Research Article

A study of asymptomatic bacteriuria in pregnancy

A Mohankumar[1*], J Kaur[2], M Deb[3], S Prateek[4]

[1]Assistant Professor, Department of Microbiology, PK Das Institute of Medical Sciences, Ottapalam, Kerala - 679522, INDIA.
{[2]Associate Professor, [3]Professor, Department of Microbiology} {[4]Professor, Department of Obstetrics and Gynecology}
Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi – 110029, INDIA.
Email: dkdrmogi@gmail.com

Abstract

Purpose: The study was conducted to determine the association between asymptomatic bacteriuria (ABU) in pregnancy and the clinical profile, causative organisms and their antibiotic resistance pattern. **Methods:** A total of 500 pregnant women who presented for a regular antenatal care were studied. Clinical details were collected and recorded in the pretested proforma. The urine culture was carried out as per standard technique. Isolates were identified and antibiotic susceptibility pattern was established. **Results:** Out of 500, significant bacteriuria was noted in 42 women (8.4%). *Escherichia coli* was the predominant organism isolated (64.3%) followed by *Klebsiella spp.* (11.9%). Fosfomycin (100%) and Nitrofurantion (92.6%) were found to be the most effective antibiotic against the urinary isolates. Ampicillin, Cotrimoxazole and Norfloxacin antibiotics which were used to treat urinary tract infection (UTI), have shown more resistance. No statistically significant association was observed between the occurrence of bacteriuria and the clinical profile like age, trimester, gravid and parity status of pregnant women. **Conclusion:** Asymptomatic bacteriuria is not uncommon among pregnant women. Thus, routine urine cultures and antibiotic susceptibility testing must be done to detect and treat it. Oral Nitrofurantoin and Fosfomycin are the antibiotic of choice for treatment of UTI in pregnant women.

Keywords: Asymptomatic bacteriuria, clinical profile, pregnancy, urine culture.

[*]**Address for Correspondence:**
Dr. A Mohankumar, Assistant Professor, Department of Microbiology, PK Das Institute of Medical Sciences, Ottapalam, Kerala-679522, INDIA.
Email: dkdrmogi@gmail.com
Received Date: 08/07/2015 Revised Date: 02/08/2015 Accepted Date: 08/09/2015

Access this article online

Quick Response Code:

Website: www.statperson.com

DOI: 11 September 2015

INTRODUCTION

Urinary tract infection (UTI) is a frequently encountered medical complication during pregnancy. It occurs in approximately 4-7% of pregnant women[1]. Multiple factors lead to the development of UTIs during pregnancy namely anatomical and physiological changes of the urinary tract leading to dilatation of ureter and increasing risk of urinary stasis. Furthermore, the glycosuria and amino-aciduria during pregnancy facilitates the growth of bacteria in urine. The presence of short urethra and anatomical proximity to the vagina in females increases the risk of UTI[2,3]. UTI in pregnancy can be symptomatic or asymptomatic. Asymptomatic bacteriuria (ABU) is defined as the "presence of actively multiplying bacteria within the urinary tract excluding the distal urethra", at a time when the patient has no urinary symptoms[4]. The incidence varies from 2-10%[2,4,5]. The most common infection is caused by *Eschericia coli* (E.coli) in 75-90%, followed by *Klebsiella pneumoniae, Proteus mirabilis*, *Coagulase Negative Staphylococcus* (CONS) and *Pseudomonas aeruginosa*. It is important to identify and treat the infected group. If left untreated, progress to symptomatic UTI including acute cystitis and pyelonephritis occurs in 15 to 45% and it is 4-fold higher than in non-pregnant women. They are also likely to develop postpartum UTI, hypertensive disease, anemia, prematurity, low birth weight babies and prenatal death[4,5]. ABU is a microbiological diagnosis based on the isolation of a specified quantitative count (greater than 10^5 Colony forming unit (CFU)/milliliters) of bacteria in a properly collected midstream specimen of urine from pregnant women without signs or symptoms of UTI. Thus, urine culture is the gold standard for diagnosis[6]. The relatively high prevalence of asymptomatic bacteriuria during pregnancy, the significant consequences for women and

How to site this article: A Mohankumar, J Kaur, M Deb, S Prateek. A study of asymptomatic bacteriuria in pregnancy. *International Journal of Recent Trends in Science and Technology*. September 2015; 16(2): 385-389 http://www.statperson.com (accessed 14 September 2015).

pregnancy, and the ability to avoid undesired outcomes with treatment justify screening and treatment. Bacteriuria should be treated with a 3 to 7 day course of antibiotics, which reduces the risk of complications[3]. The frequency of isolated pathogens and antibiotic resistance patterns can vary in different regions. With increasing antibiotic resistance, consideration of local pattern of resistance is necessary when choosing therapy. This study aims at looking into the incidence of asymptomatic bacteriuria in pregnancy, the causative organisms and their antibiotic resistance patterns.

MATERIAL AND METHODS

The study was undertaken at Departments of Microbiology and Obstetrics and Gynecology, during 2012-2013. A total of 500 pregnant women who presented for a regular antenatal care in the antenatal clinic were included and those with a history of urinary tract symptoms (dysuria, frequency, and urgency, etc.), diabetes mellitus, antibiotic administration within the previous two weeks, and fever were excluded from the study. The study and data collection were carried out with approval from the Institutional Ethical Committee. The women were instructed about the procedure of collecting mid-stream urine sample by clean catch method in a labeled sterile wide mouth screw cap container. The samples were immediately transported to the laboratory and were processed within one hour. In case of delay samples were refrigerated at 4-8^{0}C. The urine samples were cultured on 5% sheep blood agar (SBA) and Cysteine lactose electrolyte-deficient (CLED) medium by the semi-quantitative calibrated loop technique and incubated aerobically at 37^{0}C overnight. Pure growth of colonies corresponding to more than 10^5 CFU per ml was considered as significant bacteriuria. Significant bacterial isolates were identified by standard procedures. Antibiotic sensitivity testing was carried out by Kirby-Bauer Disk - Diffusion method and interpreted according to the Clinical and Laboratory Standard Institute (CLSI) guidelines[7]. The antibiotics tested for gram negative bacilli were: Ampicillin (10 µg), Amoxy-Clavulanic acid (20/10 µg), Norfloxacin (10 µg), Nitrofurantoin (300 µg), Co-trimoxazole (25 µg), Fosfomycin (200 µg), Amikacin (30 µg), Nalidixic acid (30 µg), Cefuroxime (30 µg), Cefotaxime (30 µg), Cefotaxime-clavulanic acid (30/10 µg) and Imipenam (10 µg). For gram positive cocci, Ampicillin (10 µg), Amoxy-Clavulanic acid (20/10 µg), Norfloxacin (10 µg), Nitrofurantoin (300 µg), Co-trimoxazole (25 µg), Fosfomycin (200 µg), Cefoxitin (30 µg), Gentamicin (10 µg), Vancomycin (30 µg) and Linezolid (30 µg) were used. Statistical analysis was performed using chi-square test. The *p* value less than 0.05 was considered as statistically significant.

OBSERVATIONS AND RESULTS

Out of the 500 pregnant women, who were screened for asymptomatic bacteriuria, 42 (8.4%) had significant bacteriuria while 458 (91.6%) did not have bacteriuria. The percentage of culture positivity was highest in age group 31-35 years (9.3%), followed by 8.7% and 8.2% in 21-25 and 26-30 years age group respectively. In our study, maximum percentage of culture positive cases were noted in second trimester (10.3%), followed next by first trimester (7.2%) and third trimester (6.3%). Significant bacteriuria was found more in primigravida (9.8%) than multigravida (6%). The percentage of culture positivity with significant bacteriuria was more in Multiparous women (10.8%) followed by Primiparous (8.7%) and Nulliparous (7.1%) [Table 1]. The most common organism isolated was *Escherichia coli* 27 (64.3%), followed by *Klebsiella pneumoniae* 5 (11.9%), CONS 4 (9.5%) and *Staphylococcus aureus* 3 (7.1%). *Proteus mirabilis*, *Enterobacter spp.* and *Enterococcus faecalis* were isolated in 1 case each [Table 2]. *E. coli,* the most common isolate showed 100% sensitivity to Fosfomycin and Imipenam, and showed good sensitivity to Nitrofurantoin and Amikacin with 92.6% and 70.4% and least sensitivity to Ampicillin, Co-trimoxazole and Amoxy Clavulanic acid with 3.3%, 18.5% and 33.3% of the organisms respectively. 33.3% of *E. coli* were found to be Extended spectrum beta lactamase (ESBL) positive. All other gram-negative bacteria were resistant to most of the antibiotics as that of *E. coli.* Gram-positive organisms showed 100% sensitivity to Fosfomycin and Vancomycin. Good sensitivity to Nitrofurantoin and Norfloxacin with 75% and 66.7% and least sensitivity to Ampicillin, Co-trimoxazole and Gentamicin with 25% each was noted. [Table 3].

Table 1: Clinical profile of ante-natal women (N=500)

Characteristic	Number screened	Number of ABU	P value
Age group (Years)			**0.967**
<20	44(8.8)	3(6.8)	
21-25	127(25.4)	11(8.7)	
26-30	219(43.8)	18(8.2)	
31-35	107(21.4)	10(9.3)	
>35	3(0.6)	0(0)	
Trimester			**0.370**

First	96(19.2)	6(6.3)	
Second	223(44.6)	23(10.3)	
Third	181(36.2)	13(7.2)	
Gravida			**0.136**
Primigravida	184(36.8)	11(6.0)	
Multigravida	316(63.2)	31(9.8)	
Parity			**0.610**
Nulliparous	196(39.2)	14(7.1)	
Primiparous	230(46.0)	20(8.7)	
Multiparous	74(14.8)	8(10.8)	

Figures in parenthesis denote percentage.

Table 2: Distribution of uropathogens in culture positive ABU (N=500)

Isolates	Number (%) of isolates
Escherichia coli	27(64.3)
Klebsiella pneumoniae	5(11.9)
Coagulase negative Staphylococcus	4(9.5)
Staphylococcus aureus	3(7.1)
Proteus mirabilis	1(2.4)
Enterobacter sp.	1(2.4)
Enterococcus faecalis	1(2.4)
Total	**42(100.0)**

Table 3: Antibiotic susceptibility pattern of Uropathogens

ANTIBIOTICS	Uropathogens No. (%) Sensitive						
	E. coli (n=27)	*K. pneumoniae* (n=5)	CONS (n=4)	*S. aureus* (n=3)	*Enterobacter sp.* (n=1)	*Proteus mirabilis* (n=1)	*Enterococcus sp.* (n=1)
AMP	1(3.7)	0	1(25.0)	1(33.3)	0	0	0
AC	9(33.3)	0	2(50.0)	1(33.3)	0	0	0
NX	15(55.6)	2(40.0)	2(50.0)	2(66.7)	0	1(100)	0
NF	25(92.6)	3(60.0)	3(75.0)	2(66.7)	0	-	1(100)
COT	5(18.5)	1(20.0)	1(25.0)	1(33.3)	0	0	0
FOS	27(100)	5(100)	4(100)	3(100)	1(100)	1(100)	1(100)
AK	19(70.4)	4(80.0)	-	-	1(100)	1(100)	-
NA	11(40.7)	2(40.0)	-	-	0	0	-
CU	11(40.7)	1(20.0)	-	-	0	0	-
CTX	14(51.9)	3(60.0)	-	-	0	1(100)	-
CCA	9(33.3)	2(40.0)	-	-	1(100)	0	-
IMP	27(100)	4(80.0)	-	-	1(100)	1(100)	-
CEF	-	-	2(50.0)	1(33.3)	-	-	-
GEN	-	-	1(25.0)	1(33.3)	-	-	0
VA	-	-	4(100)	3(100)	-	-	1(100)
LZ	-	-	-	-	-	-	1(100)

(AMP-Ampicillin, AC-Amoxy-Clavulanic acid, NX-Norfloxacin, NF-Nitrofurantoin, COT- Co-trimoxazole, FOS-Fosfomycin, AK-Amikacin, NA-Nalidixic acid, CU-Cefuroxime, CTX-Cefotaxime, CCA- Cefotaxime-clavulanic acid, IMP-Imipenam, CEF-Cefoxitin, GEN-Gentamicin, VA-Vancomycin and LZ-Linezolid)

DISCUSSION

Asymptomatic bacteriuria during pregnancy is a common cause of serious maternal and perinatal morbidity and with appropriate screening and treatment this morbidity can be reduced. In the present study, asymptomatic bacteriuria was diagnosed in 8.4%. It is in concurrence with other recent studies which reported the prevalence range of 2-10% [8,9,10]. An American cost evaluation study, suggests screening in all pregnant women if the prevalence of asymptomatic bacteriuria is more than 2% in that area[3]. Thus routine screening could be cost-effective in all the pregnant women. The percentage of culture positivity was highest in age group 31-35 years, but it was not statistically significant. This agrees with the other studies where there was no trend associated with age[2,12]. While some studies showed that the highest prevalence was in the younger age group,[10] others showed

that it is highest in the older age group[11]. In our study, most culture positive cases were seen in second trimester (10.3%), which was similar to other studies,[8,9] but their association was not proved statistically. Also, no statistical difference was observed for the occurrence of asymptomatic bacteriuria among the gravid and parity status of pregnant women in this study. Literature review shows that several factors are associated with asymptomatic bacteriuria during pregnancy. For example, some previous studies found that the incidence of asymptomatic bacteriuria is strongly associated with multiparity and during the third trimester. The same could not be correlated in the present study, and no statistical significance could be established. This agrees with observations made by other authors[2,11,12]. *Escherichia coli* was the predominant organism isolated (64.3%) followed by *Klebsiella spp.* (11.9%). This finding correlated with other studies[9,10,11]. *Proteus spp.* and *Enterobacter spp.* were isolated in 2.4% of cases each. Amongst the gram-positive cocci, CONS were isolated most frequently (9.5%), followed by Staphylococcus aureus (7.1%), *Enterococcus faecalis* (2.4%). However, other authors have reported *S. aureus* as the most common urinary pathogen among the gram-positive cocci[11,12]. In the present study, there were similarities in the organisms isolated as in other studies, i.e. members of family Enterobacteriaceae predominated. However, in certain respects, the organisms isolated were different from other studies, i.e. *Pseudomonas species, Streptococci* species and *Citrobacter* species were not isolated in the present study. Although the spectrum of agents causing UTI in pregnant women is relatively constant, their antibiotic susceptibility patterns are different in different geographical locations. Antibiotic susceptibility testing shows significantly high resistance to the β-lactam group of antibiotics and cotrimoxazole which are considered the traditional safe drugs in pregnancy, for both gram-negative bacilli and gram-positive cocci. Similar findings were obtained by others[8,13]. *E. coli* was sensitive to Nitrofurantoin (92.6%) and Amikacin (70.4%). This finding is in concordance with others[8,13]. However, Lavanya SV *et al*[10] reported that only 28.5% of isolates were sensitive to Nitrofurantoin. It was observed that the most useful antibiotics were, Nitrofurantoin and Amikacin. Ampicillin, Cotrimoxazole and Norfloxacin antibiotics which were used to treat UTI, have shown more resistance. Similar observations are made by many authors around the world. It is also noted in our study that there is increased resistance to third generation cephalosporin. A possible explanation for the resistance found might be the presence of 33.3% Extended Spectrum Beta-Lactamase (ESBL) in these strains. All these resistant strains were found susceptible to Imipenam and Fosfomycin. A systematic review found that fosfomycin has a high level of antimicrobial activity against Enterobacteriaceae isolates especially *E. coli* with advanced resistance to antimicrobial drugs, such as the ESBL producers[14]. In a meta-analysis, single-dose fosfomycin treatment was found to be equally effective and may provide a useful alternative option to β-lactams for the treatment of UTI, as the use of quinolones and sulfamethoxazole is avoided in pregnant women. These aspects, along with the favorable safety profile, make fosfomycin a valuable treatment option for asymptomatic bacteriuria and cystitis in pregnant women[15]. The isolates of gram-positive bacteria are few in the present study [Table 2]. However, half of *S. aureus* isolates and Coagulase negative Staphylococcus species were found to be methicillin resistant (MRSA). Sensitivity to aminoglycoside was lower among the gram positive cocci 33.3% in *Staphylococcus aureus* and 25% in CONS. Good susceptibility was shown with nitrofurantoin (75%), Fosfomycin (100%) and Vancomycin (100%).

CONCLUSION

In conclusion, given the potential sequelae of undiagnosed ABU in the obstetric population, all pregnant women should be screened for ABU. Oral Fosfomycin and nitrofurantoin are the antibiotic of choice for treatment of UTI in pregnant women. Although ampicillin and oral cephalosporins are useful and safe alternatives with a lower incidence of adverse effects, a significant number of isolates showed resistance to these antibiotics. Thus, the antibiotic sensitivity patterns should be used in determining therapy, as inappropriate therapy may lead to failure of treatment and recurrence with complications.

REFERENCES

1. McDermott S, Callaghan W, Szwejbka L, Mann H and Daguise V. Urinary Tract Infection during Pregnancy and Mental Retardation and Developmental Delay. Obstetrics and Gynecology 2000; 96(1): 113-119
2. Enayat K, Fariba F and Bahram N. Asymptomatic Bacteriuria among pregnant women referred to outpatient clinics in Sanandaj, Iran. Int Braz J Urol. 2008; 34(6): 699-707.
3. Nicolle LE, Badley S, Colgan R, Rice JC, Schaeffer A and Hooton TM. Infectious Disease Society of American Guidelines for Diagnosis and Treatment of Asymptomatic Bacteriuria in Adults. Clin Infect Dis 2005; 40(5): 643-654.
4. Jayalakshmi J, Jayaram VS. Evaluation of various screening tests to detect asymptomatic bacteriuria in pregnant women, Indian J Pathol Microbiol 2008; 51(3): 379-381.
5. Kacmaz B, Cakir O, Aksoy A and Biri A. Evaluation of rapid urine screening tests to detect asymptomatic

bacteriuria in pregnancy. Jpn J Infect Dis. 2006; 59(4): 261-263.
6. Lin K and Fajardo K. Screening for asymptomatic bacteriuria in adults: evidence for the U.S. Preventive Services Task Force reaffirmation recommendation statement. Ann Intern Med. 2008; 149(1): W20–W24.
7. Clinical and Laboratory Standards Institute guidelines. Performance standards for antimicrobial susceptibility testing; twentieth informational supplement, CLSI document M100-S20 (ISBN 1-56238-716-2). Clinical and Laboratory Standards Institute, 940 West Valley Road, Wayne, Pennsylvania 19087-1898 USA, 2010.
8. Girishbabu RJ, Srikrishna R and Ramesh ST. Asymptomatic bacteriuria in pregnancy. Int J Biol Med Res. 2011; 2(3): 740-742
9. Kerure SB, Surpur R, Sagarad SS and Hegadi S. Asymptomatic bacteriuria among pregnant women. Int J Reprod Contracept Obstet Gynecol. 2013; 2(2): 213-216.
10. Lavanya SV and Jogalakshmi D. Asymptomatic bacteriuria in antenatal women. Indian J Med Microbiol 2002; 20(2): 105-106.
11. Senthinath TJ, Rajalaksmi PC, Keerthana R, Vigneshwari RS, Revathi P, Prabhu N and Susethira AR. Prevalence of asymptomatic bacteriuria among antenatal women in rural tertiary care hospital, Tamilnadu, India. Int.j.curr.microbiol.app.sci, 2013; 2(1): 80-85.
12. Alfred AO, Chiedozie I and Martin DU. Pattern of asymptomatic bacteriuria among pregnant women attending an antenatal clinic at a private health facility in Benin, South-South Nigeria. Ann Afr Med. 2013; 12(3): 160-164.
13. Saraswathi KS and Aljabri F. Incidence of urinary tract infections in pregnant women in a tertiary care hospital. Der Pharmacia Lettre, 2013, 5(1): 265-268.
14. Falagas ME, Kastoris AC, Kapaskelis AM and Karageorgopoulos DE. Fosfomycin for the treatment of multidrug-resistant, including extended-spectrum β-lactamase producing, Enterobacteriaceae infections: a systematic review. Lancet Infect Dis, 2010; 10(1): 43–50.
15. Falagas ME, Vouloumanou EK, Togias AG, Karadima M, Kapaskelis AM, Rafailidis PI and Athanasiou S. Fosfomycin versus other antibiotics for the treatment of cystitis: a meta-analysis of randomized controlled trials. J. Antimicrob. Chemother. 2010, 65(9): 1862-1877.

Source of Support: None Declared
Conflict of Interest: None Declared