

Bacterial Etiology, Antibiotic Sensitivity Pattern and Risk Factors for Asymptomatic Bacteriuria during Pregnancy: Experience in a Tertiary Care Hospital

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Abstract

Background: Urinary tract infections (UTIs) are common during pregnancy. Untreated asymptomatic bacteriuria (ASB) during pregnancy may cause serious complications including pyelonephritis and delivery of premature or low-birth-weight infants. This study aimed to assess the risk factors for asymptomatic bacteriuria, bacterial agents and their antibiotic susceptibility pattern in pregnant women attending in Combined Military Hospital (CMH), Dhaka.

Methods: This cross-sectional study was conducted in a total of 1540 pregnant women with no signs and symptoms of UTI from October 2013 to March 2015. Clean catch mid-stream urine samples were collected from all study participants using sterile containers. Urine samples were cultured using standard bacteriological methods. Identification of suspected colonies and antibiotic sensitivity testing were done. Patients having ASB were further evaluated to find out associated risk factors.

Results: Out of 1540 pregnant women, 254 (16.5%) had asymptomatic bacteriuria (Colony forming unit $>10^5$ /mL). The most frequently isolated bacteria were Escherichia coli (*E. coli*) (50.4%), followed by Klebsiella (24.0%). The antibiotic sensitivity rate of bacterial isolates were highest for imipenem and amikacin. Among different associated conditions, anemia (16.5%), gestational diabetes mellitus (GDM) (10%) and past history of UTI (5.1%) were found to be the most frequent factors associated with increased prevalence of ASB.

Conclusion: In this study, the prevalence of ASB was high among pregnant women with anemia, GDM and past history of UTI. *E. coli* was the most common organism causing ASB, which is less susceptible to conventional oral antibiotics but more susceptible to imipenem and amikacin. So, careful drug selection is required for successful outcome in ASB.

Keywords: Asymptomatic bacteriuria, pregnancy, urinary tract infection

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Introduction

Urinary tract infection (UTI) is a common health problem among women compared with men due to shorter urethra,

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closer proximity of the anus with vagina and pathogen entry facilitated by sexual activity.^{1,2} It is estimated that one in three women of childbearing age contracts UTI, which may manifest symptoms or remain asymptomatic.³ Pregnant women are more susceptible to UTI, owing to altered anatomical and physiological state during pregnancy.²

Asymptomatic bacteriuria (ASB) is a presence of a significant quantity of bacteria in a properly collected urine specimen from a person without symptoms or signs of UTI.⁴ Asymptomatic bacteriuria occurs in 2 to 7 percent of pregnant women.^{5,6} It typically occurs during early pregnancy, with only approximately a quarter of cases identified in the second and third trimesters.⁷ Factors that have been associated with a higher risk of bacteriuria include a history of prior UTI, pre-existing diabetes mellitus (DM), increased parity and low socioeconomic status.^{8,9}

Incidence of ASB in pregnancy is very common in Bangladesh.¹⁰ Among the healthy pregnant mothers attending a tertiary care hospital in Dhaka, 30% had asymptomatic bacteriuria.¹¹ About 30% of women with untreated asymptomatic bacteriuria during pregnancy develop pyelonephritis, which may lead to delivery of premature or low-birth-weight infants.¹² This risk is reduced by 70 to 80 percent if bacteriuria is eradicated.¹³ So, they must routinely be screened for and treated accordingly if ASB is found to be present. But it is not a common practice in Bangladesh and screening for ASB in pregnancy is not considered as an essential part of antenatal care (ANC) like routine checkup for albumin and sugar in urine. In some cases, it is generally done only in the first visit of ANC.

The bacteria with their sensitivity to various antimicrobial agents vary from place to place and in the same place from time to time.¹⁴ For appropriate treatment and to avoid over-treatment that would increase both costs and incidence of side effects, it is necessary to know the pathogens causing bacteriuria and their antibiotic sensitivity patterns. The aims of this study were to identify associated risk factors of asymptomatic bacteriuria in pregnancy and its etiological agents and their sensitivity pattern.

Methods

A cross-sectional study was conducted at Combined Military Hospital (CMH), Dhaka, Bangladesh from October 2013 to March 2015. The study population comprised of all pregnant women attending in the hospital for antenatal visit during the study period. However, pregnant women who were on antibiotic treatment two weeks prior to data collection and those with clinical signs and symptoms of UTI were excluded.

Demographic data including maternal age and gestational age were collected using questionnaires. Clean catch mid-stream urine samples were collected from all participants using wide-mouthed sterile capped container. The specimen was promptly transported to the microbiology laboratory and cultured within one hour of collection. Urinary routine examination and culture reports of all patients were analyzed. Those having ASB were further investigated to identify associated risk factors. Participation was fully voluntary and consent was obtained from all participants.

Results

A total 1540 apparently healthy pregnant women were screened. Single urine sample from each participant was collected and examined for ASB. Out of them, 254 (16.5%) were found to have ASB. The mean age of the study participants was 26.13 \pm 6.37 (15–49) years. The majority of the pregnant women were in their 1st trimester (16.8%) (Table-I). The rate of isolation was higher in the age group >35 years (20.8%), (p=0.07). (Table- II).

Table I. Distribution of study population by trimester (n=1540)

| Trimester | Total number | ASB present | Percentage |
|-----------|--------------|-------------|------------|
| First | 980 | 165 | 16.8 |
| Second | 258 | 42 | 16.3 |
| Third | 302 | 47 | 15.6 |

Table II. Distribution of study population by age group (n=1540)

| Age group | Total number | ASB present | Percentage |
|-----------|--------------|-------------|------------|
| 20-29 | 920 | 162 | 17.6 |
| 30-35 | 592 | 82 | 14.3 |
| >35 | 48 | 10 | 20.8 |

Table III. Distribution of study population by Parity (n=1540)

| Parity | Total number | ASB present | Percentage |
|--------------|--------------|-------------|------------|
| Primi gravid | 960 | 160 | 16.7 |
| Multi-gravid | 580 | 94 | 16.2 |

Table IV. Distribution of patients according to associated medical disorder: (n=254)

| Medical disorder | Total number | Percentage |
|---------------------|--------------|------------|
| Anemia | 42 | 16.5 |
| Diabetes (GDM/DM) | 25 | 9.8 |
| Anemia and Diabetes | 18 | 7.0 |
| Past history of UTI | 13 | 5.1 |

Of the bacterial isolates in urine culture, *Escherichia coli* was the commonest (50.4%) organism, followed by *Klebsiella* (24.0%). (Table-V). Other less frequently identified organisms were *Enterobacter*, *Citrobacter* and *Candida albicans*.

Antimicrobial sensitivity of isolated bacteria showed that most of the isolated organism were sensitive to

imipenem and amikacin. Sensitivity to nitrofurantoin was moderate and to ciprofloxacin and penicillin was comparatively low. All of the isolated *Staphylococcus aureus* were sensitive to vancomycin. *Pseudomonas* was 20% resistant to imipenem and amikacin. (Table-VI)

Table V. Pattern of bacterial pathogens in urine culture (n=254)

| Organism | Total number | Percentage |
|-------------------------------|--------------|------------|
| <i>Escherichia coli</i> | 128 | 50.4 |
| <i>Klebsiella</i> | 61 | 24.0 |
| <i>Enterococcus spp.</i> | 22 | 8.7 |
| <i>Staphylococcus aureus</i> | 19 | 7.5 |
| <i>Pseudomonas aeruginosa</i> | 10 | 3.9 |
| Other organisms | 14 | 5.5 |

Table VI. Antibiotics Sensitivity Pattern of Bacterial isolates (n=254)

| Name of Antibiotic | Antibiotic Sensitivity of organism, number (Percentage) | | | | |
|--------------------|---|----------------------|------------------------|-------------------------|-----------------------|
| | E. coli (n=128) | Klebsiella (n=61) | Enterococcus (n=22) | Staph. aureus (n=19) | Pseudomonas (n=10) |
| Amikacin | 120 (94%) | 58 (95%) | 21 (95%) | 18 (95%) | 8 (80%) |
| Ceftriaxone | 106 (83%) | 49 (80%) | - | 15 (79%) | 6 (60%) |
| Cefuroxime | 95 (74%) | 47 (77%) | - | 11 (58%) | 4 (40%) |
| Ciprofloxacin | 88 (69%) | 40 (66%) | 17 (77%) | 12 (63%) | 5 (50%) |
| Co-amoxiclav | 96 (75%) | 45 (74%) | 18 (82%) | 15 (79%) | 4 (40%) |
| Gentamycin | 100 (78%) | 57 (93%) | 20 (91%) | 17 (89%) | 7 (70%) |
| Imipenem | 124 (97%) | 59 (97%) | 22 (100%) | 18 (95%) | 8 (80%) |
| Nitrofurantoin | 90 (70%) | 46 (75%) | 18 (82%) | - | - |
| Penicillin | 90 (70%) | 43 (71%) | 15 (68%) | 11 (58%) | 4 (40%) |
| Vancomycin | - | - | - | 19 (100%) | - |

(Not all the samples were tested against all antibiotics)

Discussion

Infections of the urinary tract are the most common bacterial infections encountered during pregnancy. These can be both symptomatic and asymptomatic. The prevalence of ASB was 18.9% in a study in Ethiopia.¹⁵ Another study in Tanzania found 13.0% prevalence of ASB.¹⁶ In a recent study in Bangladesh, the prevalence of ASB in a rural community was 12%.¹⁰ In the current study, the prevalence of ASB among pregnant women attending Combined Military Hospital, Dhaka was 16.5%, which is almost similar to other studies.

A number of conditions have been identified as risk factor for ASB, which include multiparity, gestational age, previous medical history of UTI, diabetes mellitus, anemia and anatomic urinary tract abnormalities.^{17,18} In this study maternal anemia, diabetes mellitus and previous history of UTI were found to be the associated risk factors for ASB among pregnant women. This is similar to other studies where anemia and glucose intolerance was significantly associated with ASB.¹⁸⁻²⁰ This could be due to the lowering of systemic as well as local immunity due to diabetes, anemia and previous UTI. In this study there was no significant difference in the prevalence of ASB in respect of trimester, maternal age and parity. This was similar to many other studies.^{16, 21, 22}

The predominant bacterial isolates observed in this study was *E. coli* (50.4%). This is similar to most other studies throughout the world where *E. coli* has been consistently the predominant organism causing ASB.^{18,23,24} The major contributing factor for isolating higher rate of *E. coli* is due to urine stasis in pregnancy which favors for *E. coli* strain colonization.^{25,26} The second most common pathogen causing ASB in this study was *Klebsiella*, which is similar to another recent study.²⁷

The sensitivity of imipenem and amikacin was high (80-100%) to all organisms in this study, which is similar to other studies.^{14,27} Sensitivity to ceftriaxone and nitrofurantoin were moderate and to quinolone and penicillin were low, which is different from some other studies.¹⁵ No case of vancomycin resistant *Staphylococcus aureus* was seen in this study. One-fifth of the *Pseudomonas* were resistant to imipenem and amikacin.

Conclusion

The prevalence of ASB in pregnant women at CMH, Dhaka was 16.5%. Therefore, early screening of

pregnant woman for presence of ASB and treating them according to antibiotic sensitivity pattern is utmost important to prevent maternal and fetal complications. *E. coli* and *Klebsiella* were the most frequently found bacteria causing ASB and they are less sensitive to more commonly used antibiotics like penicillin, cephalosporins and quinolones, moderately sensitive to nitrofurantoin and highly sensitive to imipenem and amikacin. Since aminoglycosides and quinolones are contraindicated during pregnancy, so carbapenems and nitrofurantoin can be the drug of choice to treat ASB.

Conflict of interest: None

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