patients Screened for Asymptomatic Bacteriuria**

Characteristic	Number (%) with Asymptomatic Bacteriuria		
	Present	Absent	Total
<b>Number</b>	<b>22(10.7)</b>	<b>183</b>	<b>205</b>
<b>Age in years</b>			
16 – 25	2 (9.5)	19	21
26 – 35	18 (11.5)	139	157
36 – 45	2 (7.4)	25	27
<b>Educational level</b>			
≤ Primary	1 (9.1)	10	11
Secondary	6 (14.6)	35	41
≥ Tertiary	15 (9.8)	138	153
<b>Religion</b>			
Christianity	20 (12.7)	138	158
Islam & Others	2 (4.3)	45	47
<b>Hb Electrophoresis Pattern</b>			
AA	12 (10.6)	101	113
AS	9 (16.4)	46	55
SS / SC	0 (0.0)	5	5
AC	1 (16.7)	5	6
Unknown	0 (0.0)	26	26

**Table 2: Prevalence of Asymptomatic Bacteriuria by Parity**

Parity	Number (%)	
	N	Bacteriuria
Para 0	88	9(10.2)
Para 1–2	91	12(13.2)
Para 3–4	22	1(4.5)
≥ Para 5	54	0
<b>Total</b>	<b>205</b>	<b>22(19.7)</b>

**Table 3: Frequency of Bacterial Isolates among Bacteriuric Patients**

Isolate	Number (%)
<i>Klebsiella</i> species	8(36.4)
<i>Escherichia Coli</i>	2(9.1)
<i>Staph saprophyticus</i>	6(27.3)
<i>Staph aureus</i>	4(18.2)
<i>Streptococcus species</i>	2(9.1)
<b>Total</b>	<b>22(100.0)</b>

against *staphylococcus saprophyticus* only (two out of the six isolates). Following treatment with a 10-day course of appropriate antibiotic, women who had significant bacteriuria from culture result became free of bacteriuria, giving a cure rate of 100%.

## DISCUSSION

The prevalence of asymptomatic bacteriuria among pregnant women attending the first antenatal (Booking)

clinic at University College Hospital Ibadan, was 10.7%. This is lower to that reported by Okonofua (14.1%) at the Obafemi Awolowo University Teaching Hospital<sup>19</sup> but slightly higher than that of Oyetunji *et al*, in Sokoto<sup>9</sup> (8.0%) and Tungrul *et al* (8.1%) among Turkish women.<sup>20</sup> It also falls within the reported range of 2–11 in most reviews.<sup>1,11,21</sup> It is noteworthy however that the clinical pattern of bacteriuria in pregnancy in Ibadan has witnessed only a marginal change from a prevalence of 9.7% obtained by Ojo and Akinkugbe 30 years ago<sup>17</sup> to the current figure of 10.7%. The prevalence rate in this study is significantly higher than that obtained by Nnatu and Odum in Lagos (4.0%)<sup>8</sup> and Mandara and Shittu in Zaria (4.8%),<sup>7</sup> among Nigerian urban population. It is however much lower than the value obtained by Olusanya and others at Sagamu (23.9%).<sup>10</sup> The variability in rates may be influenced by locality (lower in urban population such as Lagos and Zaria) and method of urine collection (mid – stream, clean catch specimen which can be contaminated if not properly done).

Gram negative enteric bacilli (coliforms) were the major pathogens isolated from the urine samples of bacteriuric women in this study. This was closely followed by *Staphylococcus saprophyticus*, a coagulase negative *Staphylococcus*. This is similar to the findings from most other studies elsewhere.<sup>9,20,22–27</sup> However, unlike other

studies which found *Escherichia coli* as the most common of all coliforms, this study isolated *Klebsiella* species as the most common gram negative organism causing bacteriuria. Overall the second most common organism causing bacteriuria from this study was found to be *Staphylococcus saprophyticus* and this is similar to the findings of Gebre-Selassie<sup>25</sup> and other workers elsewhere.<sup>24</sup>

Most of the pathogens causing bacteriuria in this study were resistant *in vitro* to amoxicillin, amoxicillin-clavulanic acid and erythromycin but very sensitive to ofloxacin, gentamycin and nitrofurantoin as seen from the overall antibiotic sensitivity pattern. Similar findings were reported by Aboderin *et al* at Obafemi Awolowo University Teaching Hospital Ile-Ife where the isolates were resistant to drugs traditionally employed to treat urinary tract infection but were relatively sensitive to nitrofurantoin.<sup>28</sup> Other workers elsewhere have reported similar findings<sup>7</sup> though in some reports, high sensitivity to amoxicillin-clavulanic acid and cephalosporins were noted.<sup>9,26</sup> Specifically, from this study, all the Gram negative organisms and *Staphylococcus aureus* were resistant to amoxicillin-clavulanic acid and amoxicillin commonly used to treat urinary tract infections while gentamycin, nitrofurantoin and ofloxacin demonstrated high efficacy against these uropathogens. Gebre-selassie reported 91% resistance to ampicillin and amoxicillin but 91% sensitivity to nitrofurantoin for the *Escherichia coli* isolates in his study.<sup>25</sup>

This study has revealed that the prevalence of asymptomatic bacteriuria among the obstetric population at the University College Hospital, Ibadan is relatively high. It has also shown that Gram negative enteric bacilli, (notably *Klebsiella* species) and coagulase negative *Staphylococcus saprophyticus* are the major uropathogens responsible for asymptomatic bacteriuria in pregnancy in this centre. Nitrofurantoin, gentamycin and ofloxacin are the major efficacious antibiotics against these pathogens.

It is recommended that routine screening for asymptomatic bacteriuria

**Table 4: Frequency and Pattern of Sensitivity Isolates to Antimicrobial Agents**

Antibiotic	Pathogens ( Number and Percentage of Susceptible Pathogens)					
	<i>Klebsiella</i>	<i>E. coli</i>	<i>Staph sapro.</i>	<i>Staph aureus</i>	<i>Strep spp.</i>	Total
N	8	2	6	4	2	22
AMX	R	R	2(33.3)	R	R	2(9.1)
AMYC	R	R	2(33.3)	R	R	2(9.1)
CHL	1(12.5)	1(50.0)	1(16.7)	R	R	3(13.6)
COT	2(25.0)	R	2(33.3)	1 (25.0)	1 (50.0)	6(27.3)
ERY	R	R	3(50.0)	R	R	3(13.6)
GEN	7(87.5)	2(100.0)	5(83.3)	4(100.0)	R	18(81.8)
NIT	6(75.0)	R	4(66.7)	4(100.0)	2(100.0)	16(72.7)
OFL	6(75.0)	1 (50.0)	6(100.0)	4(100.0)	2(100.0)	19(86.4)
TET	1(12.5)	R	R	R	R	1(4.5)
NAL	4(50.0)	1 (50.0)	R	R	R	5(22.7)

AMX, Amoxicillin; AMYC, Augmentin; CHL, Chloramphenicol; COT, Cotrimoxazole; ERY, Erythromycin; GEN, Gentamycin; NAL, Nalidixic acid; NIT, Nitrofurantoin; OFL, Ofloxacin; TET, Tetracycline; R, Resistance (None of the pathogens was susceptible)

should be offered to all pregnant women presenting for antenatal care especially at booking. However, considering the cost of screening for this condition in low resource centre like ours, appropriate cost-benefit and cost-effectiveness analysis study on various screening modalities for asymptomatic bacteriuria is also recommended.

**Limitations of the study:** This study was limited by the following:

- (a) Unavailability of wide range of antibiotic discs or wafers to carry out antibiotic sensitivity testing which invariably resulted in limited choice of antibiotics to which the isolates were sensitive.
- (b) Limited biochemical reagents used in identification of isolates. Consequently, the specific strains of *Klebsiella* and streptococcus could not be identified with absolute certainty, necessitating their being grouped together as *Klebsiella* and streptococcal species.
- (c) This study concentrated wholly on pregnant women. A comparative study of bacteriuria among pregnant and matched non-pregnant women of child bearing age may be more informative and is therefore recommended.

#### Duality of Interest

The authors had no support or assistance from any of the manufacturers of the reagents used in this study. The study was entirely funded by corresponding author with some assistance from other authors.

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