

## Study on Bacterial Profile of Urinary Tract Infection and Antimicrobial Susceptibility Pattern among Pregnant Women: A Study from a Tertiary Care Hospital

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### Abstract

*Introduction:* Urinary tract infections (UTI) are the most common infections in clinical practice. They can have serious complications on maternal and fetal outcome when they occur in pregnancy. Screening all pregnant women for significant bacteriuria can prevent the complications of UTI in pregnancy. *Aims and Objectives:* To study the bacterial profile of urinary tract infections and the antimicrobial susceptibility patterns among pregnant women. *Material and Methods:* This was a prospective hospital based study carried out in the Department of Microbiology, Deccan College of Medical Sciences, Hyderabad, Telangana, over a one year period from April 2016 to March 2017. *Results:* A total of 235 urine samples were received from pregnant women and processed in Microbiology laboratory. 110 urine samples showed significant bacteriuria. The most commonly isolated bacteria were *E. coli* 80 (72.7%), *K. pneumoniae* 7 (6.3%), *S. aureus* 13 (11.8%), *P. aeruginosa* 5 (4.5%), Coagulase negative staphylococci 5 (4.5%). *Conclusion:* This study showed that prevalence of UTI in pregnant women was 36.2%. It was also observed that *E. coli* (72.7%) was the most frequently isolated bacteria. All pregnant women should be screened for UTI with a urine culture and treated with antibiotics if the culture is positive.

**Keywords:** Urinary Tract Infection; Pregnancy; Urine Culture Antimicrobial Susceptibility.

### Introduction

Urinary tract infections are the most common infections in clinical practice [1]. Urinary tract infection (UTI) is one of the most important causes of morbidity in the general population, and is a frequent cause of hospital visits [2]. It has been estimated that globally symptomatic UTIs result in as many as 7 million visits to outpatient clinics, 1 million visits to emergency departments, and 100,000 hospitalizations annually [3]. The most common pathogenic organisms of UTI are *Escherichia coli*,

*Staphylococcus saprophyticus* and less common organisms are *Proteus* sp., *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Enterococci* and *Candida albicans* [4]. There are some structural and functional urinary tract changes, typical for pregnancy. In about 80% of pregnant women dilation of the urinary tract combined with slight hydronephrosis is observed, caused partly by a reduction in smooth muscle tone with slowing of ureteral peristalsis, and partly by urethral sphincter relaxation. This may be due to high levels of circulating progesterone [5]. Urinary tract infections (UTIs) in pregnant women pose a clinical problem and a great challenge for physicians.

Although the incidence of bacteriuria in this population is only slightly higher than in non-pregnant women, its consequences for both the mother and the fetus are severe. There is a much higher risk (up to 40%) of progression to pyelonephritis, and possibly increased risk of pre-eclampsia, premature birth and low neonatal birth weight. The increased level of progesterone in pregnancy is thought to contribute to the increased risk of UTI [5-11].

#### *Aim of the Study*

The aim of the study was to assess bacterial profile of urinary tract infections and their antimicrobial susceptibility patterns among pregnant women attending antenatal clinic at Deccan College of Medical Sciences and Owaisi Research Centre, Hyderabad.

#### **Materials and Methods**

This was a prospective hospital based study done from April 2016 to March 2017 (one year). A total of 235 urine samples were studied from pregnant women between the age of 18 to 40 years who were attending antenatal clinic at Deccan College of Medical Sciences and Owaisi Research Centre. The clinical details including name, age, and address of the patients were recorded.

Early morning clean-catch midstream urine sample was collected from each pregnant woman into a wide-mouthed sterile screw capped container. Samples were labeled and analyzed within 30 minutes of collection.

The collected urine samples were inoculated on CLED (cysteine lactose electrolyte deficient agar) agar

plates and the culture media were incubated aerobically at 37°C.

The urine culture plates were examined for pure growth determined by morphologically same type of colonies and colony counts for determination of significant and insignificant growth.

Urine culture was then performed. Identification and characterization of isolated bacteria included Gram stain followed by microscopic examination, motility test and biochemical tests as described by other workers [12-15].

For drug susceptibility test, Mueller Hinton agar (MHA) was used and commercial antibiotic multidisc were used as described by Al-ghalibiet al [16]. Antibiotic discs, Amoxicillin (AMX) 25µg, Augmentin® (AUG) 10µg, Cotrimoxazole (COT), Ciprofloxacin (CIP) 10µg, Gen-tamycin (GEN)10µg, Imipenim (IPM)10µg, Levofloxacin (LEV) 30µg, Meropenem (MEM) 10µg, Nalidixic acid (NA 30ug), Oflox-acin (OFL) 5µg, were used. Zone of inhibition was measured to determine the level of susceptibility of isolates to the antibiotics. Data obtained in this study were analyzed using SPSS version 16.0.

A growth of  $\geq 10^5$  colony forming units/ml was considered as significant bacteriuria.

#### **Results**

About 235 urine samples were collected from all pregnant women during the study

Among 235 cases, 110/235 (46.8%) cases were positive for bacteria and 125/235 (53.1%) were negative.

On microscopic examination pus cells were predominant finding in 85 (77.2%) cases.

**Table 1:** Distribution of UTI in different age groups

Age (years)	No. of Cases	No. of Positive Cases	No. of Negative Cases
18-22	37	16	21
23-27	61	21	40
28-32	89	59	30
33-37	42	11	31
38-40	06	03	03
Total	235	110	125

**Table 2:** Microscopic examination of urine samples

Isolates	No. of Positive Samples	(%)
Pus cells	85	77.2%
Red blood cells	10	9.09%
Yeast cells	15	13.6%
Total	110	100%

**Table 3:** Bacteria isolated from the urine samples

Isolated Organisms	Number of Positive Sample	Percentage (%)
E. coli	80	72.7%
S.aureus	13	11.8%
K.pnuemoniae	07	6.3%
Coagulase negative staphylococci	05	4.5%
Acinetobacter	02	1.8%
Enterococci	03	2.7%
Total	110	100 %

**Table 4:** Antibiotic sensitivity pattern of Gram Negative bacteria

Gram Negative bacteria	AMC	AMP	CIP	CTX	CTR	GEN	NIT	AK	NX	IPM	T
E.coli (80)	35(43.7%)	10(12.5%)	47(58.7%)	42(52.5%)	36(45%)	447(58.7%)	74(92.3%)	45(56.2%)	47(58.7%)	80(100%)	29(36.8%)
K. Pnuemoniae (7)	0	1(14.2 %)	1(14.2 %)	3(42.8%)	3(42.8%)	2(28.5%)	3(42.8%)	6(85.7%)	5(71.4%)	7(100%)	5(71.4%)
Acinetobacter (2)	0	0	1(50%)	1(50%)	1(50%)	1(50%)	1(50%)	1(50%)	1(50%)	2(100%)	1(50%)

**Table 5:** Antibiotic sensitivity pattern of Gram Positive bacteria

Gram positive bacteria	AMC	AMP	CIP	CTX	CTR	GEN	NX	C	COT	LZ	P	E	T
S.aureus (13)	7(53.8%)	3(23%)	9 (69.2%)	7 (53.8%)	8 (61.5%)	5 (38.4%)	9 (69.2%)	7 (53.8%)	10 (76.9%)	13 (100%)	3 (23%)	5 (38.4%)	7 (53.8%)
CONS(5)	2(40%)	1(2%)	2(40)	2 (40%)	3 (60)	2 (40%)	2 (40%)	4 (80%)	3 (60%)	5 (100%)	1 (20%)	1 (20%)	3(60%)
Enterococci (3)	0	0	1 (33.%)	0	0	1 (33.3%)	0	0	1 (33.3%)	3 (100%)	0	0	0

**Table 6:** Incidence of UTI by trimester period

Trimester Period	No. of Cases	Percentage (%)
I trimester (1st 3 months)	10	9.0 %
II trimester (2nd 3 months)	40	36.3%
III trimester (3rd 3 months)	60	54.5%
Total	110	100 %

The most commonly isolated bacteria were E. coli 80 (72.7%) followed by S. aureus 13 (11.8%).

Gram-negative bacteria were more prevalent (80.9%) than Gram-positive bacteria (19%).

AMP-Ampicillin, AMC-Amoxiclav, CTX-Cefotaxime, CTR-Ceftriaxone, CIP-Ciprofloxacin, GEN-Gentamicin, AK-Amikacin, NIT-Nitrofurantoin, T-Tetracycline, NX-Norfloracin, IPM-Imipenem.

CONS- Coagulase negative Staph, AMP-Ampicillin, AMC-Amoxiclav, CTX-Cefotaxime, CTR-Ceftriaxone, CIP-Ciprofloxacin, GEN-Gentamicin, AK-Amikacin, NIT-Nitrofurantoin, T-Tetracycline,

NX-Norfloracin, IPM-Imipenem.

All Gram negative bacteria 80 (100%) in our study were sensitive to Imipenem which is not a safe drug in pregnancy.

E. coli 74 (92.3%) and Klebsiella 6(85.7%) were sensitive to nitrofurantoin which can be used in pregnancy.

Only 10 (12.55%) E.coli were sensitive to Ampicillin

In the present study, women in their 2nd and 3rd trimester were found to have the higher incidence of UTI; 36.3% and 54.5%, respectively.

## Discussion

In the present study a total of 235 urine samples from pregnant women were studied for bacteriuria. The rate of positive samples was 46.8%. In a study by Samaga et al [17] (n=124), 36.2% samples yielded significant bacterial growth. Jain et al [18] 150 urine specimens from pregnant women were studied for bacteriuria. In the study by Manjula et al [19] (n=417), 49.4% showed significant bacteriuria.

In the present study, on microscopic examination pus cells were predominant 85 (77.2%) followed by yeast cells 10 (9.09%) and red cells 15 (13.6%). In the study by Manjula et al [19] urine microscopy revealed >10 pus cells/high power (40×) field. In a study by Battikhi et al [20] (n=123) microscopic observation of midstream urine samples revealed white blood cells (pus cells) in 26% cases and red blood cells in 9.7% cases. In our study, the age groups of 28-32 (53.6%) years and 23-27 (19%) years showed highest incidence of bacteriuria. In the study by Manjula et al [19] women in the age groups of 21-25 and 36-40 years showed highest incidence.

In the present study, the most commonly isolated bacteria were *E. coli* 80 (72.7%) followed by *S. aureus* 13 (11.8%), *K. pneumoniae* 7 (6.3%), *S. aureus* 13 (11.8%), *P. aeruginosa* 5 (4.5%) and Coagulase negative staphylococci 5 (4.5%). Gram-negative bacteria were more prevalent (80.9%) than Gram-positive bacteria (19%). Jain et al [18] observed significant bacteriuria, >10<sup>5</sup> colony forming units (CFU) per ml in 52 (34.6%) patients among 150 patients. Various bacteria isolated from the urine sample in their study were *E. coli* (44.2%), *K. pneumoniae* (19.2%), *S. aureus* (21.1%), *P. aeruginosa* (7.6%) and *E. aerogens* (7.6%). In the study by Manjula et al [19] majority of the isolates (99%) were Gram negative bacteria which included *Escherichia coli* (56.7%), *Klebsiella* spp (19.9%), *Pseudomonas* spp (6.3%), *Proteus* spp (5.8%), *Enterobacter* spp (3.8%), *Citrobacter* spp (1.4%), *Enterococcus* spp (0.9%), and other NFGNB (4.8%). Battikhi et al [20] observed prevalence of gram negative and gram positive bacteria to be 37 (69.8%) and 14 (26.4%) respectively. *E. coli* showed the highest prevalence rate followed by *S. Aureus* 11 (30.8%) and *K. pneumoniae* 7 (13.2%).

*E. coli* and *S. aureus* were the most common isolates in all age groups [3,8] however; *P. aeruginosa* was isolated from age group 38-42 years exclusively. In the study by Samaga et al [17] *E. coli* (42.2%) was isolated as predominant pathogen followed by *Staphylococcus aureus* (17.8%), *CONS* (15.5%), *Klebsiella* (11.1%), *Enterococci* (6.7%) and *Acinetobacter* (6.7%).

In the present study, women in their 2nd and 3rd trimester were found to have a higher incidence of UTI; 36.3% and 54.5%, respectively. Manjula et al [19] have reported the prevalence of UTI by gestational age (age of pregnancy) as lowest in the 3rd month 25% followed by 29% in 5th month and highest, 70.2% in 7th month of pregnancy. While the incidence of UTI if taken by trimester was 43.3% and 54.1% in 2<sup>nd</sup> and 3rd trimester respectively than in the first trimester (25%) [18] also observed that women in their 2nd and 3rd trimester were found to have a higher incidence of UTI; 32.6% and 48%, respectively. Battikhi et al [20] also observed that women in their 2nd and 3rd trimester were found to have a higher incidence of UTI; 32.6% and 48%, respectively.

Jain et al [18] studied the antibiotic sensitivity pattern of isolated organisms. They found *E. coli* was highly sensitive to nitrofurantoin, *K. pneumoniae* to ciprofloxacin, *E. aerogenes* to ceftazidime, *P. aeruginosa* to ceftazidime and *S. aureus* was highly sensitive to levofloxacin and nitrofurantoin.

Battikhi et al [20] studied antibiotic sensitivity test and observed 100.0% activity for meropenem, imipenem and levofloxacin. They were the most active antibiotics and the rate of multidrug resistance was (>50%).

## Conclusion

UTI is one of the most common bacterial infections during pregnancy. Most of the UTIs during pregnancy can lead to complications and poor fetal outcome if untreated.

The most commonly isolated bacteria were *E. coli* and *S. aureus* and Gram-negative bacteria were more prevalent than Gram-positive bacteria. Early diagnosis and treatment of UTI in antenatal women should be done to prevent complications and improve pregnancy outcomes for both the mother and the baby.

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