

Original Research



Prevalence and causative organisms of asymptomatic bacteriuria among pregnant women in Karachi, Pakistan

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Abstract

Introduction: During pregnancy, urinary tract experiences various anatomical as well as physiological changes which lead to the development of urinary tract infections. Of these, asymptomatic bacteriuria is prevalent during pregnancy and the adverse outcomes could include intrauterine growth retardation, pyelonephritis, preterm delivery, low birth weight, hypertension, and anaemia. Hence, screening for asymptomatic bacteriuria should be included in antenatal care.

Objectives: To determine the prevalence of asymptomatic bacteriuria and the frequency of different organisms causing asymptomatic bacteriuria among pregnant women attending the outpatient department at Dow University Hospital in Karachi, Pakistan

Methods: A cross-sectional study was conducted in the obstetric outpatient department (OPD) of Dow University Hospital, Karachi for six months. A total of 161 pregnant women with no clinical symptoms of urinary tract infection were included in this study. The method of urine sample collection was explained to all the enrolled participants. After collection, samples were labeled and processed. The result of the urine cultures was available after three days and was entered in the Performa. Participants with positive culture reports were treated according to the antibiotic sensitivity.

Results: The prevalence of asymptomatic bacteriuria among pregnant women was found in 17% (SD=0.61) with maximum prevalence in the age group of ≤ 25 years among primigravidae. The common organisms responsible for urinary tract infection in asymptomatic pregnant women were *Escherichia coli* (39.3%), *Klebsiella pneumonia* (17.9%), *Staphylococcus spp.* (17.9%) and *Enterococcus spp.* (14.3%).

Conclusions & Recommendations: As asymptomatic bacteriuria is associated with complications in pregnancy; hence it is essential that pregnant women should be screened for bacteriuria, regularly in every trimester of the gestational period.

Key words: *asymptomatic bacteriuria, Escherichia coli, Staphylococcus species*

Introduction

The occurrence and multiplication of microbes within the urinary tract cause urinary tract infections (UTI)(1). In certain cases, symptoms may appear or some are asymptomatic(2). Symptomatic bacteriuria is described as occurrence of bacteria ($>10^5$ colony forming unit (CFU) of an organism per ml in midstream urine) on urine culture along with symptoms (fever, pain in lower back, frequent urination, urgency, difficulty in urination). Asymptomatic bacteriuria (ASB) is explained as the occurrence of bacteria ($>10^5$ CFU of a specific organism per ml of urine) in urine culture of a woman without any symptoms (3).

In non-pregnancy state, the acidic pH condition increases the urea concentration and high osmolality makes the urine bacteriostatic(3). During pregnancy, hormonal and physical changes lead to ureteric relaxation, urinary stasis, ureteric valve dysfunction and vesico-ureteric reflux (3-4); these alterations favour bacterial colonization of lower urinary tract with ascending urinary tract infection.

During pregnancy, untreated ASB can cause various maternal complications including cystitis (up to 30%), and pyelonephritis (up to 50%) respiratory distress syndrome (2%) and septicaemia (10-20%) in cases (5). The associated adverse neonatal complications include preterm birth, intrauterine growth restriction, preterm and premature rupture of membranes and low birth weight leading to increase maternal and perinatal morbidity and mortality(6-8).

Screening of ASB is essential for pregnant women so that treatment can be offered in time and women and their babies can be prevented from above mentioned complications. Urine culture is the most assuring and gold standard test for investigating ASB(9). The most common causative organisms of UTI in asymptomatic pregnant women are *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Staphylococcus saprophyticus* followed by *Proteus mirabilis*, *Enterococcus faecalis*, *Group B Streptococcus* and *Acinetobacter* (5,10). The frequency of organisms varies with geographical location with study proven percentages of *E. coli* as

follows: 48.7% in Ghana (11), 58.96% in Iran (6), 14.2% in India (7) and 38.89% in Pakistan (12); *K. pneumoniae* 23.9% in Ghana (9), 3.73% in Iran (6), 50% in India (7); *S. aureus* 16.7% in Ghana (6), 13.43% in Iran (6), 7.1% in India (7); and *S. saprophyticus* 16.8% in Iran(6) and 16.68% reported in Pakistan(9).

It has been observed that during pregnancy, the prevalence of pyelonephritis has been reduced with the treatment of ASB, hence its screening and treatment have now become a standard of obstetrical care(9). The results of another study showed that the drug treatment of ASB during pregnancy significantly reduces the risk of pyelonephritis and preterm delivery (13). Globally, the prevalence of ASB is 2-10% during pregnancy (2). Among Asian countries, the prevalence reported is 8.9% from Iran (7), 12% from rural Bangladesh(13) and 13.2% from India(8). In Pakistan, the prevalence reported is 4.8% (3) to 7.2% (11).

Usually, it has been observed that during pregnancy, women are not screened for ASB and so are not identified to be treated until they become symptomatic. By screening and aggressively treating pregnant women with asymptomatic bacteriuria may significantly reduce the incidence of pyelonephritis during pregnancy (14-15). As there is an increase in the incidence of asymptomatic bacteriuria cases, this study was therefore conducted to identify the current prevalence of asymptomatic bacteriuria as well as the causative organisms which were isolated from the urine cultures of asymptomatic pregnant women in order to improve their maternal and neonatal outcome. Thus, the purpose of this study was to determine the prevalence as well as the frequency of different organisms causing ASB among pregnant women who were visiting the outpatient department (OPD) of public sector hospital i.e., Dow University of Health Sciences, Karachi Pakistan.

Methods

This was a cross-sectional study which was conducted in the obstetric OPD of Dow University Hospital, Karachi, Pakistan during a period of six months from

1 July 2017 till 31 December 2017. Considering the 7.2% prevalence of asymptomatic bacteriuria (16), the total sample size calculated was 161 using Open Epi software with 95% confidence interval (CI) and margin of error of 4%. Participants of this study were pregnant women of reproductive age group between 18 to 45 years (irrespective of gestational age and parity), with no clinical symptoms of UTI were recruited in this study.

Pregnant women with fever, burning micturition, pain in lower back, history of congenital anomaly of urinary tract, history of diabetes mellitus, history of immunosuppression, pre-eclampsia, usage of antibiotics within 2 weeks and catheterization within 2 weeks were excluded in this study. Those participants who fulfilled the criteria and consented to participate were selected based on non-probability consecutive sampling.

Sample collection

Prior to administering the data collection form, participants were informed about the purpose of this study, emphasizing the voluntary participation option. The participants were then asked to fill the self-administered questionnaire to inquire about age, parity, gestational age, qualification, occupation, and monthly family income. Afterwards, the participants were advised to have a routine urine microscopy and culture and sensitivity test. The method of urine sample collection was explained as per the guidelines (17), which included storage of "clean catch" mid-stream urine sample in a wide-mouthed sterile bottle which can be secured with a lid. The patients were asked not to touch the border of the container with the genital area and carefully replace the lid of the container and thereafter submit the sample to DOW main laboratory. From the main laboratory, the samples were transferred to DOW microbiology laboratory. After collection, the samples were labeled and processed on the same day; in case of any transportation or processing delay the samples were refrigerated at 4-8°C for a maximum of 4 hours to prevent the proliferation of contaminant bacteria (17).

Investigation

At DOW microbiology laboratory, the urine samples were subjected to Gram staining and cultured on CLED (cysteine lactose electrolyte deficient agar). Further testing was done using standard tests as mentioned in the Manual of Clinical Microbiology (18) for isolation and identification of organism. The result of the urine cultures was available after three days and was entered in the Performa. Participants with positive culture reports were treated as per their antibiotic sensitivity and were asked to report back in 7-10 days for repeat culture and sensitivity test as a part of the follow up.

Results

A total of 161 pregnant women of reproductive age group with no clinical symptoms of UTI were included in the study. The mean age of patients was 25.82 ± 3.95 years. Out of 161 participants, 74 (46%) were primigravid and 87 (54%) multigravidas. Most of the women were literate and housewives. Family income of the majority of participants were more than Rs. 25,000.

Among those 161 participants, the majority (n=75; 46.5%) were in the age group of ≤ 25 years, followed by the age group of 26-30 years (n=61; 37.8%). The cases of asymptomatic bacteriuria were also most common (9.3%) among the age group ≤ 25 years. However, asymptomatic bacteriuria did not show any significant relationship with age ($\chi^2=10.499$; $p>0.05$) (Table 1).

Most of the participants of this study were in primigravida (46%) followed by 2nd, 3rd and multigravida (24.2%, 16.1%, 13.6%), respectively. The cases of asymptomatic bacteriuria were high among primigravida (9.9%). The ASB cases in 3rd and more gravida were 4% and the lowest were observed in 2nd gravida (2.5%), though no statistically significant relationship was observed between asymptomatic bacteriuria and gravidity ($\chi^2=11.42$; $p>0.05$) (Table 2).

Based on trimester, the number of participants in 1st trimester was 10.6%, in 2nd trimester 34.8% and in 3rd trimester 54.7%. The majority of cases of ASB were found in 2nd trimester (8.7%), however there was no significant relationship between asymptomatic bacteriuria and trimester (χ^2 6.9; $p > 0.05$) (Table 2).

On evaluating the educational level of participants, it was observed that ASB was higher among illiterate (40%) and lowest among those who did their graduation or post-graduation (15.7%) however no statistically significant relation was observed between asymptomatic bacteriuria and participant's educational level (χ^2 = 10.76; $p > 0.05$). Similarly, ASB was higher (36.4%) among participants who had family income of < Rs. 10,000 per month and lowest (6.5%) amongst those who had monthly income Rs. >40,000.

The prevalence of ASB was 17.4% among pregnant women, whereas insignificant growth was observed in 19.9% women. Among those 17.4% women, the common organisms responsible for urinary tract infection in asymptomatic pregnant women was *E. coli* (39.3%) followed by *K. pneumonia* (17.9%), *Staphylococcus* spp. (17.9%), *Enterococcus* spp. (14.3%), *Candida* (3.6%), *Morganella morganii* (3.6%) and *Enterobacter* spp. (3.6%) (Table 3).

Based on gestational age, it was observed in the women who were in their 1st trimester the organisms mainly responsible for ASB were *E. coli* and *Streptococcus* spp. followed by *Candida*, whereas in 2nd semester *E. coli* followed by *Klebsiella*, *Enterococcus* and *Streptococcus* spp. However, in 3rd trimester the main causative organism was *E. coli* followed by *Enterococcus*, *Klebsiella* and *Streptococcus* spp. (Table 3).

Table 1: Distribution of cases according to age

Age (years)	No. of cases	%	No. of ASB	%	p value
≤ 25	75	46.6	15	9.3	0.23
26 - 30	61	37.9	8	5.0	
31 - 35	18	11.2	5	5.0	
36 - 40	7	4.3	0	0.0	

p-value calculated using Chi-squared test analysis

Table 2: Distribution of cases according to gravida and trimester

Gravida	No. of cases	%(n=161)	No. of ASB	%	p value
Primigravida	74	46.0	16	9.9	0.49
Second gravida	39	24.2	4	2.5	
Third gravida	26	16.1	6	3.7	
Multi gravida	22	13.6	2	1.2	
Trimester					
1st Trimester	17	10.6	3	1.9	0.14
2nd Trimester	56	34.8	14	8.7	
3rd Trimester	88	54.7	11	6.8	

p-value calculated using Chi-square analysis

Table 3: Distribution of bacterial isolates among culture positive samples and according to trimester

Type of bacterial isolate	No. of ASB	%	1st Trimester %	2nd Trimester %	3rd Trimester %
<i>Escheria coli</i>	11	39.3	7.1	10.7	21.4
<i>Klebsiella species</i>	5	17.9	0.0	14.3	3.6
<i>Streptococcus species</i>	5	17.9	3.6	7.1	7.1
<i>Enterococcus species</i>	4	14.3	0.0	7.1	7.1
<i>Candida</i>	1	3.6	0.0	3.6	0.0
<i>Morganella morganii</i>	1	3.6	0.0	3.6	0.0
<i>Enterobacter species</i>	1	0.6	0.0	3.6	0.0

Discussion

Urinary tract infections are caused by the presence and growth of microbes anywhere in the urinary tract. Therefore, it is one of the most common bacterial infections of mankind (19-20). It commonly occurs during pregnancy because of the morphological as well as the physiological changes which occur in the genitourinary tract. They are of two types, symptomatic and asymptomatic. Asymptomatic bacteriuria is described as the occurrence of actively growing bacteria, which is greater than 10^5 /ml of urine within the urinary tract, exclusive of the distal urethra, when the patient has no symptoms of a UTI (21). Among these pregnant women, there is a 20-30-fold increase in the risk of developing pyelonephritis (14,22) compared with women without bacteriuria. Additionally, in cases where asymptomatic bacteriuria is untreated or inadequately treated, conditions such as transient renal failure, sepsis, shock, acute respiratory distress syndrome and haematological abnormalities occur. This study assesses the prevalence of asymptomatic bacteriuria among pregnant women and the frequency of different organisms causing asymptomatic bacteriuria among these women. A total of 161 pregnant women with no clinical symptoms of UTI were included.

The participants were between 18 to 45 years with mean age of 25.82 (SD=3.95) years. In our study, the highest prevalence of infection (9.3%) was found in the age group of ≤ 25 years followed by age group of 26-30 years (5%). Similarly, Alghalibi et al. (23) stated a higher prevalence of UTIs in pregnant

women who were between 21-25 years. This high prevalence of asymptomatic bacteriuria in young age group is due to early pregnancy and multiparity in our country. On the contrary, Turpin et al. (24) and Akinloye et al. (25) reported a higher prevalence of ASB among pregnant women of age between 35-39 years. In our study there were 46% primigravid and 13.6% multigravida women. Frequency of asymptomatic bacteriuria among pregnant women by parity was found to be 10% in primigravid and 7.45% in multigravida women. In contrast to our observations Roy et al. (26) and Obirikorang et al. (27) concluded that the incidence of asymptomatic bacteriuria was higher in multigravida.

Prevalence of ASB among pregnant women was found in 17%. Studies showed varying prevalence rates of asymptomatic bacteriuria among pregnant women reporting a prevalence of 6.1% by Hazhir (28); 7.3% by Turpin et al (24), 8.4% by Hernandez et al (29) and 9.8% by Tadesse (30). Prevalence rates as low as 3.3% (31) and 3.7% (32) and as high as 22.2% (33) and 23.9% (34) have also been reported in separate studies. Difference in geographical locations, ethnicity and hygiene practices might be the contributing factor in variation of prevalence of asymptomatic bacteriuria from one place to other.

The main causative organism of UTIs during pregnancy is *E. coli*, which accounts for 80-90% of infections (35). Similar findings were observed in this study. Out of 17% women, the common organisms responsible for urinary tract infection in asymptomatic pregnant women was *E. coli* (39.29%), *K. pneumonia* (17.86%), *Staphylococcus* spp.

(17.86%) and *Enterococcus spp.* (14.29%). Different studies done by Chandel et al. (26), Imade et al. (36), Jain et al (37) and Senthinath et al. (38) have shown that *E. coli* was found in isolates, similar findings were also observed in our study (39.29%). The results of this study are also in agreement with the studies of Richardson (39), Brooks (40) and Orenstein and Wong (41) regarding the dominance of *E. coli* in causation of UTI.

In this study, stratification analysis was performed with respect to age, parity, gestational age, education, occupation and family income to observe effects of these modifiers on asymptomatic bacteriuria and different organisms causing asymptomatic bacteriuria and a meaningful effect was observed in the trimester of pregnancy and bacteriuria. This effect also shows that the incidence of ASB is high as the pregnancy advances. This significance is complementing the findings of K. Stenqvist study documenting the increased risk of bacteriuria with the length of pregnancy (42). A possible explanation behind this increased risk is the bladder compression due to the increased size of the uterus causing residual urinary volume. In contrast to our observation, Onuorah Samuel et al (43) reported that the age and socio-economic conditions contributed enormously in the prevalence of ASB amongst the pregnant women whose urine samples were examined. The prevalence was greater among the out-patients in comparison to the in-patients. *E. coli* was found to be the most prevalent bacterial isolate. Pregnant women were advised to seek qualified and experienced medical personnel for proper diagnosis, control, and treatment of pregnancy related UTIs.

The main limitation of this study includes its cross-sectional study design due to which participants were not followed during the entire period of their pregnancy for the recurrence of infection.

Conclusions & Recommendations

The complications during pregnancy can be aggravated with asymptomatic bacteriuria, and therefore it is recommended that every pregnant woman must have urine culture tests regularly to

detect asymptomatic bacteriuria. And those who were identified as positive cases must be given suitable antibiotics to prevent any obstetric complication associated with pregnancy.

Public Health Implications

Asymptomatic bacteriuria is common during pregnancy; hence it is imperative to periodically screen pregnant women during each trimester of gestation. During each antenatal visit, educate patient about personal hygiene and cleanliness around urogenital and anal area to prevent faecal contamination of urinary tract.

Author Declarations

Competing interests: We declare that we have no competing interests.

Ethics approval and consent to participate: The study protocol was approved by CPSP Research Evaluation Unit (Ref: CPSP/REU/OBG-2013-256-5781) prior to the conduct of this research.

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Author contributions: TN participated in the design of study, data collection and partially drafted the manuscript, SN also participated in manuscript drafting, statistical analysis and interpretation of data. JA has supervised the project. All authors read and approved the final manuscript.

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