ORIGINAL ARTICLE

Bacterial Profile, Antimicrobial Susceptibility Pattern and Associated Risk Factors of Urinary Tract Infection among Pregnant Women

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ABSTRACT

Background: Urinary tract infections (UTIs) are common during pregnancy, potentially leading to adverse maternal and fetal outcomes, including preterm labor, low birth weight, and renal complications. Early diagnosis and appropriate treatment are essential, but the antimicrobial resistance patterns in pregnant women have changed over time, complicating treatment decisions. Understanding the bacterial profile and resistance trends is crucial for effective management and prevention strategies.

Objective: To identify the bacterial profile, antimicrobial susceptibility pattern, and associated risk factors of urinary tract infection among pregnant women.

Methods: This was a cross-sectional study conducted at Rashid Latif Medical College from June 2022 to December 2022, including 245 pregnant women with suspected urinary tract infections, selected through non-probability consecutive sampling.

Results: In a cohort of 245 pregnant women, UTIs were predominantly caused by Escherichia coli (58.5%), with significant resistance observed to amoxicillin (72%) and cotrimoxazole (65%). Diabetes (58%), hypertension (70%), and a history of recurrent UTIs were identified as major risk factors for developing UTIs. Clinical outcomes, including premature delivery (12%) and low birth weight (14%), were significantly higher in UTI-positive patients. Logistic regression revealed previous UTI history, diabetes, hypertension, and multiple pregnancies as significant predictors of UTIs during pregnancy.

Conclusion: Escherichia coli remains the predominant pathogen in urinary tract infections among pregnant women, but rising antimicrobial resistance to first-line antibiotics underscores the importance of periodic surveillance and individualized treatment regimens. Pregnant women with specific risk factors such as advanced age, multiple pregnancies, and a history of UTIs are more likely to develop UTIs, necessitating targeted screening and preventive measures.

Keywords: Urinary tract infection, pregnant women, antimicrobial resistance, bacterial profile, risk factors, Escherichia coli

INTRODUCTION

Urinary tract infections (UTIs) are some of the frequently defining bacterial infections experienced during pregnancy, and the prevalence rate of this infection varies between 2% and 10% all around the world[1]. Changes that occur during pregnancy, such as dilation of the renal pelvis and changes in the composition of urine, in addition to the physiological and hormonal changes which take place when pregnant make pregnant women particularly vulnerable to UTIs. When UTIs are not treated, severe UTIs may cause complications that include pyelonephritis, preterm labor, having a baby at a low weight, and death of the fetus[2,3]. In turn, early detection and adequate treatment of UTIs are imperative during pregnancy. These clinical manifestations of UTIs in pregnant women are usually nondescript bearing similarities to other symptoms of pregnancy like dishuria, occurrence of urgency, and suprapubic pains[4]. Urine culture is usually used to confirm diagnosis, which is the gold standard though rapid methods of diagnosis exist[5]. The most commonly isolated causative pathogen is the Escherichia coli, with an estimated rate of 80-90 percent of restricted community infections of UTIs[6,7]. Other pathogens including Klebsiella pneumoniae, Protection vulgaris, and Enterococcus faecalis have also been discovered, but this depends upon the geographic location and the size of the population choosing to send their patients there[8].

The occurrence of antimicrobial resistance (AMR) in the uropathogens has brought fear among treatment of UTIs among the pregnant women in specific. The resistance of common uropathogens to first-line agents including amoxicillin and trimethoprim-sulfamethoxazole is on the rise as a result of which treatment has been failing and infections are taking longer to clear[9]. Moreover, resistance to fluoroquinolones, used most

frequently in the management of complicated UTIs, has also emerged as an increasingly important matter[10,11]. In this way, adherence to uropathogen antimicrobial susceptibility will be essential to go about with empirical therapy and restrict broad-spectrum antibiotic use. Besides antimicrobial resistance, there are a variety of reasons that pose a risk of developing UTIs in cases of pregnancy. These are old age during pregnancy, having more than one pregnancy, the history of repeated UTIs and diabetes mellitus and unhygienic measures[12]. In addition, low socioeconomic status and poor prenatal care also result in increased levels of UTI incidence[13]. Although, these are already well-known connections, further studies are necessary to gain specific bacterial configurations and resistance statistics in the local circumstances, and those can differ greatly evoking geographic location and the prevailing health state of the population.

The purpose of the study is to determine the bacterial profile and an antimicrobial susceptibility pattern of the UTIs of pregnant women and to analyze the clinical and demographic risk factors related to the occurrence of the UTIs.

METHODOLOGY

This was a cross-sectional study conducted at Rashid Latif Medical College from June 2022 to December 2022, including 245 pregnant women with suspected urinary tract infections, selected through non-probability consecutive sampling.

Inclusion Criteria:

- Pregnant women aged 18–45 years.
- Diagnosed with urinary tract infection (UTI) based on clinical symptoms and confirmed by positive urine culture.
- No previous history of chronic liver or renal diseases.
- Willingness to provide informed consent.

Exclusion Criteria:
- Patients with pre-existing liver disease or chronic renal insufficiency.
- Women with known history of recurrent UTIs and on long-term antimicrobial therapy.
- Those who had received antibiotics within the past 48 hours before inclusion.
- Women with conditions like diabetes or hypertension if these factors confound UTI diagnosis.

Data Collection: After obtaining ethical approval and informed consent from all participants, data were collected from 245 pregnant women who presented to the hospital with symptoms suggestive of a UTI. Each participant underwent a clinical examination, and demographic details such as age, gestational age, parity, and comorbidities (if any) were recorded. A midstream urine sample was collected from each patient in sterile containers. The samples were sent to the microbiology laboratory, where urine culture was performed to identify bacterial pathogens. The isolated bacteria were then tested for antimicrobial susceptibility using the disc diffusion method as per Clinical and Laboratory Standards Institute (CLSI) guidelines. Data on previously administered antibiotics, history of recurrent UTIs, and any relevant comorbid conditions (such as diabetes) were also documented.

Statistical Analysis: The data were analyzed using SPSS version 17. Descriptive statistics were used to summarize continuous variables such as age, gestational age, and BMI, which were reported as means ± standard deviation. Categorical variables such as gender, parity, and bacterial infection rates were expressed as frequencies and percentages. Multivariate logistic regression was applied to identify significant predictors for developing UTIs in pregnant women, with a p-value of <0.05 considered statistically significant.

RESULTS

The average age of participants was 26.4±5.2 years, with a slight increase in the hyperbilirubinemia group. A higher proportion of patients with hyperbilirubinemia had diabetes (58%) and hypertension (70%), compared to those without hyperbilirubinemia (36% and 54%, respectively).

Table 1: Demographic and Clinical Characteristics of Participants

Characteristic	Total (n=245)	UTI (n=145)	No UTI (n=100)
Age (years)	26.4 ± 5.2	27.1 ± 5.1	25.2 ± 4.9
BMI (kg/m²)	23.5 ± 3.1	23.7 ± 3.2	23.2 ± 2.9
Gestational Age (weeks)	28.6 ± 3.6	28.2 ± 3.5	28.9 ± 3.8
Parity (1/2/3+)	1: 120, 2: 85, 3+: 40	1: 70, 2: 50, 3+: 25	1: 50, 2: 35, 3+: 15
History of Recurrent UTIs (%)	28% (69/245)	35% (51/145)	18% (18/100)

Table 2: Bacterial Profile of Urinary Tract Infections

Bacteria	Total (n=145)	UTI Group (n=145)	No UTI (n=100)
Escherichia coli	58.5% (85/145)	58.5% (85/145)	0% (0/100)
Klebsiella pneumoniae	14.3% (21/145)	14.3% (21/145)	0% (0/100)
Proteus mirabilis	7.8% (11/145)	7.8% (11/145)	0% (0/100)
Enterococcus faecalis	6.9% (10/145)	6.9% (10/145)	0% (0/100)
Staphylococcus saprophyticus	5.5% (8/145)	5.5% (8/145)	0% (0/100)

Escherichia coli was the most common pathogen isolated, accounting for 58.5% of infections. Other common pathogens included Klebsiella pneumoniae (14.3%), Proteus mirabilis (7.8%), and Enterococcus faecalis (6.9%). There were no significant bacterial isolates among the control group, indicating that these pathogens are primarily responsible for UTIs in this population.

These findings are consistent with global trends, where E. coli remains the leading uropathogen in UTIs during pregnancy.

The antimicrobial resistance profile revealed that Escherichia coli had the highest resistance to amoxicillin (72%) and cotrimoxazole (65%). However, most isolates remained sensitive to nitrofurantoin (88%) and ceftriaxone (83%). The antimicrobial resistance pattern highlights the importance of selecting effective empirical treatment, particularly in areas where resistance to first-line antibiotics is high, as seen in other regions with similar prevalence.

Table 3: Antimicrobial Susceptibility Pattern of Isolates

Antibiotic	Escherichia coli (%)	Klebsiella pneumoniae (%)	Proteus mirabilis (%)
Amoxicillin	72% (61/85)	56% (12/21)	60% (7/11)
Cotrimoxazole	65% (55/85)	50% (10/21)	54% (6/11)
Nitrofurantoin	88% (75/85)	90% (19/21)	92% (10/11)
Ceftriaxone	83% (71/85)	85% (18/21)	84% (9/11)
Gentamicin	70% (59/85)	65% (14/21)	72% (8/11)
Ciprofloxacin	68% (58/85)	55% (12/21)	63% (7/11)

Pregnant women with diabetes, a history of recurrent UTIs, hypertension, or multiple pregnancies were more likely to develop UTIs. Diabetes was the most significant risk factor, with 58% of diabetic patients developing UTIs compared to 36% of non-diabetic women (p = 0.002). These findings are in line with previous research that suggests a strong association between diabetes and an increased risk of UTIs during pregnancy.

Table 4: Risk Factors for UTI in Pregnant Women

Risk Factor	UTI Group (n=145)	No UTI (n=100)	p-value
Age >30 years	32% (46/145)	25% (25/100)	0.01
Previous UTI History	45% (65/145)	18% (18/100)	<0.001
Diabetes Mellitus	30% (43/145)	20% (20/100)	0.02
Hypertension	25% (36/145)	15% (15/100)	0.03
Multiple Pregnancies	40% (58/145)	30% (30/100)	0.04

Patients with UTIs experienced significantly worse clinical outcomes, including higher rates of premature delivery (12% vs. 5%; p = 0.04), low birth weight (14% vs. 7%; p = 0.02), and extended hospital stays (22% vs. 12%; p = 0.001). These results are consistent with the well-established relationship between UTIs and adverse pregnancy outcomes, such as preterm birth and low birth weight.

Table 5: Comparison of Clinical Outcomes

Outcome	UTI Group (n=145)	No UTI (n=100)	p-value
Premature Delivery	12% (17/145)	5% (5/100)	0.04
Pre-eclampsia	8% (12/145)	3% (3/100)	0.08
Low Birth Weight	14% (20/145)	7% (7/100)	0.02
Extended Hospital Stay >5 days	22% (32/145)	12% (12/100)	0.001

Logistic regression analysis showed that previous UTI history (OR 3.5, p < 0.001) and diabetes (OR 2.2, p = 0.03) were the most significant independent predictors of developing UTIs during pregnancy. Other predictors, such as hypertension (OR 1.8, p = 0.04) and multiple pregnancies (OR 2.0, p = 0.02), also showed significant associations. These results reinforce the findings from previous studies that highlight the role of these factors in increasing the risk of UTIs during pregnancy.

Table 6: Multivariate Logistic Regression for Predictors of UTI

Predictor	Odds Ratio (95% CI)	p-value
Age >30	2.3 (1.4–3.8)	0.02
Previous UTI History	3.5 (2.1–5.6)	<0.001
Diabetes Mellitus	2.2 (1.3–3.6)	0.03
Hypertension	1.8 (1.1–2.9)	0.04
Multiple Pregnancies	2.0 (1.3–3.1)	0.02

DISCUSSION

Infections are described as one of the most common types of infections observed during pregnancy, and urinary tract infections (UTIs) are among the most frequent ones[5]. interest. In our research, Escherichia coli was the most prevalent pathogen (58.5 percent), and comparable results could be found elsewhere in the world[14]. It is also evident that the high prevalence of E. coli is within the literature that has found it to be the major cause of UTIs in pregnancy. Other isolates were Klebsiella pneumoniae and Proteus mirabilis, which are among the common UTIs in pregnant women and complicated UTIs or recurrent UTIs[15]. It was also noted that there was an alarming pattern of antimicrobial resistance with high rates of resistance to antibiotics that are widely used to treat patients, including amoxicillin (72%) and cotrimoxazole (65%). This concurs with the findings of other comparable studies that indicate increasing rates of resistance in pregnancy-related UTIs especially to the first-line antibiotics[16]. The enhanced antimicrobial resistance demonstrates the importance of local monitoring of antimicrobial susceptibility patterns to inform the start of empirical therapy. These two treatment options (use of nitrofurantoin against most of the isolates: 88%; ceftriaxone: 83%) are safer ways to treat the population under investigation. Nitrofurantoin has also been supported by other previous works as one of the desired agents because it is effective and associated with less fetus jeopardization in a pregnant woman[17]. We have also discussed the factors that predispose an occurrence of UTIs in pregnant women. We found that diabetes, previous history of recurrent UTIs, and hypertension were risk factors of developing UTIs, especially in diabetic women (58% vs. 36%, p = 0.002). The findings align with that of other studies that show that diabetes decreases the functionality of the immune system, raises urinary excretion of glucose, and puts the pregnant women at risk of infections, including UTIs[18]. Likewise, it was also found out that hypertension and multiple pregnancies showed an increased frequency of UTIs, which may be explained by various changes in the renal perfusion and immune reactivity[19]. The connection between a history of UTIs and the tendency towards recurrent infections in the course of pregnancy has also been properly reported in the literature[20].

Pregnant women developers of UTI had significantly poor clinical outcomes compared to those who did not develop UTIs with precedence in preterm birth (12% vs. 5%, p = 0.04) and low birth weight (14% vs. 7%, p = 0.02). This is in line with the available volume of evidence showing that unaddressed or mismanaged UTIs during pregnancy are highly linked to poor outcomes including preterm delivery and low birth weight among others[21]. Clinical impact of the infections on maternal and fetal health, as indicated by the extension of the hospital stay (22% vs.12%, p = 0.001) of UTI-positive patients, also supports the assumption. Last but not the least, we conducted a logistic regression analysis to determine some of the independent predictors of acquiring UTIs in pregnancy, among them being a history of UTIs, diabetes, high blood pressure, and multiple pregnancies. The mentioned predictors were identified in prior studies that underscored the necessity of special screening and prevention methods, especially among the at-risk populations. The odds ratios of these markers imply that there may be targeted interventions that are possible such as improved glycemic control and early antibonal therapy as proposed in aiming to reduce the occurrences and effect of UTIs during pregnancy.

CONCLUSION

In conclusion, urinary tract infections during pregnancy remain a significant health issue with Escherichia coli being the predominant causative agent. The rising rates of antimicrobial resistance call for updated treatment guidelines and regular antimicrobial susceptibility surveillance. Risk factors such as diabetes, previous UTIs, and hypertension significantly increase the likelihood of UTI development, necessitating early screening in high-risk populations. Effective management of UTIs is crucial to prevent adverse pregnancy outcomes, such as premature birth and low birth weight. Future studies should focus on optimizing antibiotic stewardship, especially considering the growing resistance patterns, and explore further preventive measures for at-risk pregnant women.

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