Prevalence of asymptomatic bacteriuria and associated risk factors among antenatal patients attending a tertiary care hospital

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Abstract
Asymptomatic bacteriuria (ASB) is the commonest bacterial infection which requires medical treatment in pregnancy. Untreated ASB in 25-30% of cases lead to pyelonephritis which may lead to increased risk of abortions, intrauterine fetal deaths, prematurity and low birth weight. A cross-sectional study was conducted at Gandhi Hospital over a period of ten months with 125 asymptomatic pregnant women in the age group of 15-35 years. The objectives of the study were to determine prevalence of asymptomatic bacteriuria, to identify its risk factors and to compare the screening methods. Of the 125 pregnant women, significant bacteriuria was seen in 21 (16%). The prevalence of bacteriuria showed a rise with increasing maternal age and increasing gestational period. Anemics and hypertensives were at greater risk. The most common isolates were Klebsiella pneumoniae and Staphylococcus aureus (28% each). Culture proved to be the gold standard for diagnosis. Catalase and Nitrate reduction tests were used as screening methods with a sensitivity of 90.48% and 71.43% respectively. Multiple drug resistance was observed in Gram-positive and Gram-negative isolates. Routine screening for asymptomatic bacteriuria is therefore recommended throughout pregnancy to avoid adverse fetal and maternal outcomes.

Key words: Pregnancy, asymptomatic bacteriuria (ASB), significant bacteriuria

Asymptomatic bacteriuria in pregnancy is defined as the presence of ≥ 1,00,000 organisms per milliliter (ml) of urine taken from a clean catch mid-stream urine specimen with no symptoms referable to the genito-urinary tract⁴. Women are more susceptible to infections due to the hormonal and physiological changes during pregnancy. Hydroureter of pregnancy begins in the first trimester and progresses until term, returning to normal within several weeks after delivery in most women. Dilatation of the renal pelvis along with elongation and dilatation of the ureters above the pelvic brim occurs due to lack of smooth muscle tone caused by increased levels of circulating progesterone in early weeks of pregnancy and due to...
the compression of ureters by the growing uterus, thus promoting retention of urine in the later weeks of pregnancy. Dilated ureters may contain more than 200 ml of urine and contribute to the persistence of bacteriuria in pregnancy. In addition, glycosuria and aminoaciduria in pregnancy provide an excellent culture medium for bacteria in areas of urine stasis.

Decreased ureteral peristalsis after the 2nd month with long periods of complete atony in the 7th and 8th months of pregnancy occurs under the influence of hormones. Augmentation of urinary reflux to the upper urinary tract is also due to the hormonal changes. Later in the course of pregnancy, increased bladder capacity and longer kidney length may also contribute to the development of symptomatic infection. In pregnancy, approximately 25% of untreated patients with asymptomatic bacteriuria develop pyelonephritis, usually in the third trimester or in the puerperium. Therefore, if routine antenatal screening for asymptomatic bacteriuria and treatment is implemented, the development of chronic renal disease in the pregnant women and fetal loss due to complications of urinary tract infections may be reduced. Studies by Rouse et al. have shown that compared to the policy of no screening, screening and treatment of asymptomatic bacteriuria to prevent pyelonephritis in pregnancy is cost beneficial.

The global prevalence of bacteriuria in pregnancy ranges from 4% to 23.9% in various studies. Low socio-economic status, increasing maternal age, increasing period of gestation, multiparity, anemia are all contributory risk factors associated with increased prevalence of asymptomatic bacteriuria in pregnancy. Women who develop pre-eclampsia during pregnancy seem to be predisposed to urinary tract infections. Maternal anemia has been associated with both asymptomatic bacteriuria and pyelonephritis.

The present study was undertaken to determine the prevalence of asymptomatic bacteriuria among pregnant women attending antenatal outpatient, to identify factors that increase the risk of developing asymptomatic bacteriuria and to compare the predictive accuracy of different screening methods for detection of asymptomatic bacteriuria.

Materials and Methods

This study was conducted on the outpatients in the department of Obstetrics and Gynecology and department of Microbiology at Gandhi Hospital, Hyderabad. 125 women in their first, second or third trimesters of pregnancy, in the age group of 15-35 years were enrolled for the study. Patients with history of fever (≥38°C), genito-urinary complaints and patients on antibiotics for any indication during the current pregnancy were excluded.

Demographic data recorded included maternal age, gravidity, parity and age of gestation, pertinent history with emphasis on past medical and obstetric history, previous antibiotic intake, previous history of urinary tract infection, personal and family history of hypertension and diabetes. Baseline investigations such as hemoglobin levels, urine-albumin and sugar, random blood sugar, blood urea were done.

A 'clean-catch mid stream' urine sample was collected after giving proper instructions to subjects. The specimens were analyzed by the following screening methods:

i. Wet mount of urine for cytology: Presence of >10 W.B.C's per high power field was considered significant.

ii. Gram stain: Presence of at least one organism per oil immersion field was considered significant to correlate with significant bacteriuria (≥10^5 CFU/ml).

iii. Catalase test: Frothing on addition of few drops of Hydrogen peroxide to 1ml sample of urine shows presence of Catalase enzyme.

iv. Nitrate reduction test: Appearance of pink-red color indicates the presence of nitrite and hence the ability of the organism to reduce nitrate.

Specimens were subjected to culture on blood agar and Mac Conkey's agar plates for semi-quantitative analysis by inoculation, using the standard loop technique (delivering a volume of 0.001ml of urine). The plates were incubated at 37°C overnight and bacterial colony counts were done. Counts >10^5 organisms/ml were considered as significant bacteriuria. The organisms were isolated and species identified. Antibiotic sensitivity was tested for the isolates by the Kirby-Bauer method (disk diffusion) with 0.5MC Farland Standard turbidity of the inoculum on Mueller-Hinton agar.

Subjects with significant bacteriuria were initiated appropriate treatment by the concerned obstetrician and followed up after one week for a repeat urine culture and sensitivity testing. Perinatal outcomes of all patients were followed.

Results

Of the 125 women, 113 (90.4%) were in the age group of 15-25 years and 12 (9.6%) were between the ages of 26-35 years. 21 (16.8%) women out of 125 showed significant bacteriuria. Culture positivity
was seen in 17 women (15.04%) and in 4 women (33.3%) in the 15-25 and 26-35 age groups respectively (Figure 1). 18 of the 21 positive on initial culture were cured after treatment and showed a sterile repeat culture and 3 showed a positive culture.

Figure 1. Age group-wise urine culture positivity.

Figure 2 shows the association between gestational age and culture positivity. Of the 14 women in the 1-12 weeks of gestation, 2 showed positive cultures. Of the 104 women in the 12-24 weeks of gestation, 17 had positive cultures and of the 7 women in the 25-30 weeks group, culture positivity was seen in 2. Parity showed no influence on bacteriuria in our study population.

Figure 2. Gestational age and prevalence of urine culture positivity.

Figure 3 shows the relationship between anemia and prevalence of bacteriuria. Of the 125 women, 49 (39.2%) were anemic and among these 14 showed positive cultures and of the 76 non-anemic women, 7 were culture positive. The difference between the two groups is significant at the 99.5% confidence level (z = 2.581).

Figure 3. Prevalence of urine culture positivity among the anemic and non-anemic groups.

Of the 125 women, 117 (93.6%) were normotensives and 8 (6.4%) were hypertensives. Only 18 patients among the normotensives showed positive cultures whereas 3 out of the 8 hypertensives yielded a positive culture, showing a significant difference at the 95% confidence level (z=1.618) (Figure 4).

Figure 4. Prevalence of urine culture positivity among the normotensive and hypertensive groups.

Klebsiella pneumonia and Staphylococcus aureus were the most common isolates (Table 1). On repeat urine culture, Klebsiella was isolated in two subjects and staphylococcus aureus in one. The same organisms were isolated in these three patients as in their initial culture.
The prevalence of bacteriuria was found to be associated with the demographic characteristics of patients. The prevalence is higher with increasing maternal age which is consistent with results in previous studies. This increase in prevalence is likely owing to the increase in frequency of co-morbid conditions. These are associated with neurogenic bladder and increased residual urine volume or urinary reflux.

In accordance with the previous studies, the present study also showed an increase in prevalence rates with increasing age of gestation. The American college of Obstetricians and Gynecologists reports that bacteriuria occurs in 2-7% of pregnant women; and of those who are not bacteriuric at initial screening, 1-2% will develop bacteriuria later in the pregnancy. In the present study, anemia was recorded as an important risk factor. Hypertension was also associated with a two-fold increase in the rate of bacteriuria. The underlying renal damage due to preeclampsia may weaken the patient's systemic defense mechanisms against ascending infections.

All pregnancies in the study except those with bacteriuric hypertensive mothers ended in full-term normal deliveries. Hypertensives that were bacteriuric, 9.52 % (two women) had pre-term deliveries and 4.76% (one woman) had an intra-uterine death. Possibly, these consequences could partially be attributed to their hypertension, as hypertensives also are at an increased risk of delivering prematurely. Added to that, these hypertensives were anemic too, increasing further their risk of premature labors and intra-uterine deaths. These three hypertensive patients were refractory to treatment and had positive repeat urine cultures despite treatment.

The higher prevalence rate of asymptomatic bacteriuria in this study group can be attributed to various risk factors identified in this study, such as increasing maternal age, gravidity and gestational age. Anemia and hypertension were also contributory risk factors. Low socio-economic status of the patients possibly compounded the problem.

Conclusions

The present study investigated a comprehensive set of possible factors that potentially influence the prevalence of asymptomatic bacteriuria in antenatal cases. It included not only several demographic parameters such as age, parity, gestational age and their impact on bacteriuria, but also investigated the impact of risk factors such as anemia and hypertension.

Our results indicate that the majority of the cases of bacteriuria were in the older age group. Prevalence of bacteriuria increased with gestational age. We found that the presence of anemia increased the risk of bacteriuria and that hypertensives were more bacteriuric compared to the normotensives. The high prevalence rate of bacteriuria in our study group in comparison with previous studies can be explained by the fact that our patients were almost exclusively from a low socio-economic stratum attending a government hospital and with a greater numbers at risk with anemia and hypertension.
In this study, two screening methods, Catalase test and nitrate reduction were used and their relative accuracy was determined. Culture of urine was the most effective method of detection of asymptomatic bacteriuria. Prenatal testing should therefore be carried out by urine culture to reduce the risk of false negatives.

Although asymptomatic bacteriuria is considered a community acquired infection, our antibiotic susceptibility patterns showed multiple drug resistant among both the gram negative and gram positive isolates showing the changing trends of microorganisms and the spillover of antibiotic resistant strains of bacteria into the community.

**Acknowledgments:** None

**Conflict of interest:** None

**References**


**Table 3. Predictive statistics for Catalase and Nitrate Reduction tests**

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<th>Parameters</th>
<th>Catalase</th>
<th>Nitrate Reduction</th>
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<td>Sensitivity</td>
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<td>Specificity</td>
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<td>100%</td>
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<tr>
<td>Percentage False Positives</td>
<td>0%</td>
<td>0%</td>
</tr>
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</table>

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