

Prevalence of Asymptomatic Bacteriuria and its Antibacterial Susceptibility Pattern Among Pregnant Women Attending the Antenatal Clinic at Kanpur, India

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ABSTRACT

Background: Symptomatic and asymptomatic bacteriuria (ASB) is common in pregnant women. Pregnancy enhances the progression from ASB to symptomatic bacteriuria, which if left untreated, could lead to acute pyelonephritis and other adverse outcomes such as prematurity, postpartum, hypertensive disease, anaemia, UTIs and higher foetal mortality rates.

Aim: To identify the prevalence of ASB, the most common causative microorganisms and the antibacterial susceptibilities of the isolated microorganisms at a tertiary care centre at Kanpur, India.

Materials and Methods: A total number of 300 asymptomatic pregnant women were screened for ASB by urine culture by using a semi quantitative culture method.

Results: In this study, significant bacteriuria was found in only 22 cases (7.3%). Growth of contaminants was seen in 40 cases (13.3%). Among cases which showed positive cultures, 48.9% were primigravidae and 51.1% were multigravidae. Highest

incidence was reported in age group of 21-30 years. The predominant organisms which were isolated were *Escherichia coli*, followed by *Klebsiella pneumoniae*, *Enterococcus faecalis*, *Staphylococcus aureus* and *Proteus mirabilis*. *Escherichia coli*, the most common isolate, was found to be only 61% and 70% sensitive to ampicillin and amoxicillin + clavulanate, respectively. Sensitivity to ceftriaxone and ciprofloxacin was 95%, and sensitivity to amikacin was 99%. Hundred percent sensitivity was found for the broad spectrum penicillins, imipenem, and meropenem. *Klebsiella pneumoniae*, the second most frequent organism which was grown on culture, was only 50% sensitive to ampicillin and amoxicillin + clavulanate. 100% sensitivity was found for cefuroxime, cefepime, ceftriaxone, ciprofloxacin, imipenem and meropenem.

Conclusion: Routine urine culture test should be carried out for all antenatal women, to detect asymptomatic bacteriuria, and every positive case should be treated with appropriate antibiotic therapy, to prevent any obstetric complication which is associated with pregnancy.

Keywords: *Escherichia coli*, *Klebsiella pneumoniae*, urinary tract infection

INTRODUCTION

Urinary Tract Infections (UTIs) commonly occur in pregnancy, due to the morphological and physiological changes that take place in the genitourinary tract. UTIs are of two types, symptomatic and asymptomatic. Asymptomatic Bacteriuria (ASB) is defined as the presence of actively multiplying bacteria, which is greater than 10⁵/ml of urine within the urinary tract, excluding the distal urethra, at a time when the patient has no symptoms of a UTI [1]. ASB can be found in both pregnant and non-pregnant women. The prevalence of ASB was found to be 2-11% in pregnant women. Pregnancy enhances the progression from ASB to symptomatic bacteriuria, which could lead to acute pyelonephritis in 20-50% of cases and to adverse obstetric outcomes such as prematurity, postpartum hypertensive disease, anaemia, UTIs, and higher foetal mortality rates, if it is left untreated [2,3]. Asymptomatic bacteriuria is a microbial diagnosis which is based on the isolation of a specified quantitative count of bacteria in a specimen of urine which is properly collected from a pregnant woman who does not have any signs or symptoms. Thus, urine culture is the gold standard screening technique for ASB which occurs during pregnancy [4,5]. The predominant organism that causes UTIs during pregnancy is *Escherichia coli*, which accounts for 80-90% of infections [6]. The relatively high prevalence of ASB during pregnancy, the significant consequences faced by women and their pregnancies, and the ability to avoid undesired outcomes with treatment, justify screening and treatment of ASB in pregnancy. The frequencies of isolated pathogens and their antimicrobial resistance patterns can vary in different geographical regions [7]. Therefore, the most common

causative agents should be investigated and communities should be made aware of their local antimicrobial resistances. The objective of this prospective study was to identify the prevalence of ASB, its most common causative microorganisms and the antibacterial susceptibilities of the isolated microorganisms among pregnant women who attended a tertiary care centre at Kanpur, India.

MATERIALS AND METHODS

This was a prospective study which was conducted in the Department of Microbiology and Department of Obstetrics in Rama Medical College Hospital and Research Centre, over a period of 6 months, starting from 1st November 2012 to 30th April 2013. A total number of 300 pregnant women who attended antenatal clinic were included in this study. Pregnant women with a history of UTI symptoms (dysuria, frequency and urgency, etc), pregnancy induced diabetes mellitus/ hypertension, a history of antibiotic therapy taken in the previous two weeks, pyrexia of unknown origin, known congenital anomalies of the urinary tract, were excluded from this study. After getting clearance from the ethical committee, study was conducted. Informed consents were taken from all the patients. Urine samples were collected by standard mid-stream "clean catch" method from all the pregnant women, in sterile, wide mouthed containers that were covered with tight-fitting lids. The samples were processed by using standard microbiological procedures. The specimens were cultured on dried plates of MacConkey's agar, Sheep Blood agar (in 5-10% CO₂ atmosphere) and Cystine Lactose Electrolyte Deficient agar, by standard loop method and the plates were incubated at 37°C overnight. Culture results were interpreted

as significant and insignificant according to the standard criteria. The organisms were identified by routine methods from the samples which showed significant bacteriuria. The standardized Kirby-Bauer disc diffusion test of the Clinical and Laboratory Standards Institute (formerly NCCLS) was used for antibiotic susceptibility testing and interpretations were carried out accordingly [8]. The antibiotics which were tested were ampicillin (10mcg), amoxycylav (20/10mcg), amikacin (30mcg), clindamycin (2mcg), cefepime (30mcg), ceftriaxone (30mcg), cefuroxime (30mcg), ciprofloxacin (5mcg), cotrimoxazole (25mcg), erythromycin (15mcg), fosfomycin (200mcg), penicillin G (10units), imipenem (10mcg) and meropenem (10mcg). The company which manufactured all these drugs was HiMedia (Mumbai, India), except for amoxycylav and meropenem, which were obtained from Bio-Rad, New Delhi, India.

RESULTS

Among 300 asymptomatic pregnant women who were screened, significant bacteriuria was found in only 22 (7.3%) cases [Table/Fig-1]. Among positive cultures which were obtained, 48.9% belonged to primigravidae and 51.1% belonged to multigravidae. Highest incidence (72.72%) was reported in the age group of 21-30 years [Table/Fig-2]. In our study, culture positive cases with respect to trimester were as follows: first trimester- 10 (45.45%), second trimester- 8 (36.36%), and third trimester -4 (18.18%). The commonest bacterium which was detected in culture was *Escherichia coli* (in 77.27% cases) [Table/Fig-3]. *Escherichia coli*, the most common isolate, was found to be sensitive to ampicillin (61% sensitivity) and to amoxicillin-clavulanic acid (70% sensitivity). Eighty four percent sensitivity was documented for cefuroxime. Sensitivity to ceftriaxone and ciprofloxacin was 95%, and sensitivity to amikacin was 99%. Hundred percent sensitivity was found for the broad spectrum penicillins, imipenem, and meropenem. *Klebsiella pneumoniae*, the second most frequent organism which was grown on culture, was only 50% sensitive to ampicillin, while sensitivity to amoxicillin-clavulanic acid was 50%. Sensitivity to cefuroxime, cefepime, ciprofloxacin, ceftriaxone, imipenem and meropenem was 100% [Table/Fig-4].

DISCUSSION

Asymptomatic bacteriuria (ASB) in pregnant women is one of the important causative factors which results in premature or low birth infants, postpartum UTIs and higher foetal mortality rates.

Results of culture	Number of cases	Percentage
Significant bacteriuria	22	7.3
Insignificant bacteriuria	4	1.3
Contamination	40	13.3
Sterile	234	78
Total	300	100

[Table/Fig-1]: Results of culture

Age group	No of cases	Percentage
<20	2	9.1
21-30	16	72.72
31-40	4	18.18

[Table/Fig-2]: Distribution of Culture Positive Cases with respect to age

Name of Isolate	Number of cases	Percentage
<i>Escherichia coli</i>	17	77.27
<i>K.pneumonia</i>	2	9.09
<i>Enterococcus faecalis</i>	1	4.54
<i>Proteus mirabilis</i>	1	4.54
<i>Staphylococcus aureus</i>	1	4.54
Total	22	100

[Table/Fig-3]: Distribution of bacterial isolates in positive culture

	<i>E.coli</i> n (%)	<i>Klebsiella pneumoniae</i> n (%)	<i>Proteus mirabilis</i> n (%)	<i>Staphylococcus aureus</i> n (%)	<i>E.faecalis</i> n (%)
AMP	10 (61)	1 (50)	0	0	1 (100)
AMC	12 (70)	1 (50)	1 (100)	ND	ND
AK	15 (99)	2 (100)	1 (100)	ND	ND
CPM	17 (100)	2 (100)	1 (100)	ND	ND
CTR	15 (95)	0	1 (100)	ND	ND
CIP	15 (95)	2 (100)	1 (100)	ND	ND
CD	ND	ND	ND	1 (100)	ND
COT	ND	ND	ND	1 (100)	1 (100)
CXM	14 (84)	2 (100)	1 (100)	ND	ND
E	ND	ND	ND	0	ND
FO	ND	ND	ND	ND	1 (100)
P	ND	ND	ND	ND	1 (100)
IPM	17 (100)	2 (100)	1 (100)	ND	ND
MEM	17 (100)	2 (100)	1 (100)	ND	ND

[Table/Fig-4]: Antimicrobial susceptibility pattern of the isolated organisms

AMP - Ampicillin, AMC - Amoxycylav, AK - Amikacin, CPM - Cefepime, CTR - Ceftriaxone, CIP - Ciprofloxacin, CD - Clindamycin, COT - Cotrimoxazole, CXM - Cefuroxime, E - Erythromycin, F - Fosfomycin, IPM - Imipenem, MEM - Meropenem, P - Penicillin-G

Women who have bacteriuria have a 20-50 fold increased risk of developing pyelonephritis as compared to women who do not have bacteriuria [2]. Those women who show positive cultures should be treated as per antimicrobial sensitivity patterns of the bacteria which are isolated from their samples, to prevent maternal and foetal morbidities. In this study, the prevalence of asymptomatic bacteriuria was 7.3%, which was similar to those seen in various other studies [2,9-14]. Neupane et al., (26%) and Imade et al., (45.3%) reported a higher prevalence [15,16]. This variation may be explained by the fact that there were differences in the environments, social habits of the community, socio-economic statuses, the standards of personal hygiene and education of the patients who were studied. In this study, the age group of 21-30 years showed the highest prevalence of infection (72.72%), followed by age group of 31-40 years (18.18%). Alghalibi et al., [17] reported a higher prevalence of UTIs in pregnant women who were aged 21-25 years and Turpin et al., [10] reported a higher prevalence of ASB in pregnant women who were aged 35-39 years. Advanced maternal age (of ≥ 35 years) was reported as a risk factor for asymptomatic bacteriuria [18]. The observed trend of bacteriuria in this study and reports from other studies showed that the age range of 21-40 years served as the high risk group for development of UTIs in pregnant women.

In this study, incidence of asymptomatic bacteriuria was higher in multigravidae (51.1%), which was similar to Roy et al., [19] and Obirikorang et al.,'s findings [13]. In this study, a higher rate of infection detection was seen in first trimester of pregnancy, which was similar to that seen in the study of Yahodara et al., [20] Studies done by Roy et al., [19] and Nath et al., [21] reported high rates of infection detection in second trimester. Turpin et al., [10] reported a high percentage of asymptomatic bacteriuria in the first and early second trimesters of pregnancy and attributed it to pregnant women reporting at the antenatal clinic for booking during these periods. The higher incidence in first trimester could be caused by hormonal changes occurring prior to occurrence of anatomical changes. Moreover, earliest study done by Kass explains that there is rare acquisition of bacteriuria after the second month of pregnancy [9].

The bacteria which are responsible for asymptomatic bacteriuria are of faecal origin, which colonize the periurethral area. Different studies done by Chandel et al., [11], Enayat et al., [12], Obirikorang et al., [13], Imade et al., [16], Khatkhatk et al., [22], Jain et al., [23],

and Senthinath et al., [24] have shown that *Escherichia coli* was the commonest isolate which was found; same was found in our study also (77.27%). The antimicrobial sensitivity and resistance pattern vary from community to community and from hospital to hospital. This is because of emergence of resistant strains, caused by indiscriminate use of antibiotics. In this study, the isolates showed 100% sensitivity to imipenem and meropenem. Among the aminoglycosides, amikacin showed 99% sensitivity. Ampicillin and Amoxicillin-clavulanic acid are two oral antimicrobial agents which are frequently prescribed for UTIs in pregnant women. Our culture results showed 61% and 70% sensitivities to these agents, respectively. Cefuroxime is another drug which is commonly prescribed orally for treating ASB, and sensitivity to this drug was 84%, which was comparable to sensitivities shown by ceftriaxone (95%) and cefipime (100%). Two of the isolates were multi drug resistant; one among them was *Escherichia coli*, which was an Extended Spectrum Beta Lactamase (ESBL) producer and the other was *Klebsiella pneumoniae*. Both were sensitive to imipenem and amikacin. Gram positive microorganisms were found to be important causes of ASB in some studies. Enayat et al., [12] reported that upto 16.8% of the causative organisms were Coagulase negative *Staphylococcus*. *Enterococcus faecalis* was the most common Gram positive microorganism (4.5%) which was found in our study, which correlated with Sevki et al.,'s findings [2]. Isolates were highly resistant to ampicillin, cloxacillin and erythromycin. Antibiogram in this study correlated with those of other studies (Enayat et al., Sevki et al.). Though nitrofurantoin is relatively safe in pregnancy and effective against most of the UTIs, it may cause haemolysis in a glucose-6-phosphate dehydrogenase deficient infant, if it is used close to term of pregnancy. Hence, it was not used in our study [25]. The upsurge in antibiotic resistance patterns could have been caused by antibiotic abuse and self medication. Also, low costs and availability of drugs could be other factors contributing to antibiotic resistance.

CONCLUSION

As asymptomatic bacteriuria is associated with complications in pregnancy, it is therefore imperative that pregnant women be screened for bacteriuria, periodically in every trimester of the gestational period. Routine urine culture tests should be carried out for all antenatal women to detect asymptomatic bacteriuria, and every positive case should be treated with appropriate antibiotic therapy, to prevent any obstetric complication which is associated with pregnancy. In view of changing patterns of bacterial resistance to common drugs, the importance of educating physicians on use of antibiotics accordingly to provide empirical therapy, is important.

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