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Prevalence and Antimicrobial Susceptibility of Asymptomatic Bacteriuria among the Pregnant Women at Tertiary Care Teaching Hospital, Tirupati, Andhrapradesh, India - A Retrospective Study

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Abstract

Aim: This retrospective study aims to demonstrate the prevalence of asymptomatic bacteriuria by aerobic bacterial uropathogens among the pregnant women and to determine their susceptibility to various antimicrobial agents. **Materials and Methods:** A Retrospective study was conducted in a tertiary care teaching hospital, Sri Venkateswara Medical College, over a period of 12 months from January 2013 to December 2013. We included all pregnant women who underwent bacteriologic examination of 560 urine samples in the Department of Microbiology, Sri Venkateswara Medical College, Tirupati. With universal safety precautions, the urine specimens were processed. Identification was done by standard protocols. The antimicrobial susceptibility testing was done by Kirby Bauer's Disk Diffusion method and interpreted as per CLSI guidelines. **Results:** The isolates in the samples were Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosae and Proteus species. Escherichia coli occurred most frequently (46.67%) while Proteus Species had the lowest frequency of occurrence (10.37%) in the samples. The infection was most prevalent among the women aged between 21 - 30 years (63.25%) and lowest among those between 41 - 50 years of age (1.91%). Imipenem, Amoxicillin-clavulanic acid, Amikacin and Ceftriaxone were the antibiotics with the highest activity against E. coli. The susceptibility among Staphylococcus aureus is highest with Imipenem and Amoxicillin-clavulanic acid. With regard to Proteus spp. and Pseudomonas aeruginosae the highest activity was observed with Imipenem. **Conclusion:** Pregnancy promotes the progression of asymptomatic to symptomatic bacteriuria with its consequences such as pyelonephritis, urinary tract infections and increased foetal mortality, therefore regular urine analysis of all pregnant women by certified health authorities is recommended.

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1. Introduction

In developing countries, UTIs are among the most common health problems affecting women in their reproductive ages. Pregnant women are more susceptible to UTIs due to a combination of hormonal and physiologic changes that predispose them to bacteriuria. The incidence of acute pyelonephritis in pregnant women is also significantly increased. Factors such as history of recurrent urinary tract infection, diabetes, low social economic status, increasing maternal age, multiparity, and anatomical abnormalities of the urinary tract have also been associated with a two fold increase in bacteriuria during pregnancy. [1] Bacteriuria refers to the presence of bacteria in urine. The upper urethra is the most frequent site of infection within the urinary tract but the entire system is always at risk of invasion by bacteria once one of the parts is infected. [2]. It is generally accepted that 100,000 CFU/ml of urine is significant bacteriuria whether the patient is symptomatic or asymptomatic [3].

The apparent reduction in immunity of pregnant women appears to encourage the growth of both commensal and non-commensal microorganisms. The physiological increase in plasma volume during pregnancy decreases urine concentration and up to 70% pregnant women develop glucouria, which encourages bacterial growth in the urine.[4] Pregnancy causes numerous changes in the woman's body. Hormonal and mechanical changes increase the risk of urinary stasis and vesicoureteral reflux. These changes including shortness of the urethra and difficulty with hygiene due to a distended belly increase the frequency of urinary tract infections in pregnant women. Urinary tract infections are one of the most common bacterial infections during pregnancy. [5]Increased risk of infection of pregnant women and foetus as a result of asymptomatic bacteriuria has been reported [6]. Pregnancy enhances the progression from asymptomatic to symptomatic bacteriuria which could lead to pyelonephritis and obstetric outcomes such as prematurity, low birth weight and higher foetal mortality rates [7] [8].This retrospective study was carried out to determine the prevalence of uropathogens in urinary tract infections among the pregnant women receiving antenatal care at Government Maternity Hospital, Tertiary Care teaching Centre, Tirupati, Andhrapradesh, India. It is hoped that the result of this retrospective study would aid the planners of the health care delivery system in India, in the formulation of policies and programmes for the control of urinary tract infections by uropathogens especially among pregnant women.

2. Materials and Methods

This retrospective study was conducted at Department of Microbiology, Sri Venkateswara Medical College, Tirupati, Andhrapradesh, India. The study was a retrospective review of pregnant women admitted with the diagnosis of asymptomatic bacteriuria from 1 January 2013 to 31 December 2013. Following regulatory approvals by scientific committee, all patient information was kept confidential. A semi-structured questionnaire was prepared to record the medical history, examination details and investigation reports from Medical Record Section at Government Maternity Hospital, Tirupati, Andhrapradesh. Mid stream urine specimens were inoculated on Cysteine Lactose Electrolyte Deficient (CLED) Agar, Mac Conkey agar and Nutrient agar (Himedia Laboratories Pvt Ltd., Mumbai). After overnight incubation the plates were examined for bacterial growth. Further identification and confirmation of organisms was done by the standard identification technique which include studying the colonial morphology, Gram's stain and Biochemical reactions.

Antibiotic Susceptibility Study:

Antibiotic susceptibility patterns of the bacterial isolates were evaluated using disk diffusion technique according to criteria set by CLSI 2009. The antibiotic disc (ABTEK, India) containing the following antibiotics was used: Ampicillin (AMP) 10 µg, Ceftazidime (CAZ) 30 µg, Ceftriaxone (CTR) 30 µg, Amikacin (AK) 30 µg, Amoxicillin-clavulanic acid (AMC) 30 µg, Nitrofurantoin (NIT) 30 µg, and Ciprofloxacin (CPR) 5 µg, Cotrimoxazole (COT) 25 µg and Imipenem (IPM) 10µg.

Exception Criteria:

Those with positive urine cultures but with incomplete data were excluded. The exclusion criteria used to select the study cases were as follows: 1. A negative urine culture (no growth), 2. Urine specimen unsuitable for analysis (mixed growth or leaked specimen), 3. Multiple pregnancies with underlying renal disease (renal calculi and/or anatomical anomalies).

Statistical Analysis

All the study data were entered into the computer database using standard format, checked for errors and verified. Data maintained in the computer sheets were organised by SPSS version 17.0 software for Windows. Data will be presented in appropriate Tables by calculating percentage, rate etc.

3. Results and Discussion

Results

The urine samples obtained from 560 pregnant women receiving antenatal care at the in-patient and out-patient departments of Government Maternity Hospital, Tirupati, Andhrapradesh, were examined for asymptomatic bacteriuria. The prevalence of bacteriuria in the pregnant women is shown in Table 1.

Table 1: Prevalence of Asymptomatic Bacteriuria among the Pregnant Women

Pregnant Women	Number Examined	Number with Asymptomatic Bacteriuria	Prevalence (%)
Out-Patient Women	300	160	28.57
In-Patient Women	260	100	17.86
Total	560	260	46.43

Out of 560, 260 samples were found to contain bacterial cells in excess of 100,000 CFU/ml, indicating significant bacteriuria. The bacterial isolates from the urine samples of the pregnant women and their frequency of occurrence are shown in Table 2.

Table 2: Bacterial Isolates from the Urine Samples of the Pregnant Women and their frequency of occurrence.

Isolates	Identity	Number Isolated	Frequency of Occurrence (%)
1.	<i>Escherichia coli</i>	126	46.67
2.	<i>Staphylococcus aureus</i>	84	31.11
3.	<i>Pseudomonas aeruginosae</i>	32	11.85
4.	<i>Proteus species</i>	28	10.37

They were mostly gram negative rods. *Escherichia coli* occurred most frequently (46.67%), while *Proteus species* had the least frequency of occurrence (10.37%). The occurrence of asymptomatic bacteriuria in the pregnant women according to the age groups is shown in Table 3.

Table 3: Occurrence of Asymptomatic Bacteriuria among the Pregnant Women According to the Age Groups

Age Group	Number Examined	Number with Asymptomatic Bacteriuria	Percentage Occurrence (%)
16 -20	188	82	43.62
21 – 30	234	148	63.25
31 – 40	96	22	22.92
41 – 50	42	8	1.91

The occurrence was most common in the women between 21 and 30 years of age (63.25%) and lowest in those between 41 and 50 years (1.91%). The occurrence of asymptomatic bacteriuria according to the socio-economic status of the pregnant in-patient women is shown in Table 4.

Table 4: Occurrence of Asymptomatic Bacteriuria According to the Socio-Economic Status of the In-Patient Pregnant Women

Social Economic Status	Number examined	Number with Asymptomatic Bacteriuria	Percentage Occurrence (%)
House Wives	102	52	50.98
Farmers	98	36	36.74
Civil Servants	60	12	20

The occurrence was most among House Wives (50.98%) and lowest among the civil servants (20%). The occurrence of asymptomatic bacteriuria according to the socio-economic status of the pregnant out-patient women is presented in Table 5.

Table 5. Prevalence of Asymptomatic Bacteriuria According to the Socio-Economic Status of the Out-Patient Pregnant Women.

Social Economic Status	Number examined	Number with Asymptomatic Bacteriuria	Percentage Occurrence (%)
House Wives	122	76	62.3
Farmers	104	58	55.77
Civil Servants	74	26	35.14

The occurrence was also highest among the pregnant House Wives (62.3%) and lowest among the pregnant civil servants (35.14%)

Table 6: Antibiotic resistance of the uropathogenic bacteria isolated from pregnant women.

Uropathogenic Isolate	AMP (%)	CTR (%)	CAZ (%)	IPM (%)	AK (%)	COT (%)	NIT (%)	AMC (%)	CIP (%)
<i>Escherichia coli</i> (N = 126)	87.6	22.4	40.2	1.2	22.2	76.4	36.9	14.2	48.2
<i>Staphylococcus aureus</i> (N = 84)	88.6	26.8	36.2	00	21.4	62.8	10.2	00	5.2
<i>Pseudomona spp</i> (N = 32)	100	53.6	62	0.8	12.4	69	78	14.2	76.8
<i>Proteus spp</i> (N = 28)	60	48.4	54	00	10.2	53.3	56.2	10.6	72.8
TOTAL	86.52	37.8	48.1	0.5	16.55	65.38	45.33	9.75	50.75

Imipenem, Amoxicillin-clavulanic acid, Amikacin and Ceftriaxone were the antibiotics with the highest activity against *E. coli*. The susceptibility among *Staphylococcus aureus* is highest with Imipenem and Amoxicillin-clavulanic acid. With regard to *Proteus spp.* and *Pseudomonas aeruginosae* the highest activity was observed with Imipenem.

Discussion

In this retrospective study, out of the 560 urine samples from pregnant women in both the in-patient and out-patient departments of Government Maternity Hospital, Sri Venkateswara Medical College, 260 showed significant bacteriuria, giving a prevalence rate of 46.43% (Table1). The prevalence was higher in the pregnant women in the out-patient department than in the in-patient department. This may be due to the fact that the in-patient pregnant women were receiving adequate medical care than their out-patient counterparts. We excluded patients with incomplete documentation, a negative urine culture (no growth), urine specimen unsuitable for analysis (mixed growth or leaked specimen) and Multiple pregnancies with underlying renal disease (renal calculi and/or anatomical anomalies). The prevention of UTI in pregnancy aims at preventing colonization of urine through measures such as proper hygiene, prevention of constipation, good toilet training, abundant fluid intake, frequent urination and routine post-coital urination. [9],[10],[11],[12]. Screening for bacteriuria is recommended among all pregnant women at the first prenatal visit and in the last trimester of pregnancy. [13],[14]. The most effective method is urinalysis followed by culture. In the presence of risk factors for UTI (previous history of UTI, pre-existing renal disease, diabetes), it is recommended to do urinalysis every month. [15],[16]. In this retrospective study, out of the 560 urine samples from pregnant women in both the in-patient and out-patient departments of Government Maternity Hospital, Sri Venkateswara Medical College, 260 specimens showed significant bacteriuria, giving a prevalence rate of 46.43% (Table 1). The prevalence was higher in the pregnant women in the out-patient department than in the in-patient department. This may be due to the fact that the in-patient pregnant women were receiving adequate medical care than their out-patient counterparts.

We excluded patients with incomplete documentation, a negative urine culture (no growth), urine specimen unsuitable for analysis (mixed growth or leaked specimen) and Multiple pregnancies with underlying renal disease (renal calculi and/or anatomical anomalies). Mainly Gram negative bacteria belonging to Enterobacteriaceae were isolated from urine samples of pregnant women. The most predominant uropathogen was *Escherichia coli* accounting for 46.67% was seen in our study in comparison to most frequently isolated organism in Britain (65.1%) and in two US studies by Sahm et al., in 2001 [17]. This finding is similar to other reports which suggest that gram negative bacteria, particularly *E. coli* are the commonest pathogens isolated from patients with UTI. The incidence of *E. coli* in our study was higher when compared with the Nigerian studies reporting 42.10% [18]. Most of the studies conducted in Africa and Arab countries showed less than 50% isolation of *E. coli* from the UTI patients but reported a higher percentage (29%) of *Staphylococcus aureus* as second most frequently isolated bacteria from UTI cases. Reports from other developing or developed countries were the isolation of Gram positive bacteria as uropathogen is very low <10% [19], [20], [21]. Our study confirmed that *E. coli* is still the most frequent pathogen in both outpatient and inpatient settings [22]. It can, therefore, be inferred from the above results that the prevalence of Asymptomatic bacteriuria varies from one geographical location to another, which can possibly be attributed to differences in the mode of screening and/or compounding risk factors such as age, parity, educational level, social

habits of the community, differences in health care environmental and personal hygiene.[23], [24]. The results of antimicrobial resistance of isolated bacteria showed that the percentage of resistance as the following; high resistance to Ampicillin (86.52 %), Co-trimoxazole (65.38 %) and Ciprofloxacin (50.75%) was observed. Also, It was found moderate resistance to Nitrofurantoin (45.33%), Ceftazidime (48.1 %), Ceftriaxone (37.8 %) and Amikacin (16.55 %). Imipenem (0.5%) and Amoxicillin-clavulanic acid (9.75%) most active antibiotics against isolated uropathogens with the lower resistance prevalence. The predominant uropathogens in this study exhibited high resistance to cephalosporins and penicillins and this may be due to the production of Extended-spectrum beta-lactamases (ESBLs) especially with Ampicillin and Ceftazidime. The main risk factors ESBL-producing pathogens isolated from pregnant women with UTI are recurrent urinary tract infections and antibiotic exposure. [25].The present findings showed that the Gram-positive isolates were most sensitive to Imipenem and Amoxicillin-clavulanic acid and Nitrofurantoin in contrast with fluoroquinolones. Our finding in agreement with the study done in Addis Ababa in which most Gram negative isolates from patients with UTIs showed high susceptibility to Imipenem and Amoxicillin-clavulanic acid, Amikacin and nitrofurantoin. [26]. Because of the lack of surveys for antimicrobial resistance and the absence of control prescribing policies, the antibiotic resistance among pathogenic bacteria is a major health problem in developing countries and affects the whole world. The developing multidrug resistant bacteria (MDR) making treatment a difficult task and therefore increase threat to both mother and fetus and will minimize chance of prescribing safe antibiotic, infection difficult to eliminate and treatment successes hard to achieve.[27]. In pregnant women, UTIs are complicated problems because of there is no suitable antibiotics for treatment and due to the greater risk of pyelonephritis. The high prevalence of isolates which resistant to cephalosporins and ampicillin in our local strains limits the use of these antibiotics in pregnant women, therefore, safer alternatives were used such as Imipenem, amoxicillin/clavulanate, Amikacin and nitrofurantoin for cystitis, while pyelonephritis should be treated with fourth-generation cephalosporins. [27] Antibiotic choice can be tailored based on organism sensitivities when available from urine culture results. One-day antibiotic courses are not recommended in pregnancy, although 3-day courses are effective.[28] Antibiotics commonly used include amoxicillin, ampicillin, cephalosporins, nitrofurantoin, and trimethoprim-sulfamethoxazole.

4. Conclusion

In conclusion, UTI needs to be detected and treated promptly because treatment has shown its effectiveness in preventing pregnancy related complications. Routine screening for asymptomatic bacteriuria should be practiced regularly. E. coli is the commonest organism causing UTI in pregnancy. There was a need for control of the use of non prescribed antibiotics. Also, continuous monitoring of antibiotic resistance profiles of uropathogenic isolates in the pregnant women. The antibiotic susceptibility testing before antibiotic prescription is very necessary in order to ensure adequate treatment of urinary tract infection.

5. Competing Interests

The author(s) declare that they have no competing interests.

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