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Prevalence of asymptomatic bacteriuria and its antibiotic susceptibility pattern among pregnant women in Patan Hospital: a descriptive study

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Abstract

Introduction: Asymptomatic bacteriuria (ASB) is common during pregnancy. ASB is a risk factor for adverse perinatal outcomes and maternal complications. The gold standard for detecting bacteriuria is urine culture. Therefore, a routine urine culture should be done in pregnant women to screen for bacteriuria at the first antenatal visit. This study was conducted to determine the prevalence of ASB, the most common organism, and its antibiotic sensitivity pattern at Patan Hospital.

Method: This descriptive study was conducted from November 1, 2020, to October 31, 2021. All pregnant women visiting the Patan Hospital antenatal clinic who fulfilled the inclusion criteria were enrolled after obtaining written consent. After taking the patient's history and conducting an examination, proper instructions were given to collect a urine sample, which was then sent for culture and sensitivity testing. The report was collected, and treatment was provided accordingly. Data were collected, and descriptive analysis was done.

Result: Among 122 pregnant women, the prevalence of asymptomatic bacteriuria was 10.6%. *Escherichia coli* was found to be the most prevalent organism to cause asymptomatic bacteriuria, followed by *Klebsiella pneumoniae*. These organisms were 100% sensitive to imipenem and meropenem, but least sensitive to ampicillin.

Conclusion: Early screening, identification of the infecting organism, and antibiotic sensitivity testing are important interventions to prevent complications to both the pregnant woman and the fetus.

Keywords: Asymptomatic bacteriuria; *E. coli*; *Klebsiella pneumoniae*; Imipenem; Meropenem

INTRODUCTION

Asymptomatic bacteriuria (ASB) is defined as the presence of more than 100,000 organisms/mL in a urine sample in an asymptomatic patient.^{1, 2} Untreated ASB leads to acute cystitis and pyelonephritis in 40% and 25-30% of the cases, respectively.³ This risk is reduced by 80% if bacteriuria is eradicated.⁴ Screening for bacteriuria with a urine culture is recommended during the first antenatal visit, typically between 12 and 16 weeks of gestation.⁵ In a study conducted at BP Koirala Institute of Health Sciences (BPKIHS), the incidence of ASB was found to be 8.7%.⁶

ASB can lead to adverse perinatal outcomes like premature birth, low birth weight and perinatal death.⁷ It is also associated with variety of maternal complications like hypertension, anaemia, amnionitis and endometritis.⁷ Early diagnosis and treatment help to prevent adverse maternal and fetal conditions.⁸ There is a paucity of data on ASB from our country, and hence, this study is planned to find the prevalence of ASB and culture and sensitivity pattern at Patan Hospital.

METHOD

This is a quantitative cross-sectional study conducted at the antenatal clinic of Patan Hospital, Patan Academy of Health Sciences (PAHS), Nepal, from November 1st, 2020, to October 30th, 2021. Ethical approval for this study was obtained from the Institutional Review Committee (IRC) of PAHS. The reference number was PSG2103161496. The general objective of this study was to determine the prevalence of asymptomatic bacteriuria among pregnant women visiting the antenatal clinic of Patan Hospital, while the specific objective was to identify the common bacteriological profile and assess its culture and sensitivity pattern.

All pregnant women at their first antenatal visit without any signs or symptoms of urinary tract infection were enrolled in the study after obtaining their written consent. Those pregnant women who had a history of fever >38°C in the previous 2 weeks, history of intake of antibiotics in the last 2 weeks, urinary tract catheterization in the previous 2 weeks, history of current intake of immunosuppressive therapy, known congenital anomaly of the genitourinary tract, or urinary tract calculi were excluded from the study.⁹

Sample size was calculated using the following formula:

$$n = z^2 * p(1-p) / d^2 = (1.96)^2 * 0.087(1-0.087) / (0.05)^2 = 122$$

where,

n = sample size,

Z = Z statistic for a level of confidence = 1.96

P = prevalence = 8.7% (according to study done in BPKIHS, Nepal)⁶

d = precision (d = 0.05)

The total sample size was calculated to be 122.

All pregnant women who provided consent for the study and met the inclusion criteria were enrolled. The

consecutive sampling method was used. Those enrolled in the study were asked to collect a midstream urine sample in a clear, sterile, and leak-proof container. Instructions on how to collect urine were clearly explained in a language the patients understood by the duty doctor at the antenatal clinic. Pregnant women were asked to wash their hands with soap and water. Then collect the midstream urine in a urine container. They were asked to tightly screw the lid onto the urine container, taking care not to touch the inside. The container was properly labelled with their name and hospital number, and the sample was sent to the microbiology lab.

Collected urine samples were processed according to Clinical Laboratory Standard Institute (CLSI) 2019 guidelines in the Department of Microbiology of PAHS for culture/sensitivity. Specimens were mixed gently and inoculated using calibrated loops (0.001/0.01 ml) into standard culture media. Significant bacteriuria was interpreted based on colony-forming unit (CFU) thresholds. Pregnant women came with urine culture reports after two days at the antenatal clinic, and appropriate antibiotic treatment was provided to culture-positive cases. Urine culture report of pregnant women who failed to follow up was traced, and those with culture-positive reports were asked to follow up in the antenatal clinic of Patan Hospital over the phone for appropriate antibiotic treatment.

Data on the demographic profile and other relevant details were obtained by the attending doctor, who interviewed study participants in the antenatal clinic. A Structured Proforma was filled after enrolling the cases, and a report of bacteriuria and antimicrobial susceptibility pattern was filled during follow-up at the antenatal clinic. Collected data were entered in Epi-Info version 7.1, and descriptive analysis was done by analyzing the data and interpreting it.

RESULT

Among 122 pregnant women enrolled, the follow-up rate was 100%. All of them were married, and 34.4%(n=42) were primigravida and 65.6%(n=80) were multigravida. In this study, 13 (10.6%) had asymptomatic bacteriuria, 109 (89.4%) had sterile samples, and the most prevalent organism was *E. coli*(10(76.93%)), followed by *Klebsiella pneumoniae*(3(23.07%)).

In this study, *E. coli* was found to be 100% sensitive to meropenem, imipenem, and piperacillin-tazobacum, whereas most were resistant to amikacin and trimethoprim-sulfamethoxazole. *Klebsiella pneumoniae* was found to be 100% sensitive to amikacin, gentamycin, meropenem, nitrofurantoin and 100% resistant to ampicillin. Antibiotic susceptibility of different microbial organisms is shown in Table 1.

Table 1. Antibiotic susceptibility pattern of various organisms of pregnant women

Antibiotic Susceptibility		E. coli	K. pneumonia
Amikacin	Sensitive	9(90%)	3(100%)
	Resistant	1(10%)	0
Ampicillin	Sensitive	3(30%)	0
	Resistant	7(70%)	3(100%)
Cefixime	Sensitive	5(50%)	1(33.33%)
	Resistant	5(50%)	2(66.66%)
Ceftriaxone	Sensitive	5(50%)	1(33.33%)
	Resistant	5(50%)	2(66.66%)
Ciprofloxacin	Sensitive	5(50%)	2(66.66%)
	Resistant	5(50%)	1(33.33%)
Gentamycin	Sensitive	9(90%)	3(100%)
	Resistant	1(10%)	0
Imipenem	Sensitive	10(100%)	3(100%)
	Resistant	0	0
Meropenem	Sensitive	10(100%)	3(100%)
	Resistant	0	0
Nitrofurantoin	Sensitive	9(90%)	3(100%)
	Resistant	1(10%)	0
Ofloxacin	Sensitive	5(50%)	2 (66.66%)
	Resistant	5(50%)	1 (33.33%)
Piperacillin-Tazobactam	Sensitive	10(100%)	2 (66.66%)
	Resistant	0	1 (33.33%)
Trimethoprim-Sulfamethoxazole	Sensitive	7(70%)	2 (66.66%)
	Resistant	3(30%)	1 (33.33%)

DISCUSSION

The prevalence of asymptomatic bacteriuria was 10.6%. This finding was similar to that of studies conducted by Thakur et al. at BPKIHS and Maratha, et al., at Nepal Medical College, in which the prevalence of asymptomatic bacteriuria was 8.7% and 9.6%, respectively.^{6,10} This might be due to the similar geographical conditions of these places. This finding can also be compared with a similar study done by F. Smail, et al., at Sri Siddhartha Medical College, India, where the prevalence of asymptomatic bacteriuria was 10% and another study conducted by L. Sayam, et al., at Gitam Institute of Medical Sciences, Visakhapatnam, with the prevalence of asymptomatic bacteriuria as 9.6%.^{11,12} These similarities in the prevalence of ASB may be due to similarity in the sociocultural background, similar standard of personal hygiene, and educational status of the study population.

However, in contrast, a study done in Ghana by Karikari et al. in 2020, showed the prevalence of ASB to be 20%,¹³ and 18.8% in another study done by M. E. et al., at the antenatal clinic of Hawassa Referral Hospital, Southern Ethiopia.¹⁴ This may be due to differences in economic status, cultural practices across various countries, and the nutritional status of the population. Similarly, the prevalence of ASB was found to be as low as 4.4% in a study done in Bangladesh by Lee et al.¹⁵ This contrasting finding may be due to the regular health education provided in health facilities and to increased public awareness among pregnant women of the importance of antenatal care follow-up during pregnancy in the study area.

E. coli was found to be the most prevalent organism causing asymptomatic bacteriuria, followed by *Klebsiella pneumonia*, in this study. This finding is similar to the study conducted at BPKIHS in 2012 and at NMC in 2011.^{6,10} In contrast to the studies conducted in Ethiopia and Ghana, the most common organism was Coagulase-Negative *Staphylococcus* (CONS).¹³ However, in other parts of the world, the most common organism was *E. coli*.^{14,16} This difference in ASB prevalence may be due to differences in sanitary practices and socioeconomic status.

E. coli and *Klebsiella pneumonia* were 100% sensitive to meropenem, imipenem, and piperacillin-tazobactam, while the most resistant drug for both pathogens was ampicillin in this study. In a study done at Nepal Medical College in 2011, Gentamycin was most sensitive, whereas imipenem and meropenem were the most sensitive in this study. Amikacin was the least sensitive in their study, whereas ampicillin was the least sensitive in this study.¹⁰ This might be due to different empiric antibiotics used at different centers.

The study conducted at BPKIHS in 2012 showed that 50% of the isolates were sensitive to nitrofurantoin and 15% of the isolates were sensitive to amikacin. In contrast, this study Found That *E. Coli* was sensitive to nitrofurantoin in 90% of cases, and *Klebsiella pneumonia* was sensitive to nitrofurantoin in 100% of cases.⁶ *E. coli* was sensitive to amikacin in 90% of cases, and *Klebsiella pneumonia* was sensitive to amikacin in 100% of cases in this study. This may be due to the easy availability of nitrofurantoin as an over-the-counter drug in that centre. This upsurge in antibiotic-resistant patterns could be due to antibiotic abuse and self-medication. Additionally, the low cost and availability of drugs could be another contributing factor to antibiotic resistance. In a similar study done at Sri Siddhartha Medical College, Tumkur, India, the findings were consistent with our findings. The sensitivity pattern was similar to our study.¹¹

In a study done at Zekai Tahir Burak Women's Health Education and Research Hospital, Turkey, in 2011, sensitivity found to be only 57.2% sensitive to ampicillin and 100% for imipenem and meropenem for *E coli* which similar to this study. As for *Klebsiella pneumonia*, 100% sensitivity was found for ceftriaxone, imipenem, and meropenem, which is different than this study, as ceftriaxone was only 33.3% sensitive to *Klebsiella pneumonia*.¹⁷ This might be due to more frequent use of ceftriaxone in this study center.

A worrying observation of 28.8% and 52% resistance recorded against imipenem and vancomycin, respectively, was found in a study done in Ghana.¹³ These drugs (carbapenem and glycopeptides) were highly effective against members of the enterobacteriaceae and used as the last line of treatment drugs in managing difficult-to-treat MDR pathogens in these hospitals.

The antimicrobial sensitivity and resistance patterns vary from community to community and from hospital to

hospital. Resistance to commonly used antibiotics is much more prevalent, with very few choices of drugs left for the treatment of UTI, especially in the pregnant population. The reasons for this alarming phenomenon might be due to inappropriate, inadequate, and incorrect administration of antimicrobial agents in empiric therapies and a lack of appropriate infection control strategies. There is also a wide range of clinical indications for which these antibiotics are used, such as pneumonia, upper respiratory tract infections, and pelvic inflammatory disease, which may have led to resistance.

This is a single centre study with a limited sample size and hence multicentre study with large sample size is needed to generalise findings.

CONCLUSION

Screening should be performed in all pregnant women, regardless of symptoms of urinary tract infection, with urine culture as part of antenatal care in the first trimester. Treatment of asymptomatic bacteriuria in pregnancy should be an integral part of obstetric care to prevent maternal and fetal complications. Urine culture should be included in antenatal guidelines as a screening protocol during the first visit.

DECLARATIONS

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Conflict of Interest

None

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None

Ethical Clearance

From IRC PAHS

Consent of the Study

Written consent was taken from all the participants

Consent for Publication from Authors

All authors permitted the publication of the findings.

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