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RESEARCH ARTICLE

Bacteriological profile of urinary tract infection in pregnant women in a tertiary care hospital in Western Assam

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ABSTRACT

Background: UTI is a common morbidity in pregnancy, which leads to a harmful impact on pregnancy outcome. Early diagnosis and definitive treatment, following culture and sensitivity testing, alleviate symptoms and are crucial for the well-being of both the mother and the fetus. **Methods:** A hospital-based retrospective cross-sectional study was conducted in the Department of Microbiology in a tertiary care Hospital, Dhubri, to determine bacteriological profile of urinary tract infection in pregnant women and their antimicrobial susceptibility pattern. Data were collected from the hospital electronic database and laboratory E database, urine culture and sensitivity with effect from 1st July 2024 to 30th June 2025. Significant bacterial isolates (as per Kass criteria) were analyzed conventionally by observing colony morphology, gram staining, and automated method in Vitek 2 MS using identification (ID)and antimicrobial sensitivity (AST) card with inoculums size 0.5MF according to Clinical Laboratory Standard Institute (CLSI). **Results:** Out of 234 cases, 13.24% yielded significant growth, and GNB (80.65%) was significantly higher compared to GPB (19.35%) isolates (p value <0.01). E.coli (61.29%) outnumbered all other isolates, followed by Ksp (12.90%), SA (9.67%), and Esp (6.45%). E. coli was sensitive to Imipenem (100%), Fosfomycin (100%) followed by Amikacin (89.5%), Nitrofurantoin (68.4%), and Piperacillin-Tazobactam (57.9%). Ciprofloxacin (31.6%) and Ceftazidime (31.6%) were found to be the most resistant. Ksp was found to be the most sensitive to Imipenem (100%), followed by Amikacin (75%), Gentamycin (75%), whereas SA was 100% sensitive to Linezolid, Daptomycin,Vancomycin, followed by 66.6% Gentamycin, Ciprofloxacin, and Levofloxacin. MRSA was detected in 66.6% of SA isolates. Incidence of bactereuria was significantly higher in lower socioeconomic and illiterate women and 1st trimester of pregnancy (p value < .05). **Conclusion:** UTI is significant in pregnant women, which leads to complications and recurrence. Besides good genital hygiene, guided treatment after urine culture sensitivity is a must during pregnancy. So that early diagnosis and definitive treatment can be started in the patient with UTI to reduce complications and improve the outcome of pregnancy.

Keywords: Urinary tract infection, bacteriuria, pregnancy, Escherichia coli.

Urinary tract infection (UTI) in pregnancy is one of the commonest problems worldwide and under diagnosed or hidden co morbidity of pregnancy, which may cause adverse clinical and birth outcomes in women of lower socioeconomic status living in a developing country [1]. UTI is defined as significant bacteriuria $\geq 10^5$ colony colony-forming units (CFU) per ml of clean catch midstream urine, which is either due to bacterial colonization or UTI [2, 3]. Increased incidence of UTI in pregnancy is reported due to its anatomy related to the short urethra and its close proximity to the anus. Fecal flora may enter the urinary tract, which may contribute to the development of UTI in females [4, 5]. Though the majority of the infections are asymptomatic but many a times it may lead to ascending infection and thus may cause serious acute pyelonephritis or nephritis.

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UTI is the most common morbidity after anemia in pregnancy [6]. Hormonal influence, physiological changes in pregnancy, and pressure of the growing uterus over the urinary bladder may cause stasis of urine back flow leading to bacterial growth, and predispose to UTI [7-9]. In pregnancy, the spectrum of UTIs includes asymptomatic bacteriuria (ASB), acute cystitis, and pyelonephritis [4]. Bacterial colonization causes ASB, whereas acute cystitis produces symptoms during pregnancy, like dysuria, increased frequency of micturition, urgency, along with fever. Patient with pyelonephritis presents with fever, loin pain, and systemic symptoms. Prevalence and microorganisms related to UTI are similar in females irrespective of pregnancy; however, UTI in pregnant women leads to complications and recurrence even after treatment [8].

Prevalence of UTI in pregnancy is variable, ranging between 8-14 percent, and Enterobacteriaceae, including Escherichia coli (E.coli), Klebsiella species (Ksp) account for 90% of UTI. E. coli is the most common bacterial agent (60-90%) in UTI. Other gram-negative bacteria (GNB) like, Ksp, Enterobacter species (Esp), Proteas species (Psp), Acinetobacter species (Asp) and gram-positive bacteria (GPB) such as Staphylococcus aureus (SA), Coagulase negative Staphylococcus species (CONS), Enterococcus species (ES), Group B beta-hemolytic streptococci and Candida species are less frequent infection [4].

Failure to treat UTI in pregnancy may lead to rise of toxaemia of pregnancy (TP), premature rupture of membrane (PROM), preterm labour (PTL), renal and haematological abnormality, intrauterine growth retardation (IUGR), and low birth weight (LBW). Other co-morbidities like anemia, gestational diabetes mellitus/diabetes mellitus (GDM/DM), hypertension (HTN), and pre eclampsia/ eclampsia are related to UTI as mentioned in many studies.

Early diagnosis and treatment by doing culture and sensitivity in addition to urine microscopy, followed by treatment, helps the patients to alleviate symptoms, as well as is also important for the well-being of both the mother and the fetus [10].

Therefore, a study was conducted to estimate the prevalence of UTI in pregnant women attending a tertiary care Hospital, Dhubri, Assam. The primary objective of our study is to analyse the bacteriological profile of UTI in pregnant women and their antimicrobial susceptibility patterns. Demographic characteristics and their relationship, and their adverse or unusual clinical presentation in hospitalized patients, are our secondary objectives.

Methods

It was a hospital-based retrospective cross-sectional study carried out in the department of Microbiology in a tertiary care hospital, Dhubri, after obtaining ethical clearance from the Institutional Ethics committee. Data were collected from the hospital electronic data base and laboratory E data base. We collected all the information and data of persons from whom urine samples were sent to our department for culture and sensitivity, with effect from 1st July 2024 to 30th June 2025. Samples collected from individuals other than pregnant women are excluded from the study. Following aseptic precautions, mid-stream clean catch collected urine samples were received at the microbiology collection centre. Samples were labelled properly as per the requisition form and transported to the laboratory to process as early as possible within 4 hours, maintaining the cold chain to prevent the confounding error, as delay may lead to false positive results as a result of an increase in colony-forming units of bacteria in urine. Patient's details, demographic such as age - wise distribution, socioeconomic status, gravida, parity were entered in E-database. The socio-economic status of the patients was documented as per the modified BG Prasad classification [11].

Microscopy was done for all the samples for the presence of bacteria, RBC, and pus cells by gram stain and wet mount. Subsequently, each sample was cultured in Cysteine Lactose Electrolyte Deficient (CLED) agar by semi-quantitative method by using a standard inoculating loop (i.e., 1µl volume loop) and incubated for 24 hours at 37 °C temperature. We considered a positive culture result as per the recommendation of the Kass criteria for significant bacteriuria [2]. Bacterial identification was done conventionally by observing colony morphology, gram staining, and biochemical characteristics, and then by automated method in Vitek 2 MS using identification (ID) and antimicrobial sensitivity (AST) card for ID and AST. We used an inoculum of 0.5 McFarland (MF) unit for analysis as per Clinical Laboratory Standard Institute (CLSI) [12].

Sample size calculation: The sample size was calculated using online Raosoft statistical software. The sample size was estimated as n= 254 by observing the previous year's electronic data of patients who were tested culture positive, considering a level of confidence of 95% and a margin of error of 8.5%.

Statistical Analysis: The data were entered into MS Excel spreadsheets and analyzed using the SPSS (Version: 21.0) statistical package. The description of the data is in the form of mean ± SD for quantitative data, while in the form of % proportion for qualitative (categorical) data. For analysis, descriptive and inferential statistics were used. The Kolmogorov - Smirnov test was done to test the normality of the distribution of a continuous variable. The differences in the proportion were tested for statistical significance using a non-parametric chi-square test for variables measured on a nominal scale. For values showing normal distribution, one-way analysis of variance (ANOVA) was employed to elicit the statistical significance of variation when three variables were taken together for continuous variables. Tukey's post-hoc analysis was applied for intergroup comparison of continuous variables. The Mann-Whitney U test was done to compare differences between two groups for both continuous and ordinal dependent variables, not normally distributed. Chi-square and Fisher's exact probability test were used to find the significance of study parameters on a categorical scale. A 'p' value of <0.05 is considered significant.

Results

A total of two thousand three hundred twenty-nine (2329) urine samples were received and processed in the laboratory of the microbiology department from 1st July, 2024 to 30th June, 2025. Out of 2329 samples, two hundred fifty-four (254) samples were received from the obstetrics department. A total of twenty (20) urine samples were received from postpartum cases; therefore were excluded from the study. A total of two hundred thirty-four (234) cases of UTI were included and analyzed.

Out of 234 cases, 31 samples (13.24%) yielded significant growth. A total of 203(86.76%) samples were found to be either insignificant growth or not showing any growth (84.2%), and growth of mixed contaminant bacteria was 6(2.56%), which were confirmed by repeat culture.

Demographic profile of the women is shown in table 1. There was no significant difference between the gravida of the women (p value > 0.05). There was a significant difference in the incidence of bacteriuria amongst lower socioeconomic and illiterate women in comparison to upper and literate women (p value < .05). The mean age of pregnant women was 25±5.7 years.

Trimester-wise distribution of pregnant women is shown in figure 1. There was a significant difference between the trimester-wise distributions of patients with UTI (p value < 0.05). On post-hoc analysis, there was a significant difference between 1st trimester (64.52%) and 2nd trimester (16.13%), and 1st trimester and 3rd trimester (19.35%) respectively (p value < .05). There was no significant difference between the 2nd trimester and 3rd trimester (p value > .05).

Table1: Demographic profile of patients

Age in years (Mean ± SD)	Gravida No (%)		Socioeconomic status No (%)			Education No (%)	
	Primi	Multi	Upper	Middle	Lower	Illiterate	Literate
25±5.7	18(58%)	13(42%)	0	2(6.4%)	29(93.6%)	26(84%)	5(16%)
P value	>0.05		<0.05			<0.05	

Table 2: Bacteriological profile of urine culture

Isolates	No	%	P value
GNB	25	80.65	
E.coli	19	61.29	
Klebsiella spp	4	12.9	
Acinetobacter spp	1	3.23	
Enterobacter spp	1	3.23	
GPB	6	19.35	<.05
Staphylococcus aureus	3	9.67	
CONS	1	3.23	
Enterococcus fecalis	2	6.45	

GNB = Gram-negative bacteria; E.coli = Escherichia coli; GPB = Gram-positive bacteria; CONS = Coagulase negative staphylococcus species; spp = species.

Bacteriological profile of urine culture is shown in table 2. Prevalence of GNB was 25(80.65%) and found to be significantly higher compared to GPB (19.35%) isolates (p value <0.01). Among GNB, E coli was found in 19 (61.29%) cases followed by Ksp 4 (12.90%); Asp 1 (3.23%) and Esp (3.23%). Among GPB, SA 3(9.67%), CONS 1 (3.23%) and ES 2 (6.45%) was found respectively.

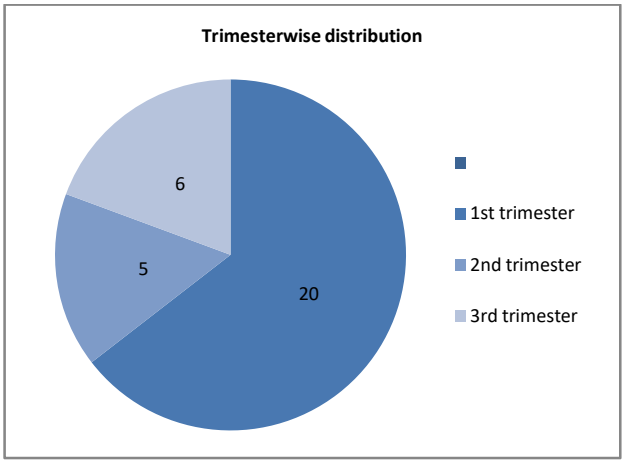

Figure1: Trimester-wise distribution of pregnant women.

Table 3: Antimicrobial sensitivity pattern of GNB

Isolates	Antibiotic sensitivity pattern n = 25 (100%)									
GNB	**PIT**	**CTZ**	**CTR**	**IPM**	**AK**	**GEN**	**CIP**	**NIT**	**COT**	**FMN**
E.coli (19)	57.9%	31.6	52.6%	100%	89.5%	84.2%	31.6%	68.4%	78.9%	100%
Klebsiella spp (4)	75%	75%	75%	100%	75%	75%	75%	75%	75%	ND
Enterobacterspp (1)	100%	100%	100%	100%	100%	100%	100%	100%	100%	ND
Acinetobacterspp (1)	100%	100%	100%	100%	100%	100%	100%	100%	100%	ND

GNB=Gram Negative Bacilli; PIT=Piperacillin+Tazobactum, CTZ=Ceftazidime; CTR=Ceftriaxone, IPM=Imipenem; AK=Amikacin; GEN=Gentamycin; CIP=Ciprofloxacin; NIT=Nitrofurantoin; COT= Cotrimoxazole, FMN= Fosfomycin

Table 4: Antibiotic sensitivity pattern of gram positive isolates

Isolates (6)	Antibiotic sensitivity pattern n= 6 (%)									
GPB	**CX**	**GEN**	**LE**	**CN**	**LZ**	**DN**	**TEI**	**VAN**	**TE**	**TG**
Staphylococcus. Aureus (3)	33.3%	66.6%	66.6%	100%	100%	100%	100%	100%	66.6%	100%
CONS (1)	100%	100%	100%	0	100%	100%	100%	100%	100%	100%
Enterococcus spp (2)	ND	100%	0(0%)	0(0%)	100%	ND	100%	100%	0(0%)	100%

GPB=Gram positive bacteria , CONS=Coagulase negative staphylococcus species; spp=species
CX=Cefoxitin; BP= Benzyl - Penicillin; GEN=Gentamycin; CIP=Ciprofloxacin; LE=Levofloxacin; EN=Erythromycin; CN=Clindamycin; LZ=Linezolid; DN=Deptomycin; TEI=Teicoplanin; VAN=Vancomycin; Te=Tetracyclin; TG=Tigecycline; ND= not detected

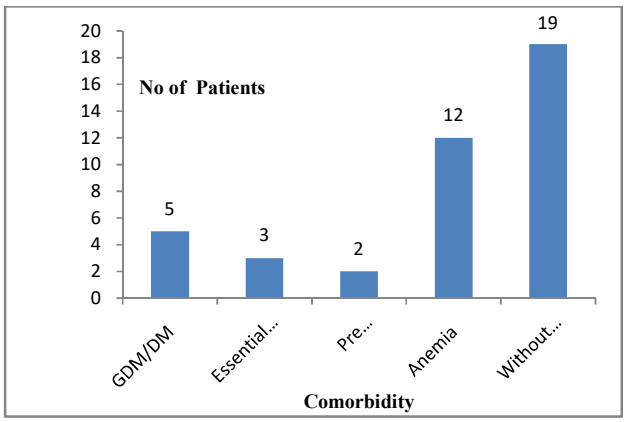

Figure 2: Associated comorbidity of pregnant women (GDM = Gestational diabetes mellitus; DM = Diabetes mellitus; HTN = Hypertension)

Antimicrobial sensitivity was done for all isolates using Vitekcard ID & AST, and patterns are shown in the table 3 & table 4. E.coli shows pattern of highest sensitivity to antimicrobial Imipenem (100%), Fosfomycin (100%) followed by Amikacin (89.5%), Gentamycin (84.2%), Cotrimoxazole (78.9%), Nitrofurantoin (68.4%) and Piperacillin + Tazobactum (57.9%), Ceftriaxone (52.6%) respectively. Ciprofloxacin (31.6%) and Ceftazidime (31.6%) found to be least sensitive. Ksp found to be the most sensitive to Imipenem (100%), followed by Amikacin (75%), Gentamycin (75%), Cotrimoxazole (75%), Nitrofurantoin (75%), Piperacillin+Tazobactum (75%), and Ceftriaxone (75%). Ciprofloxacin (75%), Ceftazidime (75%). Antibiotic sensitivity of SA 3 (100%) was sensitive to Clindamycin, Linezolid, Daptomycin, Teicoplanin, Vancomycin, and Tigecycline, followed by 2(66.6%) in Gentamycin, Ciprofloxacin, and Levofloxacin. Cefoxitin was found to be resistant in 66.6% isolates and termed as Methicillin resistant Staphylococcus aureus (MRSA). Esp 100%were sensitive to Linezolid, Daptomycin, Teicoplanin, Vancomycin, whereas resistant to tetracycline, levofloxacin.

Associated comorbidities of pregnant women are shown in figure 2. The majority of patients were without comorbidity (61.29%) and with anemia (38.71%), respectively. Only 16.13%, 9.68% and 6.45% were found to be associated with GDM/DM, essential HTN, and pre-eclampsia/eclampsia, respectively.

Discussion

Pregnant women are vulnerable to UTI because of morphological and physiological changes in the genitourinary tract during pregnancy. Frequently, ASB progresses to symptomatic UTI or pyelonephritis by invasion of the urinary tract and serious complications to both the mother and fetus. Hill et al reported an incidence of 1.4 per cent of acute pyelonephritis in pregnancy [13]. Smaill et al in a systematic review showed the overall incidence of pyelonephritis in the untreated ASB group to be 21 per cent with a range of 2.5 to 36 per cent [14]. Asymptomatic bacteriuria is associated increased risk of symptomatic bacteriuria, increased incidence of preeclampsia toxemia (PET), PROM, PTL, IUGR, and LBW [15]. Therefore, it is necessary to identify both asymptomatic and symptomatic bacteriuria in pregnancy by doing culture and sensitivity and proper antibiotic treatment, which may need to be started.

Our study shows the prevalence of bacteriuria was 13.24% which is similar to the study done by A Rajaratnam et al [16] (13.2%) and 10% (Assam) by Talukdar et al [17]. Similar study was conducted by Lee AC et al in rural places in Bangladesh which is similar to the demographic profile in our institution and found a prevalence of 8.5%[18].

The difference in prevalence was due to differences in the study design and study population. Higher prevalence of UTI reflects the study population belonging to underprivileged, illiterate, rural, and poor hygiene of women who participated in the study.

Mean age in our study was 25±5.7 years, which is similar to the study conducted by Yadav et al [19]. High median age group might be due to the inclusion of both primi and multi para women.

In our study, a significant difference in UTI was found between the 1st trimester (64.52%) and 2nd trimester (16.13%), and 1st trimester (64.52%) and 3rd trimester (19.35%) respectively (p <. 05) whereas Talukdar et al found maximum prevalence in the 2nd trimester of pregnancy, which is contrary to our study results [17]. The difference was probably due to the study design, as we have examined retrospectively all the samples obtained in our laboratory, irrespective of asymptomatic or symptomatic patients.

Most of the isolates were GNB (80.65%), and E. coli (61.29%) was the dominant isolate, followed by Ksp (12.90%) and SA (9.67%) amongst GPB, which is in accordance with the study by Talukdar et al [17]. A similar study was done by Radha et al in their early pregnancy in a tertiary care hospital in Kerala and found E. Coli as predominant uropathogens (57.14%) which is in accordance with our study [20]. Predominance of E. Coli was due to a lack of proper hygiene, bacteria reached the urinary tract.

We did antimicrobial sensitivity for all isolates using Vitekcard ID & AST. Ciprofloxacin (31.6%) and Ceftazidime (31.6%) were found to be the least sensitive or most resistant against E. Coli, whereas Imipenem and Fosfomycin show a pattern of 100% sensitivity. Ksp was found to be the most sensitive to Imipenem (100%), followed by Amikacin(75%), Gentamycin (75%), Cotrimoxazole (75%), Nitrofurantoin (75%), and Piperacillin + Tazobactum (75%), Ceftriaxone (75%), Ciprofloxacin (75%), Ceftazidime (75%). A similar study was done by Sabharwal et al on antibiotic susceptibility of uropathogenic isolates and found similar results [10]. However, Talukdar et al found 100 % sensitivity in Imipenem and more than 75% sensitivity in ciprofloxacin and Ceftazidime [17]. The variable sensitivity of antibiotics depends upon community to community, hospital protocols, and the misuse of antibiotics. Talukdar et al collected urine samples from all asymptomatic patients prospectively, whereas we analyzed retrospectively all the urine samples collected in our department irrespective of symptoms. Probably the obstetrician sent a sample of urine after antibiotic therapy that was not responding to therapy.

Vancomycin, Clindamycin, Linezolid, Daptomycin, Teicoplanin, and Tigecycline show a pattern of 100% sensitivity in SA, followed by 66.6% sensitivity against Gentamycin; Ciprofloxacin and levofloxacin. Patil et al found 100% sensitivity to Vancomycin, Linezolid in all the SA isolates, which correlates similar antibiotic susceptibility pattern in our study. A similar study was done by Taha et al on antibiotic susceptibility of bacterial isolates and found 100% Daptomycin sensitivity in GPB [21, 22]. In our study, we found 66.6% MRSA among SA isolates. Gowda et al assessed the antibiotic sensitivity pattern of ASB in pregnant women in a tertiary care centre and found 80% which is in line with our study [23].

In our study, the majority of patients did without have any comorbidity (61.29%). We found various comorbidities in 38.71% of patients, including anemia (38.71%), GDM/DM (16.13%), essential HTN (9.68%), and preeclampsia/eclampsia (6.45%), respectively. Taghavi et al assessed the association between urinary tract infection in the first trimester and the risk of preeclampsia in pregnant women mentioned similar comorbidity in their study [24].

Limitation: These findings of the study will aid researchers in their understanding of the variables associated with infection in high-prevalence regions. However, the present study is limited to one year period and included data from only one centre. A larger multicentric study including data from the state could highlight the scenario more prominently. Moreover, our study was mainly limited to a retrospective analysis of the database. An in-person interview amongst the participants would have given more reliable personal details.

Conclusion

In our study, we found that 13.24% of pregnant women reported suffering from UTI. The mean age of pregnant women was 25±5.7 years, and the incidence was highest in 1st trimester of pregnancy E. Coli was the most common offender, showed cent percent sensitivity to Fosfomycin and Imipenem. 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. Culture sensitivity guided treatment to improve pregnancy outcome. Therefore, besides good genital hygiene, urine routine screening at antenatal clinics should be done in early pregnancy, irrespective of symptoms.

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Conflict of interest: None. **Disclaimer:** Nil.

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