Original Research Article

Prevalence of Urinary Tract Infections among Pregnant Women Visiting Antenatal Care Clinic in a Teaching Hospital: A Cross-sectional Study

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How to cite this article: Bibhas Kumar Sahu, Subasini Majhi, Madan Mohan Majhi et. al. Prevalence of Urinary Tract Infections among Pregnant Women Visiting Antenatal Care Clinic in a Teaching Hospital: A Cross-sectional Study. Indian Journal of Public Health Research and Development/Volume 15 No. 3, July-September 2024.

Abstract

Introduction: Urinary Tract Infection is a common infection in pregnant women and ranges from 3.3% to 24.6%. Though there are studies on patterns of microorganisms and the antibiotic susceptibility patterns, microorganism patterns vary in our locality and also the sensitivity pattern.

Objectives: (a) To study the prevalence of UTI in pregnant women (b) To identify the microorganisms associated (c) To find out their antimicrobial susceptibility pattern.

Methodology: A Cross sectional study was conducted for two months at the Antenatal Care Clinic in the Department of Obstetrics & Gynaecology and Department of Microbiology in S.C.B. Medical College and Hospital, Cuttack. **Sample Size**: Sample size was calculated to be 196 by using prevalence of UTI among pregnant women to be 15 % and with precision of 5% and 95% confidence level. In this study 200 pregnant women were included. **Statistical analysis:** Statistical analysis was done using SPSS. A P-value less than 0.05 was considered statistically significant.

Results: The overall prevalence of UTI was 14 % (95% CI 9.2-18.8) of which 8.5% cases were symptomatic for UTI and 5.5% were asymptomatic. Among the isolates, E. Coli (39.30%) was found to be the most common causative organism and showed higher sensitivity to Nitrofurantoin (100%) and Imipenem (72.7%). Klebsiella pneumoniae were sensitive to Imipenem, Ciprofloxacin and Amikacin (100%). Coagulase Negative Staphylococcus (CoNS) isolates were highly sensitive to Gentamicin, Ampicillin Sulbactam, Linezolid and Vancomycin (100%). Enterococcus faecalis were sensitive to Ampicillin, Sulbactam, Linezolid and Vancomycin (100%). Proteus mirabilis was found

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Submission date: September 8, 2023 **Revision date:** September 11, 2023 **Published date:July 4, 2024**

to be highly sensitive to Ciprofloxacin, Cefotaxime, Amikacin, Amoxyclav and Imipenem (100%). Staphylococcus aureus showed 100% sensitivity to Linezolid.

Conclusion: The overall prevalence of UTI in pregnant women visiting the antenatal care clinic for routine check-up was found to be 14% in this study. Some of the isolates were found to be resistant to the commonly used antibiotics. Therefore, culture and antimicrobial susceptibility testing should be carried out before prescribing antibiotics.

Keywords: Antimicrobial susceptibility, pregnant women, and urinary tract infection

Introduction

Urinary Tract Infection (UTI) are more common in women as compared to men. This is because the urethra in females is shorter and is in close proximity to the anus, which makes it easier for bacteria to enter the urinary tract. Certain conditions like Pregnancy increase the risk of UTI in females. Studies show that after anaemia, UTI is the second most common complication in pregnant women. [1,4]This is because various physiological changes both anatomical and hormonal take place in the female during pregnancy, which favour the development of UTI. At around the 6th week of pregnancy, the ureters begin to dilate, a condition known as "hydronephrosis of pregnancy"[2]. Increase in levels of hormones-estrogen and progesterone lead to decrease in ureteral and bladder tone. The pressure of the gravid uterus further leads to urinary stasis and vesico-ureteral reflux. The urine is also less acidic and contains more proteins and sugars. The combination of all these factors aggravates the risk of UTI in pregnancy.

UTI is diagnosed when there is an overgrowth of bacteria in the urinary tract ($\geq 10^5$ Colony Forming Units (CFU)/mL of urine), irrespective of the presence of clinical symptoms. Another condition, known as asymptomatic bacteriuria (more than 10^5 CFU/ mL of urine in a clinically asymptomatic person) is also common in pregnant women.[3] UTI includes a spectrum of disorders, ranging from those affecting the lower urinary tract, like cystitis, to those affecting the kidney, such as pyelonephritis. Apart from Bacteria, certain viruses (like Adenovirus) and fungi (like Candida) can also cause UTI.

UTI is a common infection in pregnant women, ample of studies enumerated the burdens of UTI among pregnant females and ranges from 3.3% to 24.6%. [5, 6, 7, 8] This also varies according to the trimesters of pregnancy. Most common organism isolated is *E.coli*, followed by *Klebsiella pneumoniae* and *S. aureus* (8.3% each), *Proteus mirabilis* (3.4%) and *Pseudomonas aeruginosa*. [9,8,6] High resistance was noted against the beta-lactam group of antimicrobials (35%-90%), fluoroquinolones (75%- 80%) and Cotrimoxazole (75%). Resistance was quite low against the aminoglycosides (0-15%) and Nitrofurantoin (10%) and virtually absent against Imipenem (0%). [9] Similar findings of antibiotic sensitivity test was demonstrated by various researchers. [6,7,8]

UTI (if left untreated) can adversely affect the health of foetus and the pregnant mother [4] and may lead to serious obstetric complications, poor maternal and perinatal outcomes like intrauterine growth restriction, preeclampsia, caesarean delivery and preterm deliveries. Therefore, all pregnant women visiting the Antenatal Care Clinic should be routinely screened for UTI. Though there are studies of patterns of microorganisms and the antibiotic susceptibility patterns, microorganism patterns may vary in our locality also the sensitivity pattern. With this back ground the study was conducted to (a) Study the prevalence of UTI in pregnant women (b) To identify the microorganisms associated with UTI (c) To find out their antimicrobial susceptibility pattern.

Material and Methods

A Cross sectional study was conducted for two months duration (August -September, 2022) at the Antenatal Care Clinic in the Department of Obstetrics & Gynaecology) and Department of Microbiology in S.C.B. Medical College and Hospital, Cuttack. All consented pregnant women visiting the Antenatal Care Clinic for check-up were included in the study. Patients with Known cases of underlying renal pathology or chronic renal disease were excluded. **Sample Size:** Sample size was calculated to be 196 by using prevalence of UTI among pregnant women to be 15 % [7] and with precision of 5% and 95%

confidence level and in this study 200 pregnant women were included. **Methodology:** Every alternate pregnant woman visiting the Antenatal Care Clinic at SCB Medical College, Cuttack for routine check-up in a day were approached to participate in the study. After receiving consent, relevant medical, obstetrical and socio-demographic characteristics were gathered using a questionnaire. They were inquired for history suggestive of UTI (like urgency, frequency etc.). Those who are unwilling to take participation subsequent patient was approached and the process was repeated till 200 patients. Mid-stream urine samples were collected using a wide mouthed, screw capped sterile container after cleaning the urethral meatus. Standard quantitative loop was used to inoculate urine sample on Cysteine Lactose Electrolyte Deficient (CLED) Agar and the plate was incubated for 24 hours at 37°C. A count of at least $10^{(5)}$ colony forming unit (CFU)/mL of urine was considered significant. Identification of causal organism was done using standard biochemical test.[10,11] Antimicrobial susceptibility testing [12] (AST) was performed by Kirby Bauer's Disc diffusion method on Mueller–Hinton Agar (MHA), following CLSI guidelines and the antimicrobial susceptibility pattern was recorded. **Statistical analysis:** The collected data was entered into Excel. Statistical analysis was then done using Statistical Package for the Social Sciences (SPSS) trial version. A Chi square test was performed on certain parameters. Bivariate analysis of the distribution of symptoms of UTI was done and the Odds Ratio and 95% Confidence Interval was noted. P-value less than 0.05 was considered statistically significant.

Results

The overall prevalence of UTI was 14 % (95% CI 9.2-18.8) of which 8.5% cases were symptomatic for UTI and 5.5% were asymptomatic. The results of urine culture reported that out of 200 women, significant growth (>10^5 CFU/mL of urine) was observed in 14% of women, while insignificant growth (< 10^5 CFU/mL of urine) was seen in 5.5% of women. Eight percent of the samples collected were contaminated. No growth was observed in the 72.5% samples. Association of demographic characteristics and UTI in patients has been shown in **Table 1.**

Table 1: Association of UTI and demographic characteristics of patients. (N=200)

Parameters	UTI present no. (%)	UTI absent no. (%)	X2 value	P-value
Age group(Years)				
21-30	19 (11.6)	145 (88.4)	4.4121	0.0356
31-40	9 (25.0)	27 (75.0)		
Socio- economic status				
High	0 (0.0)	4 (100.0)	0.022	0.989
Middle	21 (13.9)	130 (86.1)		
Low	7 (15.6)	38 (84.4)		
Personal hygiene				
Good	2 (6.2)	30 (93.8)	9.876	0.007
Average	14 (11.1)	112 (88.9)		
Poor	12 (28.6)	30 (71.4)		
Gestational age				
First trimester	0 (0.0)	23 (100.0)	8.722	0.012
Second trimester	5 (8.2)	56 (91.8)		
Third trimester	23 (19.8)	93 (80.2)		
History of previous UTI				
Present	0 (0.0)	12 (100.0)	1.025	0.311
Absent	28 (14.9)	160 (85.1)		
Any significant medical history				
Present	2 (5.9)	32 (94.1)	1.503	0.22
Absent	26 (15.7)	140 (84.3)		

The distribution of various symptoms of UTI has been shown in **Table 2**.

Table 2: Association of various symptoms and UTI in patients. (N=200)

Parameters	UTI		OR (95%CI)	P-value
	Present	Absent		
Distributions of symptoms of UTI				
Symptomatic cases	17(14.8)	98 (85.2)	1.1 (0.51-2.63)	0.71
Asymptomatic cases	11(12.9)	74(87.1)		
Increased frequency of urination				
Present	16 (14.55)	94 (85.45)	1.1(0.49-2.4)	0.8059
Absent	12 (13.33)	78 (86.66)		
Burning sensation during urination				
Present	4 (28.6)	10 (71.4)	2.7 (0.7-9.2)	0.1153
Absent	24 (12.9)	162 (87.1)		
Lower abdominal pain				
Present	8 (14)	49 (86)	1.0 (0.4-2.4)	0.9928
Absent	20 (13.9)	123 (86.1)		
Fever and malaise				
Present	2 (66.7)	1 (33.3)	13.1 (1.1 -150.2)	0.0381
Absent	26 (13.2)	171 (86.8)		

The study depicted that the presence of UTI was significantly associated with the presence of various symptoms of UTI like increased frequency of urination; burning sensation during urination; lower abdominal pain and Fever and malaise. The frequency of different microorganisms associated with UTI in pregnant women is shown in **Figure 1**.

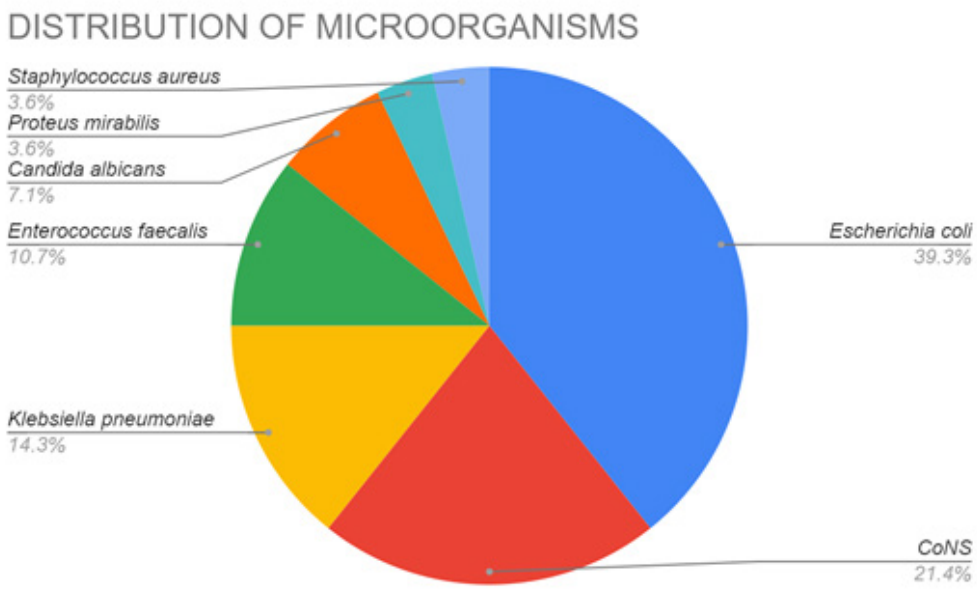

Figure 1: Frequency of different microorganisms associated with UTI in pregnant women (n=28)

Out of the total 28 samples showing significant growth in culture, seven different microorganisms were isolated. Among the isolates, *E.* Coli (39.30%) were found to be the most common causative organism of UTI in pregnant women. The Antimicrobial susceptibility pattern of the isolated bacteria has been shown in **Table 3**.

Table 3: Antimicrobial susceptibility pattern of isolated microorganism

ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF ISOLATED BACTERIA									
BACTERIAL ISOLATES	**PATTERN**	**ANTIBIOTICS TESTED**							
		IPM	**NIT**	**CTX**	**CIP**	**CPM**	**AK**	**AMC**	**VA**
E. coli (n=11)	S	8(72.7)	11(100)	4(36.4)	5(45.45)	2(18.2)	6(54.55)	3(27.27)	
	I	1(9.1)	0(0)	0(0)	1(9.1)	2(18.2)	0(0)	3(27.27)	
	R	2(18.2)	0(0)	7(63.4)	5(45.45)	7(63.4)	5(45.45)	5(45.45)	
Klebsiella pneumoniae(n=4)	S	4(100)	0(0)	0(0)	4(100)	1(25)	4(100)	2(50)	
	I	0(0)	0(0)	0(0)	0(0)	1(25)	0(0)	0(0)	
	R	0(0)	4(100)	4(100)	0(0)	2(50)	0(0)	2(50)	
CoNS(n=6)	S				0(0)				6(100)
	I				0(0)				0(0)
	R				6(100)				0(0)
Enterococcus faecalis(n=3)	S		2(66.7)		2(66.7)				3(100)
	I		0(0)		1(33.3)				0(0)
	R		1(33.3)		0(0)				0(0)
Proteus mirabilis(n=1)	S	1(100)		1(100)	1(100)	0(0)	1(100)	1(100)	
	I	0(0)		0(0)	0(0)	0(0)	0(0)	0(0)	
	R	0(0)		0(0)	0(0)	1(100)	0(0)	0(0)	
S. aureus(n=1)	S				0(0)				
	I				0(0)				
	R				1(100)				

ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF ISOLATED BACTERIA										
BACTERIAL ISOLATES	**PATTERN**	**ANTIBIOTICS TESTED**								
		A/S	**DOX**	**GEN**	**LZ**	**NV**	**OF**	**ERY**	**COT**	**CX**
E. coli (n=11)	S								5(45.45)	
	I								0(0)	
	R								6(54.55)	
Klebsiella pneumoniae (n=4)	S								3(75)	
	I								0(0)	
	R								1(25)	
CoNS(n=6)	S	6(100)	4(66.7)	6(100)	6(100)	6(100)				
	I	0(0)	0(0)	0(0)	0(0)	0(0)				
	R	0(0)	2(33.3)	0(0)	0(0)	0(0)				
Enterococcus faecalis(n=3)	S	3(100)	1(33.3)		3(100)		1(33.3)			
	I	0(0)	2(66.7)		0(0)		2(66.7)			
	R	0(0)	0(0)		0(0)		0(0)			

Continue.....

Proteus mirabilis(n=1)	S									
	I									
	R									
S. aureus(n=1)	S		0(0)	0(0)	1(100)			0(0)	0(0)	0(0)
	I		0(0)	1(100)	0(0)			0(0)	0(0)	0(0)
	R		1(100)	0(0)	0(0)			1(100)	1(100)	1(100)

S- Sensitive, I- Intermediate, R- Resistant IPM-Imipenem, NIT- Nitrofurantoin, CTX- Cefotaxime, CIP- Ciprofloxacin, CPM-Cefepime, AK- Amikacin, AMC- Amoxyclav, VA- Vancomycin, A/S-Ampicillin Sulbactam, DOX- Doxycycline, GEN- Gentamicin, LZ- Linezolid, NV-Novobiocin, OF- Ofloxacin, ERY-Erythromycin, COT-Cotrimoxazole, CX-Cefoxitin.

The most common isolate E. coli showed higher sensitivity to Nitrofurantoin (100%) and Imipenem (72.7%). All the isolates of *Klebsiella pneumoniae* were sensitive to Imipenem, Ciprofloxacin and Amikacin (100%). All the *Coagulase Negative Staphylococcus* (CoNS) isolates were highly sensitive to Gentamicin, Ampicillin Sulbactam, Linezolid and Vancomycin (100%). All the isolates of *Enterococcus faecalis* were found to be sensitive to Ampicillin Sulbactam, Linezolid and Vancomycin (100%). *Proteus mirabilis* was found to be highly sensitive to Ciprofloxacin, Cefotaxime, Amikacin, Amoxyclav and Imipenem (100%). *Staphylococcus aureus* showed 100% sensitivity to Linezolid.

Discussion

UTI is considered as one of the most common complications during pregnancy, which may lead to serious outcomes if left untreated. This study estimating the prevalence of UTI among pregnant women in an outpatient setting in a tertiary care hospital of Eastern Odisha. The overall prevalence of UTI in pregnant women in this study was 14%. This result is comparable with the study done previously in Bangalore, India by Rudri Bai IM et al. (15%).[7]Another study outside India by Abdikhaliq Hussein Ali et al. from Hargeisa, Somaliland has also reported similar estimate (16.4%). [13] Sabharwal ER et al. [9] and Sadhvi K et al. [8] have reported higher prevalence (24% and 24.6% respectively) as compared to this study. Kant et al. [14] Northern India, however, found out the overall prevalence of UTI to be 3.3 %, which was less as compared to this study. This variation could have been due to the differences in the environmental conditions, socio-economic backgrounds and levels of personal hygiene of the women in different parts of the country.

In this study, the prevalence of symptomatic UTI cases among pregnant women was 8.5%. This result agrees with the study by Abdikhaliq Hussein Ali et al. [13] conducted in Hargeisa, Somaliland, in which the prevalence of symptomatic UTI was 9.5%. However, higher prevalence of symptomatic UTI has been reported by Sadhvi K et al. (15.7%) [7] and lower prevalence has been reported by Kant et al. (2.2%). [14] The prevalence of asymptomatic UTI cases in this study was 5.5%. Higher prevalence of Asymptomatic UTI has been recorded by R. Sujatha et al [6] from Kanpur (7.3%) and lower prevalence has been recorded by Kant et al. (1.1%). [14] This difference in the prevalence of symptomatic and asymptomatic UTI might be due to variation in sample size taken into study.

According to the results of this study, *E. coli* (39.30%), *CoNS*(21.40%), *Klebsiella pneumoniae* (14.30%), *Enterococcus faecalis* (10.70%), *Candida albicans* (7.10%), Proteus mirabilis (3.60%) and *Staphylococcus aureus* (3.60%) were the various microorganisms isolated from the collected urine samples. *E. coli* was found to be the most common causative organism in this study. This is because *E. coli* is the most common organism found normally in the rectum and could have reached the urinary tract due to lack of proper hygiene. Other studies by Sadhvi K. et al.[8] and Sibi et al.[15] from Bangalore found the percentage of *E. coli* in the isolates to be 34.4% and 43.9% respectively, which is in line with this study. Higher percentage of *E. coli* has been reported by Sabharwal ER et al. (63.3%).[9] CoNS (21.40%) turned out to be the second most common isolate in this study. Study by Abdikhaliq Hussein Ali et al.[13] also found CoNS (15.9%) to be the second

most common isolate in urine samples collected from pregnant women.

This study depicted that most of the ***E. coli*** isolates were the most sensitive to Nitrofurantoin (100%) and Imipenem (72.7%), commonly used drugs against E. coli. Higher resistance was seen against Cefotaxime and Cefepime (63.4% each). Very less sensitivity to Amoxyclav (27.2%) was observed. Study by R. Sujatha et al. [6] however shows higher sensitivity to both Imipenem and Cefepime (100% each) and Amoxyclav (70%). Study by Sadhvi K et al. [8] showed higher sensitivity to both Nitrofurantoin (91.4% and 100% in symptomatic and asymptomatic cases, respectively) and Imipenem (97.1% and 100% in symptomatic and asymptomatic cases, respectively) but shows least sensitivity (0%) to Amoxyclav. In this study, *Klebsiella* was found to be 100% sensitive to Ciprofloxacin, Imipenem and Amikacin and 100% resistant to Nitrofurantoin and Cefotaxime. Three out of four (75%) of the samples showed sensitivity to Cotrimoxazole and 50% of the samples showed sensitivity to Amoxyclav. R Sujatha et al. [6] recorded similar sensitivity to Imipenem (100%), Ciprofloxacin (100%) and Amoxyclav (50%). Sadhvi K et al. [8] however reported least sensitivity to Cotrimoxazole (0%). *Enterococcus faecalis* was found to be 100% sensitive to Linezolid, Vancomycin and Ampicillin Sulbactam and 66.7 % sensitive to Nitrofurantoin and Ciprofloxacin. Higher sensitivity (100%) to Nitrofurantoin and Ciprofloxacin was recorded by Sadhvi K et al. [8] They, however reported least sensitivity to Ampicillin Sulbactam (0%). *Proteus mirabilis* was 100% sensitive to Imipenem, Cefotaxime, Ciprofloxacin, Amikacin and Amoxyclav and 100% resistant to Cefepime. R Sujatha et al. [6] also showed 100% sensitivity to Imipenem, Ciprofloxacin, Amikacin and Amoxyclav. They however reported 100% sensitivity to Cefepime, which was different from this study. Study by Abdikhaliq Hussein Ali et al. [13] varied from this study and reported only 25% sensitivity to Amoxyclav. **Coagulase Negative *Staphylococcus aureus***was found to be 100% sensitive to Vancomycin, Linezolid, Gentamicin and Ampicillin Sulbactam. It was found to be 100% resistant to Ciprofloxacin. Abdikhaliq Hussein Ali et al. [13], however, reported higher sensitivity (63.6%) to Ciprofloxacin. ***Staphylococcus aureus*** was found to be 100% sensitive to Linezolid and showed 100% resistance to Ciprofloxacin, Doxycycline Erythromycin and Cotrimoxazole. In contrast, reported higher sensitivity to Ciprofloxacin (65%) and Erythromycin (85%). R Sujatha et al. [6]also showed higher sensitivity to Cotrimoxazole (100%) as compared to this study. In this study, Staphylococcus aureus was found to be 65% resistant to Cefoxitin and was therefore identified as MRSA (Methicillin-resistant staphylococcus aureus).

The cause of variation in pattern of antimicrobial susceptibility in different studies from different areas is due to the development of resistant strains of bacteria, caused primarily due to self-medication and indiscriminate use of antibiotics.

Conclusion

The overall prevalence of UTI in pregnant women visiting the antenatal care clinic for routine check-up was found to be 14% in this study. Pregnant women in the age group of 21-30 years and in the third trimester of pregnancy had the highest prevalence of UTI as compared to their other counterparts. UTI has been recognized as one of the most common complications during pregnancy. The study also focused on the antimicrobial susceptibility pattern of various antibiotics used in UTI. Some of the isolates were found to be resistant to the commonly used antibiotics. Therefore, culture and antimicrobial susceptibility testing should be carried out before prescribing antibiotics.

Conflict of interest: Nil

Source of Funding: Provided by the institution as a part of ICMR STS project.

Ethical Clearance: Ethical clearance obtained from Institutional Ethics Committee Date of ethical clearance- 02.06.2022 . Reference number of ethical clearance-1057 and written informed consent was taken from each participant.

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