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Asymptomatic bacteriuria in pregnant Nigerian women at the Lagos University Teaching Hospital, south west Nigeria

Oluwole Ayodeji A.[1,2], Ugwu Aloy Okechukwu[2,3], Omisakin Sunday I.[1,2], Akinajo Rebecca Opeyemi[2]

[1]College of medicine, University of Lagos, Lagos, Nigeria
[2]Department of Obstetrics and Gynaecology, Lagos University Teaching Hospital, Lagos, Nigeria
[3]Department of Obstetrics and Gynaecology, 68 Nigerian Army Reference Hospital, Yaba, Lagos, Nigeria

Corresponding Author

Aloy Okechukwu Ugwu, Senior Registrar, Department of Obstetrics and Gynaecology, Lagos University Teaching Hospital, P.M.B. 12003, Surulere Lagos, Nigeria, Tel.: +2347033132189, e-mail: okeyugwu92@gmail.com

Abstract

Background: Dipstick urinalysis is a handy and cost effective method for the early detection of asymptomatic bacteriuria. Asymptomatic bacteriuria occurs in 2-10% of pregnancies and has been associated with low birth weight and preterm delivery in pregnant women if untreated.

Objective: To determine the incidence of asymptomatic bacteriuria in pregnancy, the distribution of infecting organisms and the antibiotic sensitivity pattern in pregnant Nigerian women attending the antenatal clinic of the Lagos University Teaching Hospital, Idi- Araba, Lagos.

Methodology: This was a prospective study. The study population were 201 consecutive asymptomatic pregnant women, who attended the antenatal clinic of LUTH for booking between 1st July and 31st December, 2021. Two consecutive urine samples were collected and analysed for microscopy, culture and sensitivity and urinalysis. The outcomes of interest were prevalence of asymptomatic bacteriuria at LUTH, bacterial isolates, and their antibiotic sensitivity pattern.

Results: The mean age of the population studied was 31years ± 4.56SD. The mean gestational age was 23.8 ± 5.39 SD with a range of 11-34 weeks; and majority of the participants (65.7%) were recruited at gestational ages between 14 and 26 weeks. The prevalence of asymptomatic bacteriuria in this study was 13.9%. The commonest isolated organism was klebsiella (46.4%) followed by Escherichia coli (21.4%). Ceftazidime, ofloxacin, and gentamycin showed good overall sensitivity with 92.9%, 89.3%, and 67.9%% respectively. From the results of urinalysis, nitrites showed a sensitivity of 48.3% and specificity of 98.2% with a positive predictive value of 83.3% while presence of bacterial cells on urine microscopy showed sensitivity of 31.2%, specificity of 85% and a positive predictive value of 27%.

Conclusion: The incidence of asymptomatic bacteriuria in this study was considerably high and therefore, there may be need to consider introduction of routine urine culture at booking or in the second trimester.

Key Words: Pregnancy, asymptomatic bacteriuria, antibiotics

Introduction

Urinary tract infection (UTI) is the second most common medical complication of pregnancy, second only to anaemia, and without proper management may have a significant adverse effect on the outcome of pregnancy.[1] Asymptomatic bacteriuria (AB) is defined as a quantitative count of > 100 × 10^6 colony-forming units of bacteria per litre (CFU/L) of urine without specific symptoms of a urinary tract infection.[2,3]

It is a common occurrence in pregnancy worldwide.[2,3] However, some pregnant women are more at risk than others, such women include those with diabetes, Human immunodeficiency virus, recurrent urinary tract infections, polycystic kidneys, other congenital renal *anomalies*, and sickle cell disease.[2,3]

The prevalence of asymptomatic bacteria during pregnancy is 2-10%.[3,4,5] The prevalence of asymptomatic bacteriuria in pregnancy in Nigerian women have been variously quoted as between 10-40%.[5,6,7,8]

The risk of asymptomatic bacteriuria rises with increasing parity, lower socioeconomic status, increased age, sexual activity in pregnancy, low socioeconomic status, poor perineal hygiene, increasing parity, sickle cell trait or disease, diabetes, and previous history of urinary tract infection.[5,6,7]

When untreated, about 20 to 35 percent of pregnant women with AB will progress to developing symptomatic urinary tract infection (UTI), including pyelonephritis.[9,10] However, this risk is reduced significantly to about 70 to 80 percent if bacteriuria is treated.[1,9]

In pregnant women, several physiological changes occur in the urinary tract, increasing the potential for pathogenic colonisation.[1,3,5,9] There is significant increase in bladder volume and decrease in detrusor tone. There is also associated ureteric dilatation in majority of pregnant women, attributed to a combination of progestogenic relaxation of ureteric smooth muscle and pressure from the expanding uterus. At the same time there is associated relative sparing of the left ureter because of the protection from the sigmoid colon and upper rectum. The resultant effect, however, is increased urinary stasis, distortion of ureteric valves and subsequent vesicoureteric reflux, which encourages bacterial colonisation of the urinary tract and ascending infection as the end result. Additionally, these physiological changes, with relative glycosuria in some pregnant women, a fall in urine osmolality, sexual activity in pregnancy with trauma to urothelium may synergistically favour bacterial proliferation of the urogenital tract.[2,3,5,7,9,10]

Asymptomatic bacteriuria is usually diagnosed when routine screening of urine with culture is performed on pregnant women without symptoms of a UTI.[1,2] The midstream, clean-catch urine collection technique remains the most utilized method of specimen collection. Careful instruction of specimen collection lessens contamination from vaginal bacteria. Bacteriuria is considered significant if there are at least 100,000 bacterial colonies per ml of freshly voided urine collected by the mid-stream clean-catch technique; if there are no symptoms of acute urinary tract infection (UTI) the bacteria is covert or asymptomatic.[2] The optimal time for screening has been shown to be 16weeks gestation.[10]

In the past, urine examination involved the assessment of the appearance, odour and taste of urine, and certain physicians, known as Pisse Prophets, made lucrative business from urine examination (uroscopy) and its interpretation (uromancy).[11,12] With the advances in medicine, various methods have been developed to screen for asymptomatic bacteriuria; among these are urinalysis to look for protein, leucocytes, red blood cells, urine dipstick for nitrites and leukocyte esterase. These tests are readily available and easy to use, but they have poor predictive values and relatively high false negatives results.[9] The gold standard for detecting bacteriuria in pregnancy is urine culture. A clean-catch (mid-

stream) urine specimen is ideal and will have to be examined no later than 2 hours after collection in order to obtain accurate results.[11,12]

The common etiologic agents of AB in pregnancy are the same as those of non- pregnant women.[9,10] Escherichia coli (E. coli) accounts for 80-90% of the causative agents in AB or UTI. Other organisms include Proteus mirabilis, Klebsiella pneumoniae, enterococci, Gardnerella vaginalis and Ureaplasma ureolyticum. Other less frequent organisms are Group B streptococcus, Staphylococcus saprophyticus, staphylococcus aureus and Staphylococcus haemolyticus.[9,10,11]

The treatment goal of AB in pregnancy is to eradicate the infection with the shortest possible course of antibiotics and to maintain sterile urine for the remainder of pregnancy.[11] However, antibiotics to be chosen should be sensitive to the organism cultured and safe for mother and fetus.[9,11] Urinary antisepsis such as nitrofurantoin, and other antimicrobials for example, cephalexin, amoxicillin, Amoxicillin-clavunalate and fosfomycin are all considered safe for use in pregnancy.[9,12,13] The obstetrician should also counsel the women on certain behavioural modifications that may or will enhance good hygiene and reduce bacterial contamination of the urethral meatus, these include: wiping from front-to-back after urinating or defecating, washing hands before using the toilet, using washcloths to clean the perineum, encouraging the use of liquid soap to prevent colonization from bar soap, and to clean the urethral meatus first when bathing.[12,13]

Sulphonamides can be used in second trimester, but it is best avoided in third trimester because of risk of severe jaundice and kernicterus especially in pre-term babies.[10] These women should have a follow-up urine culture 1-2 weeks after completing therapy and monthly urine cultures thereafter.[13]

This study therefore aims to determine the prevalence of asymptomatic bacteriuria among pregnant women attending the antenatal clinic of the Lagos University Teaching Hospital.

Materials and Methods

This was a prospective study of all consecutive pregnant women who attended the antenatal clinic at the Lagos University Teaching Hospital (LUTH) between 1st July and 31st December, 2021.

The study population was 208 consecutive asymptomatic pregnant women who attended the antenatal clinic of the LUTH for booking. The pregnant women had no symptoms of urinary tract infection, no urethral catheterisation in present pregnancy, no history of recent use of antibiotics and history of previous urinary tract infection. Diabetic, hypertensive and sickle cell disease pregnant women were also excluded. All the participants gave consent to participate in the study after being duly informed and counselled.

Sample Collection

For all the participants recruited, information obtained included the name, age, parity, and gestational age from the antenatal records.

All the consenting women recruited were instructed on how to collect a clean-catch specimen of urine. The vulva was parted with the left thumb and the index finger and a cotton swab held on the right hand was used to wipe the vulva from front backwards and anterior-posteriorly. The first few millimetres of urine were voided and then at least 10 mls of the mid-stream urine was collected into two labelled sterile universal bottles making it paired samples. For the purpose of this study, a participant was said to be positive for asymptomatic bacteriuria, if urine samples in the paired samples, showed the presence of $>10^5$ organisms per ml of clean catch urine. Urinalysis, microscopy, culture and sensitivity were done on all samples collected. The data obtained was entered into a computer and analysed using Statistical Package for Social Sciences (SPSS) version 20.0.

Results

The total number of participants recruited for the study was 208 but only 201 samples were analysed due to lost samples and participants lost to follow up. Table 1. Shows the sociodemographic variables of the study participants. The mean age was 31years ± 4.56SD. The mean gestational age was 23.8 ± 5.39 SD with a range of 11-34 weeks; and majority of the participants (65.7%) were recruited at gestational ages between 14 and 26 weeks. Most of the participants were married 96.52%. Majority had at least secondary education, while more than half were of low parity. Table 2, shows the urinalysis results of 28 women who had positive urine culture: 13 (43.4%). Table 3: The results of urine microscopy showed 10 samples (35.7%) and 3 samples (10.7%) with bacterial cells and pus cells respectively. The prevalence of asymptomatic bacteriuria in this study was 13.9%. The commonest isolated organism was klebsiella (46.4%) followed by Escherichia coli (21.4%). Other bacteria isolated were enterococcus, pseudomonas, citrobacter and morganella morgani (Table 4).

Table 1. Socio-Demographic variables.

AGE(YEARS)	**FREQUENCY (%)**
15-24	19 (9.4)
25-34	134 (66.7)
35-44	46 (22.9)
≥45	2 (1.0)
Mean age	31± 4.56SD
GESTATIONAL AGE (WEEKS)	
≤13	20(9.9)
14-27	131(65.2)
≥28	50(24.9)
MARITAL STATUS	
Single	2(0.99)
Married	198(98.5)
Divorced	1(0.51)
Educational status	
≤Primary Education	7 (3.5)
≥Secondary Education	194 (96.5)
PARITY	
≤2	101 (50.3)
3-4	61 (30.3)
≥5	39 (19.4)

Table 2. Urinalysis of pregnant women with Positive Urine Culture.

Parameters	Positive	%
All normal	13	46.4
Nitrites	15	53.6
Red Blood Cells	2	7.1
Protein	2	7.1
Leucocytes	3	10.7
Glucose	1	3.6

Dipstick (Combi-10); Total number analysed = 28

Table 3. Urine Microscopy.

PATTERNS	**POSITIVE**	**(%)**
Bacterial Cells	10	35.7
Pus Cells	3	10.7
Crystals	7	25.0
Casts	5	17.9
Yeast Cells	4	14.3
Epithelial Cells	2	7.1

Table 4. Types of organisms isolated from urine culture.

PATHOGEN	**FREQUENCY**	**%**
Klebsiella	13	46.4
Escherichia coli	6	21.4
Enterococcus	4	14.3
Pseudomonas	3	10.7
Citrobacter	1	3.6
Moganella morgani	1	3.6
Total	28	100.0

Total positive culture=28; Total sample=201; Incidence=13.9%

The sensitivity pattern of the isolated organisms was shown in table 5. Ceftazidim, cephalexin, and gentamycin showed good overall sensitivity with 92.9%, 89.3%, and 67.9%% respectively while overall sensitivity to amoxicillin, cloxacillin and trimethoprim were low: 3.6%, 3.6% and 10.7% respectively (Table 6). Nitrites showed a sensitivity of 48.3% and specificity of 98.2% with a positive predictive value of 83.3% while presence of bacterial cells on urine microscopy showed sensitivity of 31.2%, specificity of 85% and a positive predictive value of 27%. Others showed low specificity and sensitivity (Table 6).

Discussion

Asymptomatic bacteriuria (AB) has long been recognized as one of the commonest medical

complications in pregnancy. It is the persistent colonisation of the urinary tract by significant numbers of bacteria in women without urinary symptoms.[1]

The prevalence of AB in our study was 13.9%. This is lower to that reported by Oli et al in Nnewi[6]

Table 5. Predictive values of urinalysis.

TEST	FN	FP	TP	TN	SPECIFICITY	SENSITIVITY	POSITIVE PV	NEGATIVE PV
Nitrites	16	3	15	167	98.2%	48.3%	83.3%	96.5%
Bacteria	22	27	10	142	85.0%	31.2%	27.0%	86.6%
Pyuria	27	23	3	148	86.5%	10.0%	11.5%	84.6%
Leucocytes	27	17	3	154	90.1%	10.0%	6.3%	85.1%
Haematuria	28	11	2	160	93.6%	6.7%	15.0%	85.1%
Protein	27	8	2	164	95.3%	6.9%	20.0%	85.9%

FN=False positive, FP=False positive, TP=True positive, TN=True negative, PV=Predictive value.

Table 6. Sensitivity pattern of pregnant participant' urinary isolates.

	KLEBSIELLA		E COLI		PSEUDOMONAS		ENTEROCOCCUS		CITROBACTER		MORGANELLA MORGANI		
DRUG	NO AND %SENSITIVITY		NO AND % SENSITIVITY		NO AND % SENSITIVITY		NO AND % SENSITIVITY		NO AND % SENSITIVITY		NO AND % SENSITIVITY		OVERALL % SENSITIVITY
Amoxycillin	13	7.6	6	0.0	4	0.0	3	0.0	1	0.0	1	0.0	3.6
Co-Amoxycillin	13	46.0	6	33.3	4	0.0	3	33.3	1	0.0	1	100	35.7
Nitrofurantoin	13	61.5	6	100.0	4	0.0	3	33.3	1	0.0	1	100	57.1
Nalidixic	13	61.5	6	83.3	4	0.0	3	33.3	1	0.0	1	100	53.6
Trimethoprim	13	7.6	6	16.7	4	0.0	3	0.0	1	0.0	1	100	10.7
Gentamycin	13	61.5	6	66.7	4	75.0	3	66.7	1	100	1	100	67.9
Ofloxacin	13	92.3	6	100.0	4	75.0	3	66.7	1	100	1	100	89.3
Cefuroxime	13	38.4	6	100.0	4	0.0	3	66.7	1	0.0	1	100	50.0
Cefalexin/Cefalor	13	23.1	6	16.7	4	0.0	3	33.3	1	0.0	1	100	21.4
Ceftazidim	13	92.3	6	100.0	4	100	3	66.7	1	100	1	100	92.9
Cloxacillin	13	7.6	6	0.0	4	0.0	3	0.0	1	0.0	1	0.0	3.6

southeast Nigeria, who found a prevalence of 18.2% but close to that of Awonuga et al[5] at Ibadan who also reported a prevalence of 10.7% and 15.1% also reported by Ezeome and colleagues in Enugu, Nigeria.[14]

Coliforms (klebsiella -46.4% and Escherichia coli -21.4%) were the commonest organisms isolated in our study; this is similar to the study by Awonuga et al[5] where coliforms were found to be more prevalent, however it is different from that of Oli et al in Nnewi who reported E. coli to be higher when compared to our study where Klebsiella was the commonest organism.[6] Ezeome and co-workers also isolated more E. coli in their study when compared to other organisms.[14] This similarity may be because they are all hospital based studies as coliforms especially E coli is the leading cause of both community-acquired and nosocomial UTI.[15]

With regards to the antibiotic sensitivity testing of the isolates, Ceftazidim (92.9%) was found to be the most effective of all the drugs, followed by ofloxacin (89.3%), gentamycin (67.9%), nitrofurantoin (57.1%), with ampicillin (3.6%) having the least sensitivity. Our finding is similar to that of Awonuga et al where only gentamycin, nitrofurantoin and ofloxacin demonstrated high efficacy against the cultured uropathogens with antibiotic sensitivity rates of 72.7%-81.8%.[5] However, it differs from that of Oli et al where ceftriaxone was discovered to be the most effective of all the drugs tested, having 75.38% sensitivity,[6] but, their sensitivity to nitrofurantoin was 60% which is comparable to the finding in our study 57.1%. It's been known that ofloxacin and other quinolones are avoided during pregnancy because of concerns about its toxic effect to the fetal cartilage. Current study suggests that ofloxacin may have no significant effect on perinatal outcomes.[16]

Antibiotics sensitivity testing is very important as glomerular filtration is known to increase in pregnant women with a resultant increase in the elimination rate of most drugs.[17]

Furthermore, increased maternal plasma volume in pregnancy, will also effectively reduce serum drug concentrations which invariably will adversely affect its bio-availability.[17] On the other hand, polyuria and frequency may also reduce urinary drug concentration and its therapeutic window.[17]

Conclusions

In conclusion, the incidence of asymptomatic bacteriuria in this study is considerably high and therefore there may be need to consider introduction of routine urine culture at booking or in the second trimester. In the absence of this, routine urinalysis to detect the presence of nitrites, alone or in combination with other parameters, could be used for screening pregnant women for asymptomatic bacteriuria.

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