Asymptomatic bacteriuria of pregnancy in Ibadan, Nigeria: a re-assessment

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ABSTRACT

Asymptomatic bacteriuria in pregnancy is the major risk factor for developing symptomatic urinary tract infection during pregnancy. In the present study, 300 pregnant women are screened for significant asymptomatic bacteriuria in order to provide an insight into the prevalence in developing countries, reassessment of some predisposing factors and aetiological agents and their susceptibility tests. The mean age of the patients in the study is 26.8 years (SD: 5.8 years, range: 16–40 years). Using 10^3 organisms/mL as a significant level of bacteriuria, the prevalence was found to be 21.0%. One hundred and fifty-eight samples had no pus cells with 25 showing significant bacteriuria, 116 samples contained 1–4 pus cells/high power field (hpf) with 25 showing significant bacteriuria, while 26 samples had ≥5 pus cells/hpf with 13 showing significant bacteriuria. There was no particular trend associated with age and rate of infection. However, there was a decline in the rate of infection in the 26–30 age group, with a sharp increase as age increased. There was high incidence of bacteriuria during the third trimester of pregnancy (21.9%) compared with that in the first trimester (7.7%), while the level in the second trimester was 22.5%. Multiparity is associated with increased bacteriuria in pregnancy. Thirty-one (49.2%) isolates grew Gram-negative bacilli; 27 (42.9%) grewGram-positive cocci and the remainder (7.9%) grew yeast-like cells. *Staphylococcus aureus* was the most frequent pathogen (41.3%), followed by *Klebsiella* species (33.3%) and *Escherichia coli* (11.1%). Bacterial isolates from this study were most sensitive to ceftazidime, followed by ceftriazone, and least susceptible to co-trimoxazole.

KEY WORDS: Bacteriuria.
Pregnancy complications, infectious.
Urinary tract infections.

Introduction

Urinary tract infection (UTI) can be classified into three disease categories according to the site of infection: cystitis (the bladder), pyelonephritis (the kidney), and bacteriuria (urine). Colonisation of urine in the absence of clinical symptoms is termed asymptomatic bacteriuria, which is regarded as the presence of ≥1000 (10^3) colonies/mL urine from a specimen obtained by the clean-catch, midstream collection method. However, Kass[1] suggests that this level should be 100,000 (10^5) colonies.

Asymptomatic bacteriuria may precede symptomatic urinary tract infection, characterised by dysuria, frequency, pain and fever, which accounts for over six million outpatients visit each year.[2] Studies of women with acute dysuria show that significant bacteriuria can be associated with lower colony counts. Asymptomatic bacteriuria is common, with a prevalence of 10% during pregnancy.[3] Hence, routine screening for bacteriuria is advocated.[4]

Pregnant women are at increased risk of UTI. From the sixth week of pregnancy to a peak during weeks 22 to 24, approximately 90% of women develop ureteral dilatation, which will remain until delivery (hydronephrosis of pregnancy). Increased bladder volume and decreased bladder tone, along with decreased ureteral tone, contribute to increased urinary stasis and ureterovesical reflux.[5] In pregnancy, 13–27% of untreated women with asymptomatic bacteriuria develop pyelonephritis, usually requiring hospitalisation for treatment.[6] Bacteriuria in pregnant women increases the risk for preterm delivery and low birthweight by about 1.5–2-fold and may also increase the risk of fetal and perinatal mortality.[7] Bacteriuria occurs in 2–7% of pregnant women. Of those who are not bacteriuric at initial screening, 1–2% will develop bacteriuria later in pregnancy.[8]

Through screening and aggressively treating pregnant women with asymptomatic bacteriuria, it is possible to decrease the annual incidence of pyelonephritis during pregnancy significantly.[3] In randomised, controlled trials, treatment of pregnant women with asymptomatic bacteriuria has decreased the incidence of preterm birth and low-birthweight infants.[9]

This study aims to determine the prevalence of asymptomatic bacteriuria in pregnancy and its aetiological agents. Accuracy in predicting the presence or absence of significant pyuria as an indicator for early asymptomatic bacteriuria is also evaluated. Prevalence of asymptomatic bacteriuria in pregnancy in the three tiers of healthcare in Ibadan is also determined.

Materials and methods

Study population

The study was carried out at University College Hospital (UCH), Ibadan, for a period of six months. The study groups

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Table 1. Association of pus cells with bacterial growth.

Number of pus cells	Frequency	Number with growth	Percentage	Number without growth	Percentage
0	158	25	15.8	133	84.2
1–4	116	25	21.6	91	78.4
≥5	26	13	50.0	13	50.0
Total	300	63	21.0	237	79.0

Table 2. Association of age with bacterial growth.

Age	Frequency	Number with growth	Percentage	Number without growth	Percentage
16–20	48	10	20.8	38	79.2
21–25	82	18	21.9	64	78.1
26–30	87	15	17.2	72	82.8
31–35	60	11	18.3	49	81.7
36–40	23	9	39.1	14	60.9
Total	300	63	21.0	237	79.0

comprised pregnant women attending obstetrics and gynaecology clinics at UCH, Adeoyo Maternity Hospital (AMH) and the primary healthcare centre (HCO), Oniyanrin, Ibadan, for the first antenatal visit. Information about their age, occupation, residential address, period of pregnancy, number of children, prophylactic use of antibiotics and previous obstetrics and gynaecology complication(s) were obtained. All subjects were examined and no signs or symptoms of classical urinary tract infection (UTI) were observed.

Specimen collection

Clean-voided midstream urine was collected from each patient in sterile screw-capped universal glass containers by nurses who had been instructed in the technique of perineal cleansing and specimen collection.

Culture and sensitivity

Uncentrifuged urine specimens, irrespective of leucocyte count, were cultured using a platinum loop that delivers 0.001 mL urine to the surface of well-dried blood agar and McConkey agar plates, with subsequent streaking to produce discrete colonies. After incubation at 37°C for 24 h, the numbers of colony-forming units were estimated and bacterial counts of ≥1000 were regarded as indicative of significant bacteriuria.[1]

Microscopy

A quantity (10 mL) each well-mixed urine sample was centrifuged at 2000 x *g* for 5 min. Supernatant was discarded and a drop of the deposit was examined microscopically at high magnification for the presence of pus cells, red blood cells, epithelial cells, casts, crystals, yeast-like cells, *Trichomonas vaginalis* and *Schistosoma* ova.

Bacterial isolates were confirmed by standard microbiological methods.[10] The antibiotic susceptibility of each isolate was tested manually according to NCCLS recommendations for disc diffusion.[11]

Table 3. Association of trimester of pregnancy with bacterial growth.

Trimester	Frequency	Number with growth	Percentage	Number without growth	Percentage
First	26	2	7.7	24	92.3
Second	160	36	22.5	124	77.5
Third	114	25	21.9	89	78.1

Table 4. Association of number of children with bacterial growth.

Number of Children	Frequency	Number with growth	Percentage	Number without growth	Percentage
0	117	21	18.0	96	82.0
1–2	112	23	20.5	89	79.5
3–4	60	15	25.0	45	75.0
≥5	11	4	36.4	7	63.6

Results

The mean age of the patients included in the study was 26.8 years (standard deviation [SD]: 5.8 years, range: 16–40 years). Sixty-three (21%) of the 300 specimens yielded significant growth using a level of bacteriuria of 10^3 organisms/mL as an indication of significant bacterial count. Association of the presence of pus cells with bacterial growth is recorded in Table 1.

There were no child-bearing women ≥40 years of age in this study. Although there was no particular trend in infection rate within the different age groups (Table 2), the highest rate of infection was seen in the 36–40 age group. Table 3 shows the association of trimester of pregnancy with bacterial growth. Table 4 shows the association of number of children with bacterial growth.

Sixty-three isolates were recovered, of which 31 (49.2%) were Gram-negative bacilli, 27 (42.9%) were Gram-positive cocci and the remainder (7.9%) were yeast-like cells. Frequency of isolates is shown in Table 5 and their distribution is shown in Table 6. The majority of the isolates in this study were most sensitive to ceftazidime, followed by ceftriazone. The lowest level of susceptibility was to co-trimoxazole. Fluoroquinolones were not used in this study as their use is contraindicated in pregnancy.

Table 5. Frequency of isolates.

Isolates	Number	Percentage
Escherichia coli	7	11.1
Klebsiella species	21	33.3
Staphylococcus aureus	26	41.3
Pseudomonas aeruginosa	3	4.8
Enterococcus faecalis	1	1.6
Candida albicans	5	7.9
Total	63	100

Discussion

In pregnancy, 13–27% of untreated women with asymptomatic bacteriuria develop pyelonephritis, which usually requires hospitalisation for treatment.[6] Bacteriuria in pregnant women increases the risk (1.5–2-fold) of preterm delivery and low birthweight, and may increase the risk of fetal and perinatal mortality. In this study, prevalence of 21% was found, which is very high compared with that reported by Baleiras *et al*.,[12] Bachman *et al*.[8] and Gebre-Salassie,[13] but is consistent with that found in a population of diabetic pregnant women.[14] However, significant pyuria with bacteriuria was only found in 50% of cases in the present study. This underlines the relevance of correlation of pyuria with bacteriuria.[15]

The level of bacteria growth found in non-pyurial subjects corroborates the findings of de la Rosa *et al*.[16] and Bort and Beller,[17] who stated that pyuria is not a useful marker for the diagnosis of asymptomatic bacteriuria in pregnancy. The presence of significant pyuria should not be used as a screening test for asymptomatic bacteriuria in pregnancy. If this had been used in the present study then 37.4% subjects would have been missed.

Study of the prevalence of bacteriuria shows that it generally increases with age and sexual activity.[18] In addition, occurrence of bacteriuria during pregnancy increases with trimester, which agrees with the work of Stenqvist *et al*.[19] In the present study, all the subjects in their second and third trimesters were visiting the antenatal clinic for the first time, hence it could not be established if they carried infection from the first trimester. The study also confirmed that multiparity is associated with increased bacteriuria in pregnancy.[20]

The aetiological agents associated with bacteriuria are similar in pregnant and non-pregnant women. *Staphylococcus aureus* was the most common (41.3%), followed by *Klebsiella* species (33.3%), *Escherichia coli* (11.1%) and *Candida albicans* (7.9%). The physiological alterations during pregnancy that affect immunity may account for this prevalence of *C. albicans*. The preponderance of aerobic Gram-negative enteric bacilli (*Klebsiella* species, *E. coli* and *P. aeruginosa*) in this study (49.2%) confirms the findings of Patterson and Andriole.[18] The report of the aetiological agents confirms the findings of previous studies by Okubadejo *et al*.[21] and Phillips *et al*.,[22] from Ibadan and Kampala, respectively, in which *S. aureus* featured more frequently than *E. coli*. Gebre-Selassie found *S. aureus* in small numbers and *E. coli* in high numbers (46%).13

Nitrofurantoin and co-trimoxazole should be the drugs of choice for either asymptomatic or symptomatic bacteriuria in pregnancy, in view of their relatively non-toxic nature because of the sensitivity of UTI bacterial isolates to these antibiotics. Increasing numbers of urinary isolates are developing resistance to amoxicillin and augmentin; therefore, treatment should be based on antibiotic susceptibility testing.[5]

Bacteria isolated in the present study were generally sensitive to cephalosporins (ceftazidime and cetriaxone);

Table 6. Prevalence of isolates in the hospitals.

Isolates	UCH	%	AMH	%	HCO	%
Escherichia coli	2	11.8	0	0	5	26.3
Klebsiella species	4	23.5	10	37.0	7	36.8
Staphylococcus aureus	8	47.1	12	44.4	6	31.6
Pseudomonas aeruginosa	0	0	3	11.1	0	0
Enterococcus faecalis	0	0	1	3.7	0	0
Candida albicans	3	17.7	1	3.7	1	5.3
Total	17	27.0	27	42.9	19	30.2

Table 7. Antibiotic sensitivity pattern of the isolates.

Antibiotic	*E. coli* (*n*=77)	*Klebsiella* spp. (*n*=21)	*S. aureus* (*n*=26)	*P. aeruginosa* (*n*=3)	*E. faecalis* (*n*=1)
Nitrofurantoin	3 (43.0)	14 (66.7)	15 (57.7)	0	1 (100)
Nalidixic acid	3 (43.0)	10 (47.6)	10 (38.5)	0	1 (100)
Cotrimoxazole (20 μg)	2 (29.0)	5 (23.8)	8 (30.8)	0	0
Gentamicin (10 μg)	3 (43.0)	8 (38.1)	12 (46.2)	0	1 (100)
Amoxycillin (23 μg)	2 (29.0)	6 (28.6)	10 (38.5)	0	0
Augmentin (30 μg)	3 (43.0)	8 (38.1)	14 (53.8)	0	1 (100)
Cefuroxime	3 (43.0)	10 (47.6)	15 (57.7)	0	1 (100)
Ceftriazone (30 μg)	4 (57.1)	14 (66.7)	17 (65.4)	1 (33.3)	1 (100)
Ceftazidime (30 μg)	5 (71.4)	17 (81.0)	19 (73.1)	2 (66.7)	1 (100)

however, they are not usually recommended as first-line therapy because of the lack of clinical experience in pregnant women or because of potential or unknown toxicity during pregnancy. Antibiotic sensitivity patterns provide important information about the emergence of multiresistant bacterial strains, and an indication of how successful treatment may be with a particular antibiotic. Therefore, antibiotic sensitivity testing should be encouraged, and the results of the test should be acted upon in order to treat infection successfully.

In conclusion, the prevalence of asymptomatic bacteriuria in developing countries is three times higher than in developed countries. Asymptomatic bacteriuria is the major risk factor for developing symptomatic UTI during pregnancy and may be associated with adverse effects on maternal and fetal health. Most asymptomatic UTIs develop in women with bacteriuria early in pregnancy; thus, screening for asymptomatic bacteriuria, and subsequent treatment, is indicated.

All pregnant women should be screened at the first antenatal visit, preferably during the first trimester. Pyuria is an unreliable diagnostic method for detecting asymptomatic bacteriuria in pregnant women and thus all samples, irrespective of leucocyte count, should be sent for culture. □

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