

ASYMPTOMATIC BACTERIURIA AND DRUG SUSCEPTIBILITY PATTERNS OF MID-STREAM URINE SPECIMENS AMONG PREGNANT WOMEN AT BOOKING IN A PRIVATE HOSPITAL IN KUMASI, GHANA

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Abstract

Background: Urinary tract infections (UTIs) are common during pregnancy. Asymptomatic bacteriuria (ASB) can lead to the development of cystitis or pyelonephritis if left untreated and could eventually result in very serious sequelae.

Objectives: To determine bacterial isolates and drug susceptibility patterns of mid-stream urinary specimens among pregnant women who were asymptomatic for UTI at their first antenatal attendance (booking).

Subjects and methods: A retrospective review of urine results of antenatal attendants with no symptoms of UTI at booking from January 2010 to December, 2012 was done. As part of routine investigations at booking women provided mid-stream urinary specimens and

bacterial isolates and drug susceptibility patterns were determined.

Results: The total number of women was 453 and significant bacteriuria was found in 45/453 (9.9%). The commonest bacterial isolates were *Staphylococcus aureus* 18/45 (40%) and *E. coli* 15/45 (33.3%). All the bacterial isolates were sensitive to nitrofurantoin and the least sensitivities were to erythromycin 13/45 (28.9%) and ampicillin 11/45 (24.4%).

Conclusion. All pregnant women should be screened for bacteriuria at booking since the asymptomatic ones may have significant bacteriuria which could later result in serious infections and poor pregnancy outcomes. The choice of antibiotics used should be based on maternal factors and the gestational age.

Key Words: Pregnancy, Booking, Asymptomatic bacteriuria, *Staphylococcus aureus*

Introduction

Significant bacteriuria is the finding of more than 10^5 colony forming-units per ml. of urine¹. Asymptomatic bacteriuria (ASB) is defined as significant bacteriuria without symptoms of UTI². Women with ASB during pregnancy are more likely to deliver premature or low-birth-weight infants^{3,4,5}. These pregnant women also have a 20 to 30-fold increased risk of developing pyelonephritis compared with women without bacteriuria^{6,7,8}. Other conditions including transient renal failure, acute respiratory distress syndrome, sepsis, shock and haematological abnormalities occur in cases where ASB is untreated or inadequately treated⁹.

Screening and identification of bacteriuria during pregnancy have been recommended.

The main goal of detecting and treating ASB in pregnant women is to prevent UTI and its consequences. The United Kingdom National Screening Committee¹⁰ and The American College of Obstetricians and Gynaecologists recommend screening for asymptomatic bacteriuria in pregnancy¹¹.

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Conflict of interest: None declared

Escherichia coli is the most common bacterial isolate of UTI during pregnancy^{12,13,14}. Other studies have also reported *Klebsiella* species¹⁵ and *Staphylococcus aureus*¹⁶ as the commonest isolates.

Most published studies on ASB in pregnancy have been from the developed world. In developing countries almost all studies on this subject have been in teaching hospitals.

This study was conducted in a private hospital and determined the pattern of ASB among all patients presenting for the first antenatal visit during the study period.

Subjects and methods

In this retrospective study, urine results of patients presenting for their first antenatal (booking) attendance with no symptoms of UTI from January 2010 to December, 2012 were retrieved and analysed. At booking urine cultures were done for the patient as part of routine investigations.

The study was conducted in Kumasi, Ghana at the Bomso Clinic, a Specialist Hospital situated in a busy cosmopolitan area close to the Kwame Nkrumah University of Science and Technology campus. The patients are local residents and others come from various private enterprises including mining companies, financial institutions and non-governmental organizations. The Hospital offers specialist services in Medicine, Surgery, Paediatrics and Obstetrics and Gynaecology. The details extracted included findings

on urine microscopy, culture and antibiotic susceptibility. The data were analysed using SPSS 15.0 for Windows. Associations were tested using chi square or Fisher's exact test as appropriate; the level of statistical significance was set at $p < 0.05$.

Results

Table 1 shows the characteristics of the patients. The total number of patients booking for ante-natal care during the study period was 453. Significant bacteriuria ($> 10^5$ colony forming units/mL of urine) was found in 45/453 (9.9%) of urine specimens.

Of the 45 isolates, the commonest organism was *Staphylococcus aureus* 18/45 (40%) followed by *Escherichia coli* 15/45 (33.3%). The other isolates were *Streptococcus* species 5/45 (11.1%), *Staphylococcus*

saprophyticus 4/45 (9%), *Proteus* species 2/45 (4%) and *Klebsiella* species 1/45 (2.2%).

Although no statistically significant association was found, the prevalence of significant bacteriuria was highest among women aged between 21 - 30 years, those of parity 1- 4 and in the second trimester.

Table 2 shows the sensitivities of the isolated organisms. All were sensitive to nitrofurantoin followed by gentamycin 42/45 (93.3%), ciprofloxacin 31/45 (68.9%), nalidixic acid 27/45 (60.0%), and cefuroxime 24/45 (53.3%). Antibiotics with less than 50% sensitivities were ceftriaxone 22/45 (48.9%), augmentin 21/45 (46.7%) and the lowest sensitivities were to erythromycin 13/45 (28.9%), and ampicillin 11/45 (24.4%).

Table 1. Characteristics of patients (total number = 453)

Characteristic	No. of women with significant bacteriuria (n = 45)	No. of women without significant bacteriuria (n=408)	X ² (p-value)/ Fisher exact test (*)
Age (range 16 to 43years)			
≤ 20years	0	4	*(p=0.44)
21 to 30 years	32	248	
31 to 40 years	13	148	
≥41 years	0	8	
Parity (range 0 to 9)			
0	10	139	*(p=0.21)
1 to 4	35	266	
≥5	0	3	
Trimester			
First	14	102	X ² = 0.81 P=0.66
Second	28	274	
Third	3	32	

Table 2. Antibiotic susceptibility patterns of isolated organisms (Total = 45)

Antibiotic	Organisms (number and percentage of susceptible organisms)						
	<i>Staph. aureus</i>	<i>E. coli</i>	<i>Strept. Species</i>	<i>Staph. saprophyticus</i>	<i>Proteus species</i>	<i>Klebsiell aspecies</i>	TOTAL
N	18	15	5	4	2	1	45
Gentamycin	18 (100.0)	15 (100.0)	3 (60.0)	4 (100.0)	1 (50.0)	1 (100.0)	42 (93.3)
Nitrofurantoin	18 (100.0)	15 (100.0)	5 (100.0)	4 (100.0)	2 (100.0)	1 (100.0)	45 (100.0)
Erythromycin	6 (33.3)	3 (20.0)	2 (40.0)	2 (50.0)	0 (0.0)	0 (0.0)	13 (28.9)
Co-trimoxazole	7 (38.9)	5 (33.3)	1 (20.0)	1 (25.0)	0 (0.0)	0 (0.0)	14 (31.1)
Cefuroxime	7 (38.9)	12 (80.0)	2 (40.0)	2 (50.0)	1 (50.0)	0 (0.0)	24 (53.3)
Ampicillin	3 (16.7)	6 (40.0)	1 (20.0)	1 (25.0)	0 (0.0)	0 (0.0)	11 (24.4)
Augmentin	5 (27.8)	10 (66.7)	2 (40.0)	2 (50.0)	2 (100.0)	0 (0.0)	21 (46.7)
Ceftriaxone	6 (33.3)	9 (60.0)	2 (40.0)	2 (50.0)	2 (100.0)	1 (100.0)	22 (48.9)
Nalidixic acid	6 (33.3)	15 (100.0)	3 (60.0)	1 (25.0)	1 (50.0)	1 (100.0)	27 (60.0)
Ciprofloxacin	12 (66.7)	11 (73.3)	3 (60.0)	3 (75.0)	1 (50.0)	1 (100.0)	31 (68.9)

Discussion

Prevalence

The prevalence of ASB among pregnant women shows wide variations across geographical regions. High rates of 86.6% and 63.3% have been reported from two regions in Nigeria^{17,18}. Rates of 7.0% were reported in Ethiopia¹⁹ and 4-7% in Canada²⁰. The rate of 9.9% in this study compares to rates of 7.3%²¹ and 9.5%²² in similar studies in the same region in Ghana. These rates in Ghana also fall within the reported range of 2 %-11% in most reviews^{23,24}.

These variations could be attributed to the fact that prevalence of ASB varies with geographical locations, age of the subjects, studied populations and diagnostic methods. The observed difference in the prevalence levels could also be linked to environment, social habits of the community, personal hygiene and educational level.

The prevalence tends to increase as pregnancy advances. The pressure effect of a much bigger uterus on the ureters, the increasing smooth muscle relaxing effect of pregnancy hormones and the pressure on the bladder from the descending presenting part, may all lead to stasis of urine, which will encourage bacteria multiplication. Furthermore, the immunosuppressive effect of pregnancy may be most pronounced in the third trimester.

In addition, certain chemicals such as glucose is released in to the urine which changes the pH of theurine and favour the growth of most pathogens present in the bladder²⁵. Multi-parity falls within the age-group that experiences increased sexual activities which serves as a risk factor for UTI, as most of the bacterial pathogens isolated formed the normal flora of the vaginal region.

Organisms

In this study, *Staphylococcus aureus* was the commonest cause for ASB which is different from two studies in the same region in Ghana where *E. coli* was the commonest^{21,22}. However this finding is similar to those of studies in Aba, Abia State¹⁶. And Edo-Ekiti, Ekiti State²⁶ both in Nigeria *E. coli* was the second commonest organism in this study.

The other organisms are all found in the genital region and changes in pregnancy including urinary stasis and sexual activity could encourage infection. The high prevalence rate of the urinary pathogens in the female population, especially pregnant women might not be a surprising issue considering the anatomical structure and the proximity of the genital tract to the bowel that allows for easy contamination.

Drug Sensitivities

As shown in Table 2 the isolates were highly sensitive to nitrofurantoin, the quinolones (ciprofloxacin and nalidixic acid) and the aminoglycoside gentamycin. The sensitivities were nitrofurantoin 45/45 (100.0%), followed by gentamycin

42/45(93.3%), ciprofloxacin 31/45(68.9%), nalidixic acid 27/45(60.0%), and cefuroxime 24/45(53.3%). Antibiotics with less than 50% sensitivity were ceftriaxone 22/45(48.9%) and augmentin 21/45 (46.7%). The lowest sensitivities were to erythromycin 13/45(28.9%), and ampicillin 11/45(24.4%). In this study the second generation cephalosporin cefuroxime was slightly more active against *E. coli* than the third generation cephalosporin ceftriaxone, although this was not statistically significant.

Most studies on ASB in pregnancy report high sensitivity to nitrofurantoin and gentamycin. Nitrofurantoin and gentamycin are both easily available and affordable, but their use are beset with some concerns. Nitrofurantoin is bactericidal and has a broad spectrum of activity against UTIs caused by gram-negative and gram-positive organisms. It is also administered orally. Nitrofurantoin should be taken with food to improve its absorption. It is contraindicated in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency because of risk of intravascular haemolysis resulting in anaemia. For the same reason, nitrofurantoin should not be given to pregnant women after 38 weeks of pregnancy, or who are about to give birth. Because safer alternatives are available, some experts consider quinolones contraindicated during pregnancy, especially during the first trimester. Nalidixic acid is only recommended for use during pregnancy when benefit outweighs risk²⁷.

The aminoglycoside, gentamycin is administered parenterally and could pose inconveniences as the patient has to have daily injections by trained health personnel. In our circumstances this would be disruptive to the patient's social and economic activities since she otherwise feels well. Gentamycin is used to treat many types of bacterial infections, particularly those caused by Gram-negative organisms. Gentamycin is also ototoxic and nephrotoxic, with this toxicity remaining a major problem in clinical use. Like all aminoglycosides, when gentamycin is given orally, it is not systemically active. This is because it is not absorbed to any appreciable extent from the small intestine. It is administered intravenously, intramuscularly or topically to treat infections.

It is noted that those drugs considered safe in pregnancy (ampicillin, augmentin, erythromycin) showed the least effectiveness in this study. This could support the assertion that this could be due to widespread and indiscriminate use/misuse as observed by other investigators²⁸. Antibiotic prescription in pregnancy depends on proper assessment of the pregnant women by the physician, based on the pharmacokinetic property of the drugs, thereby evaluating the drugs side effect and level of toxicity for the patient and fetus.

Conclusion

The main goal of detecting and treating ASB in pregnant women is to prevent UTI and its

consequences. The value and cost effectiveness of routine screening for ASB in pregnancy is controversial. The choice of antibiotic should however be based on urine culture, stage of gestation, clinical data and the characteristics of the antibiotic. In our circumstances, the G6PD status of pregnant women should be determined at booking and where this is negative the quinolones could be administered because they are affordable and effective orally.

Health education about personal hygiene and cleanliness around the urogenital and anal area to prevent faecal contamination of the urinary tract should be emphasized during antenatal visits.

Urine microscopy and culture for screening for ASB at booking, and in each of the trimesters should be recommended. Identified cases should be treated with appropriate antibiotic therapy based on sensitivity tests.

Acknowledgements

I wish to express gratitude and thanks to the management and staff of Bomso Clinic, Specialist Hospital, Kumasi.

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