ORIGINAL ARTICLE

Prevalence and Its Antibacterial Susceptibility Pattern of Asymptomatic Bacteriuria in Pregnancy of a Teaching Hospital

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Abstract

Objective: The aim of this study was to evaluate the prevalence and risk factors of asymptomatic bacteriuria (ASB) to identify commonest microorganisms and their antimicrobial susceptibility in pregnant women.

Materials and methods: A total of 230 healthy pregnant women who attended antenatal out patient department for first visit were evaluated for bacteriuria.

Results: The prevalence of ASB in pregnant women was 10%. Demographic and obstetric parameters did not significantly influence the prevalence of ASB except in rural dwelling ($\chi^2 = 4.454$, $p = 0.0348$). The dominant bacteria were *Escherichia coli* (52.17%). Uropathogens were highly sensitive to imipenem and aminoglycosides and less sensitive to nalidixic acid, ampicillin, amoxicillin, and cotrimoxazole.

Conclusion: There is a high prevalence of ASB among pregnant women in the study. With the exception of rural dwelling, demographic and obstetric parameters did not significantly influence the risk of ASB. Therefore, routine ASB screening among pregnant women is suggested in our environment.

Keywords: Antibiotic sensitivity, Asymptomatic bacteriuria, Pregnancy, Urine culture.

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Introduction

Asymptomatic bacteriuria (ASB or asymptomatic significant bacteriuria) is defined as the presence of actively multiplying bacteria in the urinary tract, excluding the distal urethra, in a patient without obvious urinary symptoms.[1] The prevalence during pregnancy is similar to that in non-pregnant women and varies from 4 to 7%.[2,3] Prevalence of ASB increases with lower socioeconomic classes, past history of asymptomatic urinary tract infection, high parity and age.[4,5] Asymptomatic bacteriuria is a microbial diagnosis based on the isolation of a specified quantitative number of bacteria in urine specimen. So urine culture is the gold standard for screening of ASB. *Escherichia coli* is isolated in almost 60–90% ASB in pregnant women in different studies carried out all over the world, at different periods of time. Other common agents include *Proteus mirabilis, Klebsiella pneumoniae, Enterococcus,* group B beta-hemolytic *Streptococci*, *Staphylococcus saprophyticus*, etc.[6,7] The frequencies of isolated pathogens and their antimicrobial susceptibility patterns can vary in different geographical areas. It is important to identify the commonest pathogens in a particular locality and the community should be made aware regarding the antimicrobial susceptibility patterns of those organisms. So, the aim of this study was to observe the prevalence and risk factors of ASB, common microorganisms isolated and antibacterial susceptibilities of the isolated microorganisms among pregnant women who attended the tertiary care center.

Materials and Methods

This cross-sectional study was carried out in the Obstetrics and Gynecology, and Microbiology Department of a medical college. Ethical clearance for the study was obtained from the Institutional Ethics Committee. Informed consents were taken from all participating pregnant women. Women at any gestational age attending the antenatal clinic for their first visit were included and those women having a history of urinary tract symptoms (dysuria, frequency, and urgency, etc.), antibiotic administration within the previous 7 days, pyrexia of unknown origin and recurrent UTI were excluded from the study. The minimal sample size was estimated to be 226 (with 5% absolute error at 95% confidence interval and adding 10% attrition rate) considering the prevalence rate of ASB about 16% from the previous study in Northern Indian women.[8] By using the systematic sampling method, the women were selected. Previous antenatal records showed that an average of 4,500 pregnant women visited for the 1st time in the antenatal outpatient department within a year. This annual number was divided by the minimum sample size (226) to get a sampling fraction of 19.9. Some

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women may not give consent although it fulfils the inclusion criteria, and therefore, the sample was taken after the interval of every 15 women though sampling fraction which was 19.

The midstream urine samples were taken for urinalysis and culture was done on cysteine lactose electrolyte deficient (CLED) medium or MacConkey agar and blood agar employing standard loop method (i.e., 1 µL volume loop).[9] Women having > 10^5 colony forming units/mL of single organism were diagnosed positive for ASB and treated.[10] The standardized Kirby-Bauer disc diffusion method as per the Clinical and Laboratory Standards Institute (i.e., CLSI) guideline was used for antibiotic susceptibility testing and interpretations were carried out accordingly.[11]

A structured proforma was used to obtain the data. The data obtained consist of age, address, educational status, parity, gestational age, history suggestive of urinary tract infection (dysuria, frequency, fever, suprapubic and loin pain), history of antibiotics use, culture and sensitivity result. Data were presented as numbers and percentages in tables. Chi-square or Fisher's exact tests were used to test for associations. Significant association was presumed if $p < 0.05$.

Results

Among 230 pregnant women who were examined for ASB, significant bacteriuria was observed in 23 cases, giving a prevalence of 10%. Table 1 depicts the influence of age, parity, locality, educational status, and gestational age of the participants on ASB. The maximum rate of 10.40% was found in the 20–30 years age group and minimum rate of 7.69% in >30 years group. The relationship of prevalence among the age group is not statistically significant (Chi-square value = 0.1488, df = 2, $p = 0.9283$). Among significant bacteriuria positive women, highest prevalence was observed in nulliparous women (11.81%) while the women having one or two children had the least prevalence. However, no significant relationship was found between parity and prevalence ($\chi^2 = 1.038$, df = 2, $p = 0.5950$). The pregnant women who resided in rural areas were more likely to have ASB and it is statistically significant ($p < 0.05$). However, ASB did not have any significant relation with level of education. The prevalence of ASB with respect to trimester was as follows: first trimester—3 (8.11%), second trimester—9 (10.98%), and third trimester—11 (9.91%); but no significant relation of ASB with the trimester of the pregnancy was observed ($\chi^2 = 0.2349$, df = 2, $p = 0.8892$).

The bacterial isolates are listed in Table 2. The dominant bacteria were *E. coli* (52.17%) followed by *Klebsiella pneumoniae* (21.73%), *Staphylococcus aureus* (17.39%), and *Enterococcus faecalis* (8.69%), respectively. The antibiotic susceptibilities of the isolates are mentioned in Table 3. *E.coli*, the commonest isolate, was found to be sensitive to cotrimoxazole (41.67% sensitivity) and to nalidixic acid (50% sensitivity). Seventy five percent sensitivity was observed for doxycycline and ciprofloxacin. Sensitivity to nitrofurantoin and gentamicin was 83.33% and sensitivity to

Table 2: Bacterial isolates among pregnant women with significant bacteriuria

Bacterial isolates	*Number of women with isolates (%)*
Escherichia coli	12 (52.17)
Staphylococcus aureus	4 (17.39)
Enterococcus faecalis	2 (8.69)
Klebsiella pneumoniae	5 (21.73)
Total	23 (100)

Table 1: Prevalence of asymptomatic bacteriuria among pregnant women

Variables	*Significant bacteriuria N (%)*	*No significant bacteriuria N (%)*	*Total number of cases (%)*	χ^2	*df*	*p-value*
Age in years						
<20	4 (9.09)	40 (90.91)	44 (100)	0.1488	2	0.9283
20–30	18 (10.40)	155 (89.60)	173 (100)			
>30	1 (7.69)	12 (92.31)	13 (100)			
Parity						
0	15 (11.81)	112 (88.19)	127 (100)	1.038	2	0.5950
1–2	7 (7.69)	84 (92.31)	91 (100)			
≥3	1 (8.33)	11 (91.67)	12 (100)			
Locality						
Rural	21 (13.04)	140 (86.96)	161 (100)	4.454	1	0.0348*
Urban	2 (2.89)	67 (97.11)	69 (100)			
Literacy						
Illiterate	3 (9.09)	30 (90.91)	33 (100)	0.2397	3	0.9709
Primary	10 (10.64)	84 (89.36)	94 (100)			
High school	8 (10.39)	69 (89.61)	77 (100)			
Higher education	2 (7.69)	24 (92.31)	26 (100)			
Gestational age						
1st trimester	3 (8.11)	34 (91.89)	37 (100)	0.2349	2	0.8892
2nd trimester	9 (10.98)	73 (89.02)	82 (100)			
3rd trimester	11 (9.91)	100 (90.09)	111 (100)			

$p < 0.05$, statistically significant; χ^2, Chi-square test; df, degrees of freedom

Table 3: Antimicrobial susceptibility pattern

Drugs	*E. coli* N (%)	*S. aureus* N (%)	*E. faecalis* N (%)	*Klebsiella* N (%)
Ciprofloxacin	9 (75)	4 (100)	0	4 (80)
Nitrofurantoin	10 (83.33)	ND	1 (50)	4 (80)
Nalidixic acid	6 (50)	ND	ND	3 (60)
Cefepime	11 (91.67)	3 (75)	ND	5 (100)
Amikacin	11 (91.67)	3 (75)	2 (100)	5 (100)
Ampicillin	7 (58.33)	ND	1 (50)	3 (60)
Amoxicillin	8 (66.67)	2 (50)	2 (100)	4 (80)
Cotrimoxazole	7 (41.67)	3 (75)	1 (50)	3 (60)
Doxycycline	9 (75)	2 (50)	2 (100)	4 (80)
Azithromycin	ND	4 (100)	2 (100)	ND
Gentamicin	10 (83.33)	ND	2 (100)	5 (100)
Tobramycin	ND	ND	ND	5 (100)
Vancomycin	ND	4 (100)	2 (100)	ND
Imipenem	12 (100)	4 (100)	ND	5 (100)

cefepime and amikacin was 91.67%. Hundred percent sensitivity was found for imipenem.

Klebsiella pneumoniae, the second most frequent isolate, was 60% sensitive to nalidixic acid, ampicillin, and cotrimoxazole. Sensitivity to amoxycillin, ciprofloxacin, nitrofurantoin and doxycycline was 80% and that for cefepime, amikacin, gentamicin, tobramycin, and imipenem, it was 100%.

All the *S. aureus* isolates were sensitive to ciprofloxacin, azithromycin, vancomycin and imipenem; two (50%) were sensitive to amoxicillin and doxycycline and three (75%) were sensitive to cefepime, amikacin, and cotrimoxazole. All isolates of *E. faecalis* were sensitive to amoxicillin, amikacin, doxycycline, gentamicin, azithromycin, vancomycin; no one was sensitive to ciprofloxacin, one to ampicillin, nitrofurantoin, and cotrimoxazole.

Discussion

In this study, the prevalence of ASB in pregnant women was 10% which was almost similar to 9.5% reported from the study in Kumasi, Ghana.[12] It is lower than the 13.5% that was reported in Mangaluru, Karnataka,[13] 17% was reported in Nellore, India[14] and 26% was reported in Chitwan, Nepal.[15] This is higher than the 7.3% from the study in Kanpur, India.[16]

The highest prevalence of 10.40% was recorded in the age group of 20–30 years and the lowest rate of 7.69% among the >30 years age group. There was no significant difference in the prevalence of ASB with respect to age group ($p = 0.6597$). In a study by Imade PE et al.,[17] about 1,228 pregnant women were evaluated and maximum prevalence was observed between 20 and 30 years of age group which is comparable to the present study. In a study performed in Ghana, 220 pregnant women were examined, and the prevalence of ASB was reported maximum in the age group of >35 years which is in contrast with our findings.[18] In relation to parity, nulliparous women had a prevalence of 11.81% as against 7.69% in the parity of 1 or 2. The parity distribution in this study appeared not to have any significant effect on ASB. This study is similar to previous reports in Nigeria[19] and Ghana.[12] However, this differed from some other study where ASB in pregnancy was associated with increasing parity.[20,21]

Findings from the study reveal that the prevalence of ASB who resided in rural areas were significantly higher than urban area ($\chi^2 = 4.454$, df = 1, $p = 0.0348$). A similar finding was observed in the study of Onu FA et al.[22] Using educational status as a parameter of socioeconomic status, no significant association was found between ASB and educational status. This finding was comparable with the study of Labi et al.[23] However, the finding was at variance with the observations from south-eastern Nigeria, where ASB was mostly seen among the least educated women.[24] In this study, higher prevalence of ASB was seen in the 2nd trimester of pregnancy, which was similar to that seen in the study of Nath et al.[25]

Escherichia coli was the dominant organism in the study followed by *Staphylococcus aureus*. The other organisms isolated were *Klebsiella pneumoniae* and *Enterococcus faecalis*. This is similar to the findings reported in previous studies by Umamageswari,[26] Chandel,[27] and Gayathree.[28]

The maximum sensitivity to different antibiotics exhibited by uropathogens in this study were as follows: *E. coli*—100% sensitive to imipenem; *S. aureus*—100% sensitive to imipenem, vancomycin, azithromycin, and ciprofloxacin; *K. pneumoniae*—100% sensitive to imipenem, tobramycin, gentamicin, amikacin, and cefepime; *E. faecalis*—100% sensitive to vancomycin, azithromycin, gentamicin, doxycycline, amikacin, and amoxicillin. The uropathogens were least sensitive to nalidixic acid, ampicillin, amoxicillin, and cotrimoxazole. The reason behind resistance to these may be self-medication, antibiotic abuse, low cost, and availability of drugs. Though the sensitivity and resistance pattern of antibiotics varies from community to community and hospital to hospital due to indiscriminate use, but in various studies,[16,29] it has been observed that different uropathogens are still highly sensitive to imipenem and aminoglycosides which is similar to our study.

Conclusion

In this study, the prevalence of ASB among pregnant women was 10%. Apart from rural dwelling, demographic and obstetric parameters did not significantly influence the prevalence of ASB. The predominant organisms are *E. coli* and most isolates are sensitive to aminoglycosides and imipenem. In view of the changing patterns of bacterial resistance to common drugs, it is important to educate physicians the on use of antibiotics and not to provide empirical therapy.

Clinical Significance

As ASB lacks clinical symptoms, it may remain undiagnosed. If ASB is not treated, it may lead to various neonatal and maternal complications. Eradication of bacteria with antimicrobial agents prevents most of these. Due to discrimination in the use of antibiotics, the sensitivity pattern toward the isolates may vary from community to community and hospital to hospital. Hence, screening of ASB by urine culture along with detecting sensitivity to antibiotics is needed to include as routine antenatal care for safe motherhood.

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