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Prevalence of asymptomatic bacteriuria and its antibacterial susceptibility pattern among pregnant women

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Abstract---Background and Aim: The condition of asymptomatic bacteriuria in pregnancy is common, and up to 40% of women developing pyelonephritis in pregnancy may suffer low birth weight and membrane's premature rupture. The present study intended to investigate the incidence of asymptomatic bacteriuria and its antibacterial susceptibility pattern among pregnant women. Patients and Methods: This cross-sectional study was carried out on 183 pregnant women attending Obstetrics and Gynecology Department of Ayub Teaching Hospital, Abbottabad from December 2021 to May 2022. Pregnant women with asymptomatic bacteriuria attended the ANC services and willing to provide written consent were enrolled. Standard bacteriological procedures were followed for bacterial isolates identification using biochemical tests, colony characteristics, and Gram-staining. Kirby- Bauer disk diffusion technique was used for Antimicrobial susceptibility test on Muller-Hinton agar medium and Clinical Laboratory Standard Institute guidelines was used for interpretation of zone of inhibition diameter. Midstream urine samples were collected from each study participant and standard microbiological methods to culture urine, identify the pathogen, and conduct sensitivity tests. Data analysis was done in SPSS version 27.

Results: The prevalence of asymptomatic bacteriuria was 14.2% (n=26) among pregnant women. Of the total 26 asymptomatic bacteriuria, the incidence of Gram positive and negative bacteria was 7 (27%) and 19 (73%) respectively. The prevalence of *E. coli*, *K. pneumoniae*, *S. aureus*, and coagulase-negative staphylococci was 53.8% (n=14), 19.2% (n=5), 15.4% (n=4), and 11.5% (n=3) respectively. Ceftazidime and meropenem showed susceptibility (87.5%) and (97.3%) respectively to Gram-negative bacterial isolates. However, ampicillin (91%) and tetracycline (97%) showed resistance to Gram-negative bacterial isolates. **Conclusion:** The prevalence of asymptomatic bacteriuria was 14.2% (n=26) among pregnant women. It was found that the most prevalent bacteria were *E. coli*, *K. pneumoniae*, *S. aureus*, and CoNS. A high proportion of pregnant women with ASB were infected with MDR bacteria.

Keywords---asymptomatic bacteriuria, antibacterial susceptibility, pregnant women.

Introduction

The morphological and physiological changes that occur in the genitourinary tract during pregnancy, urinary tract infections (UTIs) are prevalent. There are two forms of UTIs: symptomatic and asymptomatic. Asymptomatic Bacteriuria (ASB) is defined as the presence of actively proliferating bacteria in the urinary system, excluding the distal urethra, at a concentration more than 10^5 /ml of urine with UTI null symptoms [1]. ASB could be found in pregnant as well as non-pregnant women. ASB in pregnant women varies from 2% to 11% globally [2, 3]. If left untreated, pregnancy accelerates the ASB to symptomatic bacteriuria progression in turn leading to severe outcomes such as anemia, preterm, UTIs, and higher foetal mortality and 20-50% cases of acute pyelonephritis [4, 5]. *Escherichia coli* is the most common bacteria accounting for infections 80-90% that originate UTIs during pregnancy [6]. In various geographical locations, the frequency of isolated pathogens and their antibiotic resistance patterns might differ [7]. In the non-pregnant phase, the uterus lies just behind and partially above the bladder, however in the pregnant state, the expanding uterus affects all urinary system tissues at different times [8]. UTIs are more common in pregnant women. Almost 90% of pregnant women suffer urethral dilatation, which lasts till delivery, beginning in week 6 and peaks between weeks 22 and 24. Urine stasis and ureter vesical reflux are related to increased bladder capacity, decreased urethral tone, and decreased bladder tone [9, 10].

These consequences can be avoided if ASB and SB are treated quickly during pregnancy [11]. Considering the UTIs associated complications during pregnancy, ANC services routinely perform the urine specimen midstream urinalysis. In contrast, Culture and antimicrobial drug susceptibility tests are done for monitoring purpose to have timely diagnosis, treatment, and prevent ASB and SB pregnant women from empirical treatment. *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella* spp, and *Proteus* spp, are similar organism causing UTIs in non-pregnant and pregnant women [12-14]. There is paucity of data regarding the

current distribution and urinary bacterial isolates susceptibility patterns of antimicrobial medication in pregnant women. As a result, the present study investigated the incidence of asymptomatic bacteriuria and its antibacterial susceptibility pattern among pregnant women.

Methodology

A total of 183 pregnant women attending Obstetrics and Gynecology Department of Ayub Teaching Hospital, Abbottabad from December 2021 to May 2022 were investigated in this cross-sectional study. Pregnant women with asymptomatic bacteriuria attended the ANC services and willing to provide written consent were enrolled. WHO Sample size was used for sample calculation by taking 95% confidence interval, precision 5%, and previous prevalence of asymptomatic bacteriuria 13.78% [15]. Pregnant women who had taken antibiotic medication in the preceding two weeks and were seriously ill and unable to complete the questionnaire were eliminated. Standard bacteriological procedure was followed for bacterial isolates identification using biochemical tests, colony characteristics, and Gram-staining. Kirby- Bauer disk diffusion technique was used for Antimicrobial susceptibility test on Muller-Hinton agar medium and Clinical Laboratory Standard Institute guidelines was used for interpretation of zone of inhibition diameter [16]. Midstream urine samples were collected from each study participant and standard microbiological methods to culture urine, identify the pathogen, and conduct sensitivity tests. A sterile screw-capped, wide-mouth container was used to collect 5 mL of freshly voided midstream urine samples. Pregnant women urine samples were straight immunized on cysteine lactose electrolyte deficient agar (CLED) medium using a calibrated inoculating wire loop (0.001 mL). The urine sample culture plates were cultured in an aerobic atmosphere at 37 °C for 24-48 hours before being tested for pathogen development. For detection, all plates containing 10^5 /ml of urine were subculture onto MacConkey agar and 5% sheep blood agar. SPSS was used for statistical analysis, which was illustrated in graphs and tabulated form. The frequency of the variables was determined using descriptive statistics, and the predictors of asymptomatic bacteriuria were determined using multiple logistic regression analysis. P-values less than 0.05 were deemed statistically significant.

Results

The prevalence of asymptomatic bacteriuria was 14.2% (n=26) among pregnant women. Of the total 26 symptomatic bacteriuria, the incidence of Gram positive and negative bacteria was 7 (27%) and 19 (73%) respectively. The incidence of *E. coli*, *K. pneumoniae*, *S. aureus*, and coagulase-negative staphylococci was 53.8% (n=14), 19.2% (n=5), 15.4% (n=4), and 11.5% (n=3) respectively. Ceftazidime and meropenem showed susceptibility (87.5%) and (97.3%) respectively to Gram-negative bacterial isolates. However, ampicillin (91%) and tetracycline (97%) showed resistance to Gram-negative bacterial isolates. Age-wise distribution of patients were as follows: 104 (56.8%) in 15-25 years, 72 (39.4%) in 26-35 years, and 7 (3.8%) in 36-45 years as illustrated in Figure-1. Figure-2 depicts the prevalence of gram-positive and negative bacteria. The incidence of bacterial isolates are shown in Table-I. Table-II represents the culture results.

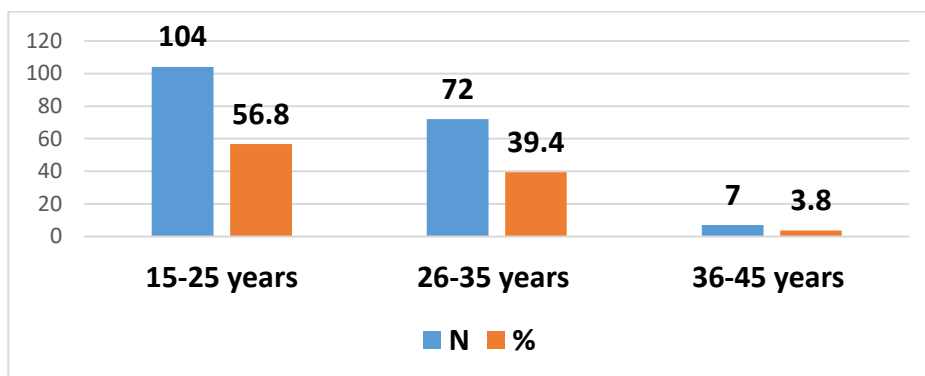


Figure 1. Age-wise distribution of patients (n=183)

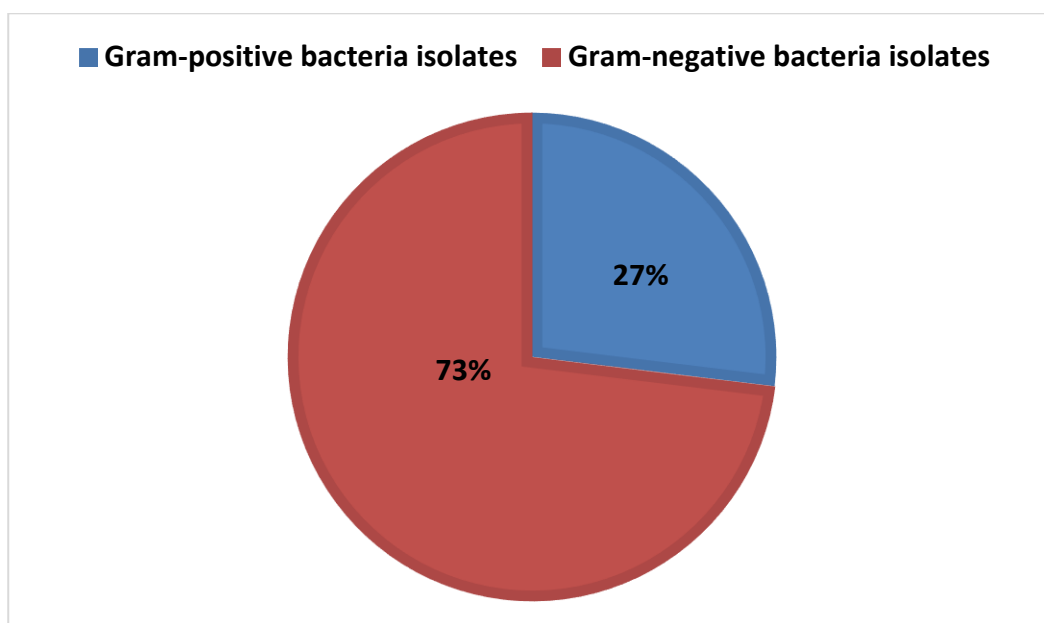


Figure 2. prevalence of gram-positive and negative bacteria isolates (n=26)

Table I
Incidence of bacterial isolates among pregnant women

Bacterial Isolates	Frequency (N)	Percentage (%)
E. Coli	14	53.8
K. pneumoniae	5	19.2
S. aureus	4	15.4
coagulase-negative staphylococci	3	11.5
Total	26	100

Table IV
Culture results

Culture results	N (%)
Significant bacteriuria	26 (14.2)
Insignificant bacteriuria	3 (1.6)
Contamination	22 (12)
Sterile	132 (72.2)
Total N (%)	183 (100)

Discussion

The present study mainly focused on the incidence of asymptomatic bacteriuria and antibacterial susceptibility pattern among pregnant women and found that the most prevalent uropathogens identified were *Escherichia coli*. Cefixime, cephalothin, and cefoxitin were the most effective against all pathogens. Asymptomatic bacteriuria was found in 14.2% of pregnant women. *E. coli*, *K. pneumoniae*, *S. aureus*, and CoNS were the most common bacterial isolates. MDR bacteria were found in a significant percentage of pregnant women with ASB. The ASB incidence among pregnant women was 23.5% reported in a previous study [17] that is greater than Tadesse et al [18], but lesser than reported by Adae et al [19]. Moreover, about 14.2% of our research participants exhibited asymptomatic bacteriuria. Our result was higher than the 2-10% range described previously [20-22].

Prior UTIs history, anemia, gravidity, and trimester (3rd) were different predictors for asymptomatic bacteriuria among pregnant women as reported in previous studies [23, 24]. The present study found no association of bacteriuria predictors among pregnant women. Patients with fever were less susceptible to develop bacteriuria than those without fever. The fastidious organisms that cause infections in malaria patients are to blame for the culture medium growth problems. As compared to women who do not have bacteriuria, women with bacteriuria have a 20-50 times greater chance of getting pyelonephritis [25]. To prevent maternal and foetal morbidities, women who have positive cultures should be treated according to the antibiotic sensitivity patterns of the bacteria identified from their samples. The frequency of asymptomatic bacteriuria in our research was 14.2%, which was comparable to earlier studies [26, 27].

Owens et al., [28] discovered that *Escherichia coli* was the most prevalent isolate detected; the same was discovered in our analysis (77.27%). Antimicrobial sensitivity and resistance patterns differ from one town to the next and from one hospital to the next. This is due to the establishment of resistance strains as a result of indiscriminate antibiotic usage. Ampicillin and amoxycillin-clavulanic acid are two oral antibacterial medicines that are often used to treat UTIs in pregnant women. Our culture findings revealed sensitivity to these compounds. Cefuroxime is another medicine that is widely administered orally for the treatment of ASB, and its sensitivity is equivalent to ceftriaxone (95%) and cefpime (100%). Two of the isolates were multidrug resistant; one was *E. coli*, which produced Extended Spectrum Beta Lactamase (ESBL), and the other was *Klebsiella pneumoniae*. Imepenem and amikacin were both toxic to both of them.

Escherichia coli was the most often isolated uropathogen 53.8% which is consistent with the findings of earlier study [29]. That is also consistent with the findings of the majority of research [30, 31]. *Staphylococcus aureus*, on the other hand, was the most common uropathogen in a research done by Puopolo et al [32]. In the similar vein, Wabe et al [33] discovered that *Klebsiella oxytoca* was the most frequent bacterium in Bamenda. These discrepancies can be explained by variances in geographical location. *Klebsiella pneumoniae* was the second most common pathogen in our investigation, which is consistent with findings from recent studies [34, 35].

Conclusion

The prevalence of asymptomatic bacteriuria was 14.2% (n=26) among pregnant women. It was found that the most prevalent bacteria were *E. coli*, *K. pneumoniae*, *S. aureus*, and CoNS. A high proportion of pregnant women with ASB were infected with MDR bacteria.

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