

# Asymptomatic Bacteriuria and Foetomaternal Outcome at the University of Maiduguri Teaching Hospital

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## ABSTRACT

**Background:** Asymptomatic bacteriuria (ASB) is a common medical complication of pregnancy and may be associated with acute pyelonephritis, preterm labour and delivery, intrauterine growth restriction (IUGR), low birth weight (LBW), anaemia, hypertension and long-term renal dysfunction. Routine screening and treatment of ASB in pregnancy are recommended. **Objective:** This study determined the prevalence, common organisms implicated, their antibiotic sensitivity pattern and the foetomaternal outcome of pregnant women with ASB. **Methods:** We conducted a prospective study at the Department of Obstetrics and Gynaecology, University of Maiduguri Teaching Hospital (UMTH), Maiduguri, Nigeria. One hundred and fifty pregnant women attending antenatal booking were consecutively recruited. We collected demographic and clinical information. A clean catch midstream urine specimen was collected for culture and sensitivity. The women were followed up to delivery and foetomaternal outcome were obtained. **Results:** The prevalence of ASB was 22%. *Escherichia Coli* was the most predominant organism isolated in 45.4%. Nitrofurantoin (90.9%), Ceftriaxone (87.8%) and Co-Amoxiclav (84.8%) showed the highest activity against the isolated microbes and were resistant to Ampicillin (87.9%) and Cloxacillin (79.7%). ASB is associated with an increased risk for UTI (P-value = 0.001), pyelonephritis (0.002), anaemia later in pregnancy (<0.001), preterm delivery (<0.001), low birth weight (<0.001) and admission to SCBU (0.023). **Conclusion:** The prevalence of ASB is high and associated with significant maternal and perinatal morbidity. We recommend screening all pregnant women attending antenatal clinics for ASB and appropriate treatment given.

**Key words:** Asymptomatic bacteriuria, pregnancy, foetomaternal outcome, urine culture, Nigeria.

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## Introduction

Asymptomatic bacteriuria (ASB) is the persistent bacterial colonisation of the urinary tract without urinary tract symptoms.<sup>1</sup> The presence of more than 100,000 colony-forming units of a potential pathogen per ml of urine is diagnostic of ASB.<sup>1,2</sup>

Urinary tract infection (UTI) is a relatively common medical pregnancy complication, and ASB is the most prevalent of these infections.<sup>3,4,5</sup> The incidence of ASB ranges between 2% and 10%.<sup>2,6</sup>

Though asymptomatic, ASB has the potential to cause maternal and foetal morbidity. Without treatment, 20-40% of ASB cases will progress to acute pyelonephritis, a leading cause of antepartum hospitalization.<sup>7,8,9</sup> Pregnant women with ASB are also at risk of developing anaemia in pregnancy, hypertensive disease in pregnancy, postpartum urinary tract infection and chronic renal disease.<sup>5,9,10</sup> Bacteriuria increases the risk of preterm delivery, low birth weight and foetal and neonatal mortality.

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The risk of preterm delivery is said to be twice as high among women who had ASB at some point during pregnancy compared to those who did not.<sup>2,7,11</sup>

Many complications of pregnancy have been attributed to UTIs such as preterm labour and delivery, intrauterine growth restriction, LBW, anaemia, hypertension and long-term renal function impairment, therefore the beneficial effect of treatment of pregnant women with ASB cannot be overemphasized.<sup>2,5,7</sup>

Preventing cases of mild and serious pyelonephritis is not only economically beneficial, but it also produces a significant improvement in the quality of life of pregnant women.<sup>12,13</sup>

Routine screening and treatment of ASB help reduce the risk of development of pyelonephritis, preterm delivery and LBW infants.<sup>1,2,7,14</sup> It is therefore not surprising that a strategy for routine screening for ASB is currently recommended by the World Health Organization and other bodies.<sup>1,3,7</sup> The culture of midstream urine specimens remains the gold standard for detecting ASB in pregnancy, with the main advantage of being able to identify the causative organism and determine antibiotic sensitivities.<sup>1,3</sup> Research has shown that screening is cost-effective when the prevalence of ASB is >2%.<sup>15,16</sup> The few studies done in northern Nigeria reported a high prevalence of 8%<sup>17,18</sup> and thus the need for a similar study in Maiduguri. This study determined the prevalence of ASB among pregnant women at booking, the common offending organisms and the foetomaternal outcome. The findings from this study should inform regular screening for ASB in our antenatal clinics.

## Methods

We conducted a prospective study at the Department of Obstetrics and Gynaecology UMTH, Maiduguri, Nigeria. Approximately 4,000 women book and attend the antenatal clinic annually. Subjects were recruited consecutively from the population of pregnant women attending the booking clinic over ten weeks. Women with symptoms suggestive of urinary tract infection and current use or use of antibiotics within the preceding two weeks were excluded.

Over ten weeks, we recruited 150 women based on the Tailors sample size formula and applied a 20% attrition rate.<sup>19</sup> We recorded demographic and

clinical variables such as age, parity, gestational age, and educational level. Maternal complications and perinatal outcomes were also recorded. The study was conducted from 3<sup>rd</sup> October to 13<sup>th</sup> December 2010.

Clean catch midstream urine specimens were collected in sterile containers and taken to the microbiology laboratory within 1 hour. In case of delay, the samples were refrigerated at 4°C. A loopful of well-mixed uncentrifuged urine was inoculated on the surface of blood, MacConkey and nutrient agar and incubated for 48 hours at 37°C. Asymptomatic bacteriuria was defined as cultures showing at least 100,000 cfu/ml of single species in a woman without symptoms suggestive of urinary tract infection. Culture was defined as contaminated if there was a mixed culture of any density or insignificant if there was a pure culture of < 100,000cfu/ml of urine.<sup>4,5</sup> Cultures in which there was no growth were classified as negative. Antimicrobial sensitivity was determined using the disc diffusion method.

Apgar score of less than 7 at 5 minutes was defined as birth asphyxia. Preterm birth was defined as birth before 37 completed weeks of gestation and low birth weight was defined as a birth weight of less than 2500g.<sup>20</sup> Urinary tract infection was defined as a history of frequency, dysuria and lower abdominal pain with a positive urine culture. Findings of fever, nausea, vomiting and flank tenderness in addition to symptoms suggestive of cystitis was defined as pyelonephritis<sup>5,16</sup>. Anaemia was defined as PCV < 30% and prelabour rupture of membranes as rupture of membrane before the onset of labour.<sup>5,21</sup>

## Ethical Issues

All aspects of the study were reviewed and approved by the Ethics Committee of UMTH. Informed consent was obtained from all subjects after the study was thoroughly explained to them, stating that they could withdraw at any time without penalty. Women who became symptomatic with positive urine cultures were treated according to the antibiotic sensitivity pattern.

## Data Analysis

Data were analysed using the statistical package for social science (SPSS.14 Inc, Illinois.). Prevalence (with a 95% Confidence interval) was calculated using Epitools (epitools.ausvet.com.au). The risk was



estimated using the odds ratio and the Chi-square test was used to test for significance at a 95% confidence interval. Tables were used to illustrate a pattern in the variables.

### Results

One hundred and fifty pregnant women were recruited for the study, out of whom 33 yielded significant growth (100,000cfu/ml of urine) giving a prevalence of 22% (95% CI 15.4 - 28.6).

The majority of the study population were within 25-34 years (64%), para 1 to 4 (52.7%), in the second trimester of pregnancy (52%) and had tertiary level education (44.1%) as shown in Table 1.

Escherichia coli (E. Coli) was the most predominant organism isolated (45.4%), followed by Staphylococcus aureus (30.3%). This is illustrated in Table 2.

Nitrofurantoin (90.9%), Ciprofloxacin (84.8%), Ceftriaxone (87.8%) and Co Amoxiclav (84.8%) showed the highest activity against the isolated microbes. Ampicillin (87.9%) and Cloxacillin (79.7%) showed the highest resistance as illustrated in table 3.

Table 4 illustrates the association between ASB and foetomaternal outcomes. ASB was associated with an increased risk for UTI (p= 0.001), pyelonephritis (p= 0.002), anaemia later in pregnancy (p<0.001), preterm delivery (p<0.001), low birth weight (p<0.001) and admission to SCBU (p=0.023). The risk for birth asphyxia (p=0.393), Perinatal mortality (p=0.051), PROM (p=0.178), and hypertension (p=0.152) were not significant.

Table 1: Sociodemographic characteristics of the study population

| AGE GROUP                 | N          | (%)        |
|---------------------------|------------|------------|
| 15 - 24                   | 45         | 30         |
| 25 - 34                   | 96         | 64         |
| 35 - 44                   | 9          | 6          |
| <b>TOTAL</b>              | <b>150</b> | <b>100</b> |
| <b>PARITY GROUP</b>       |            |            |
| 0                         | 51         | 34         |
| 1 - 4                     | 79         | 52.7       |
| ≥5                        | 20         | 13.3       |
| <b>TOTAL</b>              | <b>150</b> | <b>100</b> |
| <b>GESTATIONAL AGE</b>    |            |            |
| First trimester           | 4          | 2.7        |
| Second Trimester          | 78         | 52         |
| Third Trimester           | 68         | 45.3       |
| <b>TOTAL</b>              | <b>150</b> | <b>100</b> |
| <b>EDUCATIONAL STATUS</b> |            |            |
| None                      | 44         | 29.3       |
| Primary                   | 11         | 7.3        |
| Secondary                 | 29         | 19.3       |
| Tertiary                  | 66         | 44.1       |
| <b>Total</b>              | <b>150</b> | <b>100</b> |



Table 2: Organisms isolated in patients with ASB

| ORGANISM                      | N (%)           |
|-------------------------------|-----------------|
| <i>Escherichia Coli</i>       | 15 (45.4)       |
| <i>Staphylococcus Aureus</i>  | 10(30.3)        |
| <i>Klebsiella Pneumoniae</i>  | 5 (15.2)        |
| <i>Proteus Mirabilis</i>      | 2 (6.1)         |
| <i>Pseudomonas Aeruginosa</i> | 1 (3.0)         |
| <b>TOTAL</b>                  | <b>33 (100)</b> |

Table 3: Sensitivity pattern of isolated organisms

| ANTIBIOTIC     | SENSITIVE N (%) | RESISTANT N (%) |
|----------------|-----------------|-----------------|
| Nitrofurantoin | 30(90.9)        | 3(9.1)          |
| Ampicillin     | 4(12.1)         | 29(87.9)        |
| Cotrimoxazole  | 26(79.0)        | 7(21.0)         |
| Ciprofloxacin  | 28(84.8)        | 4(12.1)         |
| Gentamycin     | 25(75.7)        | 8(24.2)         |
| Ceftriaxone    | 29(87.8)        | 4(12.1)         |
| Co-amoxiclav   | 28(84.8)        | 5(15.1)         |
| Erythromycin   | 23(69.7)        | 10(30.3)        |
| Cloxacillin    | 7(21.1)         | 26(79.7)        |
| Amoxicillin    | 20(60.6)        | 13(39.4)        |

Table 4: Foetomaternal outcome of patients with ASB

| OUTCOME             | OR (95%CI)          | p - VALUE |
|---------------------|---------------------|-----------|
| Lower UTI           | 0.148(0.027-0.799)  | 0.001     |
| Pyelonephritis      | 0.059(0.007-0.513)  | 0.002     |
| Hypertension        | 0.310(0.079- 1.223) | 0.152     |
| Anaemia             | 0.204(0.087-0.480)  | 0.000     |
| PROM                | 0.244(0.042-1.438)  | 0.178     |
| Preterm birth       | 0.071(0.014-0.360)  | 0.000     |
| Low birth weight    | 0.041(0.005-0.049)  | 0.000     |
| Asphyxia            | 0.0276(0.017-4.533) | 0.393     |
| SCBU admission      | 0.345(0.143-0.836)  | 0.023     |
| Perinatal mortality | 0.120(0.0013-1.134) | 0.051     |

Key:

UTI; urinary tract infection

PROM; premature rupture of membranes

SCBU; special care baby unit



### Discussion

This study shows that the prevalence of ASB is high and it is associated with an increased risk for UTI, pyelonephritis, anaemia later in pregnancy, preterm delivery, low birth weight and admission to SCBU. The prevalence of asymptomatic bacteriuria in pregnant women in this study was 22% similar to 23.9% from the study in Sagamu, Nigeria<sup>22</sup>. This is however higher than the 8% reported in Sokoto<sup>17</sup> and Kano<sup>18</sup> northern Nigeria and lower than the 86.6% and 78.7% earlier reported in Benin City and Abakaliki, Nigeria respectively.<sup>23,24</sup> In this study, it is observed that pregnant women in the age group 25-34 years (54.50%), para 1-4(42.40%), and in the second trimester (54.50%) had the highest percentage of infection. These results correlate with findings at Sokoto<sup>17</sup>, Abakaliki<sup>24</sup>, Benin City<sup>25</sup> and India.<sup>26</sup> These findings, however, did not reach statistical significance probably due to the difference in sample size. The sample size was larger in those studies.

The most prevalent organism observed in this study was *E. coli* (45.4%) which agrees with earlier reports.<sup>4,9,17,23,25</sup> This could be due to the anatomical proximity of the urethra to the anal orifice which allows easy contamination and infection. Pregnant women may also find cleaning their anus properly after defecating difficult. This coupled with the urinary stasis in pregnancy allows *E. coli* strains to adhere to uroepithelial cells and replicate causing UTI.<sup>5</sup>

The prevalence of *Staphylococcus aureus* was also high (30.3%) in this study. This agrees with previous studies<sup>23, 24,25</sup> which observed an increasing trend in the prevalence of *Staphylococcus aureus* infection among asymptomatic pregnant women. The other isolated organisms included *Klebsiella* species, *Proteus* species, and *Pseudomonas aeruginosa*, in keeping with previous studies.<sup>23,25,26</sup>

The antimicrobial sensitivity and resistance pattern varies from one community to the other, from hospital to hospital and from one point in time to another. This is because of the emergence of resistant strains as a result of the indiscriminate use of antibiotics.<sup>12,13</sup> This study revealed that most of the isolated organisms were most sensitive to Nitrofurantoin, Ciprofloxacin, Ceftriaxone and Co-Amoxiclav. Gentamicin, Erythromycin and Cotrimoxazole were moderately effective against the urinary isolates. The isolates were however highly resistant to Ampicillin and Cloxacillin.

The relationship between asymptomatic bacteriuria in pregnancy with symptomatic urinary tract infections and adverse pregnancy outcomes has been well documented in the literature. This has led to the recommendation that screening for and treatment of ASB should be standard obstetric care in all antenatal units.<sup>1,3,7</sup> It is therefore not surprising that this study found an increased risk of symptomatic UTI, pyelonephritis and anaemia in women diagnosed to have ASB by culture further confirming earlier studies.<sup>3,4,7,27</sup> Although some studies have reported an increased risk for hypertension and premature rupture of the membrane in women with ASB, this study did not find such an increased risk.<sup>2,5,7,27</sup> The risk for preterm delivery, low birth weight and admission to a special baby care unit were also increased confirming earlier reports.<sup>3,7,8,14,27,28</sup> The increased risk for preterm delivery and low birth weight may explain the increased risk of admission to the special baby care unit. There was also no increased risk for perinatal mortality and birth asphyxia in keeping with earlier reports.<sup>27,28</sup>

The limitation of this study is that foetal and maternal outcomes were observed in only 73 patients which is 49% of the sample size, who came to the hospital for delivery. This is however not surprising as only 39% of live births in Nigeria took place in a health facility in the 5 years preceding the last demographic and health survey.<sup>29</sup>

### Conclusion

The prevalence of ASB at 22% is significant and there is a need for routine screening of all our antenatal patients. The increased risk for maternal and foetal morbidity observed in this study further buttresses the need to screen and treat appropriately all cases of ASB detected.

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**Conflict of interest:** None

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