e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(5); 1648-1654

Original Research Article

Prevalence and Patterns of Antibacterial Susceptibility During Pregnancy in NSCB Medical College, Jabalpur, Madhya Pradesh

Shraddha Chandrakar[1], Dipti Markam[2], Sharad Narayan Sharma[3], Ravi Prakash Singh[4*]

[1]Senior Resident, Department of Obstetrics and Gynaecology, NSCB Medical College Jabalpur, Madhya Pradesh

[2]Senior Resident, Department of Obstetrics and Gynaecology, NSCB Medical College Jabalpur, Madhya Pradesh

[3]Assistant Professor, Department of Anaesthesia, NSCB Medical College, Jabalpur, Madhya Pradesh

[4] Senior Resident, Department of Paediatrics, NSCB Medical College, Jabalpur, Madhya Pradesh

Received: 10-03-2023 / Revised: 30-04-2023 / Accepted: 10-05-2023

Corresponding author: Dr. Ravi Prakash Singh

Conflict of interest: Nil

Abstract

Background: Asymptomatic bacteriuria (ASB) has a comparable prevalence in pregnant women as it does in women who are not pregnant (between 4 and 7 percent). As age, parity, age, and history of asymptomatic urinary tract infection all have a role in the development of ASB, so do lower socio-economic statuses.

Aim and Objectives: This study aimed to (1) determine the incidence of ASB at NSCB Medical College Jabalpur and (2) determine the most common causative microorganisms and their antibiotic susceptibilities.

Materials and Method: From January 2020 to December 2020, 230 healthy pregnant women who had their first prenatal visit at NSCB Medical College Jabalpur were screened for bacteriuria. Antibiotic resistance testing was conducted, and the results were analyzed.

Results: Ten percent of pregnant women had ASB. Except for those living in rural areas (χ^2 = 4.454, p=0.0348), demographic and obstetric variables did not substantially affect the prevalence of ASB. Escherichia coli was the dominant bacteria (52.17%). Imipenem and aminoglycosides were the most sensitive against uropathogens, while nalidixic acid, ampicillin, amoxicillin, and cotrimoxazole were less sensitive.

Conclusion: Researchers observed that ASB was common among pregnant women. Except for residing in a rural location, neither demographic nor obstetric factors significantly affected the risk of ASB. From what we can see, screening all pregnant women for ASB would be prudent.

Keywords: Pregnancy, Asymptomatic Bacteriuria, Urine Culture, Antibiotic Sensitivity.

Introduction

Active bacterial growth in the urinary tract, except the distal urethra, in the absence of overt urine symptoms is known as asymptomatic bacteriuria (ASB or asymptomatic substantial bacteriuria). [1] Prevalence rates during pregnancy are comparable to those of the general population. The range is 4%-7%. [2, 3] As

age, parity, age, and history of asymptomatic urinary tract infection all have a role in the development of ASB, so do lower socio-economic statuses. [4, 5]

The isolation of a certain number of bacteria from a urine specimen constitutes the microbiological diagnosis of ASB. Therefore, the gold standard for ASB screening is a urine culture. Studies conducted worldwide and over a wide range of time frames consistently find that Escherichia coli is the causative agent in 60–90% of cases of ASB in pregnant women. Other prevalent agents include Staphylococcus saprophyticus, Group B beta-hemolytic streptococci, Enterococcus, Klebsiella pneumoniae, and Proteus mirabilis. [6, 7]

Different regions have distinct patterns of frequency and antimicrobial susceptibility among isolated microorganisms. It is important to determine which infections are most prevalent in a given area and to educate the public on the antibiotic susceptibility profiles of these pathogens. Therefore, this study aimed to examine the incidence and risk factors of ASB, the most frequently isolated microorganisms, and the antibacterial susceptibilities of these microorganisms among pregnant women who sought care at a tertiary care facility.

Materials and Methods

This study was conducted in the Obstetrics and Gynecology and Microbiology Department of NSCB Medical College Jabalpur MP from January 2020 to Dec 2020. Ethical clearance for the study was obtained from the Institutional Ethics Committee. Informed consent was 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 seven days, pyrexia of unknown origin and recurrent UTI were excluded from the study.

The minimal sample size was estimated to be 226 (with 5 percent absolute error at a 95 percent confidence interval and adding 10% attrition rate) considering the prevalence rate of ASB of about 16 percent from the previous study in Northern Indian women. [8] By using systematic sampling method the women were selected. Previous antenatal records showed that an average of 4500 pregnant women visited 1st time in antenatal outpatient departments within a year. This annual number was divided by the minimum sample size (n=226) to get a sampling fraction 19.9. Some women may not consent, although it fulfills the inclusion criteria, and therefore sample was taken after the interval of every 15 women though the sampling fraction was 19.

Midstream urine samples were collected for a urinalysis and then cultured using the usual loop method (i.e., 1 ul volume loop) on either CLED (cysteine lactose electrolyte deficient) medium or MacConkey agar and blood agar. The presence of more than 105 CFU/ml of a single organism led to the diagnosis and treatment of ASB in women. [9,10] Antibiotic susceptibility testing was performed using the Kirby-Bauer disc diffusion method, and results were interpreted according to CLSI (Clinical and Laboratory Standards Institute) guidelines.[11]

A structured proforma was used to obtain data. The data obtained include 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. A significant association was presumed if $P < 0.05$.

Results

Of 230 pregnant women tested for ASB, 23 were found to have bacteriuria, for a prevalence of 10%. Age, parity, location, socio-economic position, and gestational age are all factors in ASB, as shown in Table 1.

The maximum rate of 10.40% was found in the 20-30 age group and the minimum rate of 7.69% in the>30 years group. The prevalence relationship among the age group was not statistically significant (χ 2 =0.1488, df=2, p=0.9283). Among significant bacteriuria-positive women, the highest prevalence was observed in nulliparous women (11.81%), while women having one or two children had the least prevalence. However, no significant relationship was found between parity and prevalence (χ 2 = 1.038, df=2, p=0.5950). Statistically significant (p=0.011), ASB was more common among pregnant women who lived in rural areas.

Escherichia coli (52.17%), Klebsiella pneumoniae (21.73%), Staphylococcus aureus (17.39%), and Enterococcus faecalis (8.69%) were the most common isolates. The antibiotic susceptibilities of the isolates are mentioned in Table 3. E.coli, the commonest isolate, was sensitive to cotrimoxazole (41.67% sensitivity) and 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 cefepime and amikacin was 91.67%. A hundred percent sensitivity was found for imipenem.

Table 1: Prevalence of ASB among pregnant women

Variables	Significant bacteriuria	No significant bacteriuria	Total number of cases
Age in years			
<20	4 (9.9)	40 (90)	44
20-30	18 (10)	155 (89)	173
>30	1 (7.69)	12 (92.31)	13
Parity			
0	15 (11)	112 (88)	127
1-2	7 (7.69)	84 (92.31)	91
>3	1 (8.33)	11 (91.67)	12
Locality			
Rural	21 (13)	140 (86)	161
Urban	2 (2.89)	67 (97)	69
Literacy			
Illiterate	3 (9.9)	30 (90.9)	33
Primary	10 (10.64)	84 (89.3)	94
High school	8 (10.39)	69 (89.6)	77
Higher education	2 (7.69)	24 (92.31)	26
Gestational age			
1st trimester	3 (8.11)	34 (91.89)	37
2nd trimester	9 (10.98)	73 (89.02)	82
3rd trimester	11 (9.91)	100 (90.09)	11

Data are expressed as a number of patients (percentage)

Table 2: Bacterial isolates among pregnant women with significant bacteriuria

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

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

Table 3: Antimicrobial susceptibility pattern

Drugs	E. Coli	S. aureus	E. faecalis	Klebsiella
Ciprofloxacin	9 (75)	4 (100)	0 (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)
Doxycyclin	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)

Data are expressed as a number of patients (percentage), ND: not done.

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

Discussion

The prevalence of ASB among pregnant women was 10% in this study, close to 9.5% reported in the study from Kumasi, Ghana[12]. The incidence is less than the 13.5% reported in Mangalore, Karnataka [13], 17% in Nellore [14], and 26% in Chitwan, Nepal [15]. This exceeds the 7.3% found in the Kanpur, India study. [16]

The highest prevalence, 10.40%, was recorded in the 20-30 age group, while the lowest prevalence, 7.69%, was documented in the >30 age group. There was no significant age-related difference in the prevalence of ASB (P = 0.6597). In a study by Imade PE et al. [17], 1228 pregnant women were evaluated, and maximum prevalence was observed between the 20-30

years age group, 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 contrasts with our findings. [18]

Concerning 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 did not significantly affect ASB. Similar studies have been reported in Nigeria[19] and Ghana[12]. This was in contrast to previous research that found that ASB during pregnancy was linked to having more children. [20, 21]

Findings from the study reveal that the prevalence of ASB who resided in rural areas was significantly higher than in urban areas (χ 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 socio-economic status, no significant association was found between asymptomatic bacteriuria 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 southeastern Nigeria, where ASB mainly was seen among the least educated women.[24]

Consistent with what was found by Nath et al., ASB was more common in the second trimester of pregnancy.[25] The study found that Escherichia coli and Staphylococcus aureus were the most common types of bacteria. Klebsiella pneumoniae and Enterococcus faecalis were the other microbes found. Umamageswari[26], Chandel [27], and Gayathree [28] all found results consistent with this hypothesis.

The maximum sensitivity to different antibiotics exhibited by uropathogenic in this study was 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% susceptible to vancomycin, azithromycin, gentamicin, doxycycline, amikacin, and amoxicillin. The uropathogenic 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. Even though antibiotics' sensitivity and resistance pattern varies from community to community and hospital to hospital due to indiscriminate use, our study is consistent with other studies[16]. showing that different uropathogens remain highly sensitive to imipenem and aminoglycosides.

Conclusion

Women who were pregnant and had ASB were 10% of the study population. There was no significant difference in the prevalence of asymptomatic bacteriuria between urban and rural dwellers. Most infections are caused by E. coli, which can be treated with aminoglycosides and imipenem. Educating doctors on antibiotic use and avoiding providing empirical therapy is crucial in light of the evolving patterns of bacterial resistance to commonly used medicines.

References

1. Grewal M, Biswas MK. Cardiac, hematologic, pulmonary, renal, and urinary tract disorders in pregnancy. In: A De Cherney AH, Nathan L, editors. Current Obstetric and Gynecologic Diagnosis and Treatment. 9th ed. New York: McGraw-Hill; 2003:387– 427.
2. Arias F, Daftary SN, Bhide AG. Abnormalities of the urinary system during pregnancy. In: Arias F, Daftary SN, Bhide AG, editors. Practical Guide to High-Risk Pregnancy and Delivery: A South Asian Perspective. 3rd ed. New Delhi: Elsevier; 2008:489–505.
3. Smaill F, Vazquez JC. Antibiotics for asymptomatic bacteriuria in pregnancy.

Cochrane Database Syst Rev. 2007 Apr 18;(2): CD000490.
4. Nicolle LE. Screening for asymptomatic bacteriuria in pregnancy. Canadian Guide on preventive health care, Ottawa Health, Canada. 1994; 100-106.
5. Patterson TF, Andriole VT. Detection, significance, and therapy of bacteriuria in pregnancy: update in the managed health care era. Infect Dis Clin North Am. 1997;11(3):593–608.
6. Latham RH, Runing K, Stamm WE. Urinary tract infections in young adult women caused by Staphylococcus saprophyticus. JAMA. 1983; 250: 3063–66.
7. Wing DA, Hendershott CM, Debuque L, et al. Outpatient treatment of acute pyelonephritis in pregnancy after 24 weeks. Obstet Gynecol. 1999; 94: 683–8.
8. Jain V, Das V, Agarwal A, Pandey A. Asymptomatic bacteriuria & obstetric outcome following treatment in early versus late pregnancy in north Indian women. Indian J Med Res. 2013; 137: 753-58 9. Collee JG, Duguid JP, Fraser AG, Marmion BP Simmons A. 12. Laboratory strategy in the diagnosis of infective syndrome. In: Collee JG, Fraser AG, Marmiom BP, Simmons A, editors. Practical medical microbiology. Singapore: Churchill Livingstone Publishers, Longman; 2003. p. 53-94
9. Gerber GS, Brendler CB. Evaluation of the urologic patient: history, physical examination, and urinalysis. In: Walsh PC, Retik AB, Vaughan ED Jr, et al., editors. Campbell's urology. 8th ed. Philadelphia: WB Saunders; 2002. p. 109.
10. Performance Standards for Antimicrobial Disc Susceptibility Tests; Approved Standard-Eleventh Edition M02-A11. Vol.32, No-1. National Committee for Clinical Laboratory Standards, Wayne, PA.USA; 2012.
11. Obirikorang C, Quaye L. Asymptomatic Bacteriuria among Pregnant Women Attending Antenatal Clinic at the University Hospital, Kumasi, Ghana. Journal of Medical and Biomedical Sciences. 2012; 1(1): 38-44
12. Rajanatham A, Baby NM, Kuruvilla TS, Machado S. Diagnosis of Asymptomatic Bacteriuria and Associated Risk Factors Among Pregnant Women in Mangalore, Karnataka, India. J Clin Diagn Resv. 8(9); 2014: OC23– OC25.
13. Prasanna B, Naimisha M, Swathi K, Shalk MV. Prevalence of Asymptomatic Bacteriuria in Pregnant Women, Isolates and their Culture Sensitivity Pattern. Int. J. Curr. Microbiol. App. Sci. 2015; 4(8): 28-35
14. Neupane MS, Dhakal KS, Neupane HC, Adhikari S, Aryal B. Asymptomatic Bacteriuria among Pregnant Women attending the Outpatient Clinics of Chitwan Medical College teaching hospital in Chitwan, Nepal. IRJP. 2012; 3(11): 78–80
15. Sujatha R, Nawani M. Prevalence of asymptomatic bacteriuria and its antibacterial susceptibility pattern among pregnant women attending the antenatal clinic at Kanpur, India. Journal of Clinical and Diagnostic Research. 2014; 8(4): DC01-DC03
16. Imade PE, Izekor PE, Eghafona NO, Enabulele OI, Ophori E. Asymptomatic bacteriuria among pregnant women. N Am J Med Sci. 2010; 2(6): 263–66.
17. Turpin CA, Minkah B, Danso KA, Frimpong EH. Asymptomatic Bacteriuria in Pregnant Women Attending Antenatal Clinic at Komfo Anokye Teaching Hospital, Kumasi, Ghana. Ghana Med J. 2007; 41(1): 26–9. The New Indian Journal of OBGYN. 2023 (January-June);9(2) 220
18. Awonuga DA, Fawole AO, Dada-Adegbola HA, Olola FA, Awonuga OM. Predictors of asymptomatic bacteriuria among obstetric population

in Ibadan. Niger J Med. 2010; 19: 188–93.
19. Omole A, Nwokedi E. Asymptomatic bacteriuria in pregnancy in Kano, Northern Nigeria. Nigerian hospital practice. 2008; 2: 76-9.
20. Aminu KY, Allyu UU. Asymptomatic bacteriuria in pregnant women in the antenatal booking clinic at Aminu Kano Teaching Hospital, Kano, Nigeria. Open Journal of Obstetrics and Gynecology. 2015; 5: 286-97.
21. Onu FA, Ajah LO, Ezeonu PO, Ugochukwu O, Umeora J, Ibekwe PC, Ajah MI. Profile and microbiological isolates of asymptomatic bacteriuria among pregnant women in Abakaliki, Nigeria. Infection and Drug Resistance. 2015; 8: 232-35.
22. Labi AK, Yawson AE, Ganyaglow GY, Newman MJ. Prevalence and associated risk factors of asymptomatic bacteriuria in ante-natal clients in a large teaching hospital in Ghana. Ghana Medical Journal. 2015; 49(3): 154-58.
23. Oli A, Okafor C, Ibezim E, Akujiobi C, Onwunzp M. The prevalence and bacteriology of asymptomatic bacteriuria among antenatal patients in Nnamdi Azikiwe University Teaching Hospital Nnewi; South Eastern Nigeria. Niger J Clin Pr. 2010; 13(4): 409–12.
24. Nath G, Chaudhary M, Prakash J, Pandey LK, Singh TB. Urinary tract infection during pregnancy and foetal outcome. Indian J Med Microbiol. 1996; 14: 158-60.
25. Umamageswari SS, Swarnapriya MS, Banu AS. A Study of Pregnancy Associated Asymptomatic Bacteriuria in a Tertiary Care Hospital. International Journal of Scientific Research. 2015; 4(7): 573-75.
26. Chandel LR, Kanga A, Thakur K, Mokta KK, Sood A, Chauhan S. Prevalence of pregnancy-associated asymptomatic bacteriuria: A study was done in a tertiary care hospital. J Obstet Gynaecol India. 2012; 62(5): 511-14.
27. Gayathree L, Shetty S, Deshpande SR and Venkatesha DJ. Screening for asymptomatic bacteriuria in pregnancy: an evaluation of various screening tests at the Hasan district hospital, India. Journal of Clinical and Diagnostic Research. 2010; (4): 2702- 6.
28. Khan S, Rashmi, Singh P, Siddiqui, Ansari M. Pregnancy-associated asymptomatic bacteriuria and drug resistance. Journal of Taibah university medical sciences. 2015; 10(3): 340-45