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Urinary Tract Infections In Antenatal Women: A Prospective Observational Study Of Their Association With Preterm Labor And Fetal Complications

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ABSTRACT

Background: Urinary tract infections (UTIs) are common in pregnancy and pose significant maternal and fetal risks, including preterm labor and adverse neonatal outcomes. This study aimed to assess the association between UTIs in antenatal women and the incidence of preterm labor and fetal complications.

Methods: A prospective observational study was conducted over 12 months at Karpaga Vinayaga Institute of Medical Sciences & Research Centre, involving 200 antenatal women between 12 and 37 weeks of gestation. Participants were screened for UTIs using clean-catch midstream urine samples, followed by culture and sensitivity testing. Clinical and obstetric parameters were recorded, and maternal and neonatal outcomes were compared between UTI-positive and UTI-negative groups.

Results: Of the 200 participants, 70 (35%) were diagnosed with UTIs, predominantly caused by Escherichia coli (58.6%). UTI-positive women had significantly higher rates of preterm labor (35.7% vs. 13.8%, p=0.001), PPROM (17.1% vs. 5.4%, p=0.015), and lower mean gestational age at delivery (36.1 ± 1.8 weeks vs. 37.6 ± 1.2 weeks, p=0.003). Neonatal complications were also more frequent in this group, including low birth weight (28.6% vs. 13.8%, p=0.008), NICU admissions (20% vs. 6.9%, p=0.01), and neonatal sepsis (8.6% vs. 2.3%, p=0.04).

Conclusion: UTIs in pregnancy are significantly associated with increased risk of preterm labor and adverse neonatal outcomes. Routine screening and early antimicrobial treatment of both symptomatic and asymptomatic bacteriuria are essential strategies to improve perinatal health outcomes.

1. INTRODUCTION

Urinary tract infections (UTIs) are a common and significant obstetric concern, affecting approximately 8% of pregnancies and encompassing a clinical range from asymptomatic bacteriuria (ASB) to acute pyelonephritis [1]. Physiological changes during pregnancy—such as ureteral dilatation, bladder underactivity, immunological modulation, and the influence of progesterone on smooth muscle relaxation—favor the ascent of bacterial pathogens, primarily Escherichia coli [1]. Though ASB is often clinically silent, failure to detect and manage it can lead to serious maternal complications, including sepsis, acute respiratory distress syndrome (ARDS), and disseminated intravascular coagulation (DIC) [1,2].

Preterm labor, defined as birth before 37 completed weeks, remains a major contributor to neonatal morbidity and mortality. Genitourinary infections are recognized triggers for the inflammatory cascade leading to uterine contractility, membrane rupture, and cervical ripening[3]. A comprehensive 2024 meta-analysis involving over 2.8 million pregnancies reported that

UTIs during pregnancy are associated with a significantly increased risk of preterm delivery (adjusted OR 1.92; 95% CI 1.62–2.27), with consistent findings in UTI-based (OR 1.79) and PTB-based (OR 2.01) subgroups [3].

Supporting regional data include a prospective Indian study that reported elevated preterm labor rates in women with ASB [4], while African cohorts noted UTI prevalence rates of 14–64% among pregnant women, often asymptomatic, yet strongly linked to preterm complications [4]. Associated fetal risks include low birth weight, IUGR, neonatal sepsis, and cerebral injury secondary to chorioamnionitis [3,5].

Given rising ESBL-producing uropathogens[2] and inconsistent screening efficacy[1,3], this prospective study investigates UTI prevalence and outcomes in antenatal women, aiming to strengthen evidence for standardized screening protocols.

2. MATERIALS AND METHODS

A prospective observational study was conducted collaboratively by the Departments of Obstetrics & Gynecology and Urology at Karpaga Vinayaga Institute of Medical Sciences & Research Centre (KIMS&RC), Madhuranthagam, Chengalpattu District, Tamil Nadu, India. The study was carried out over a period of 12 months, from May 2024 to May 2025, at this tertiary care academic institution with multidisciplinary diagnostic and maternal–fetal services. All pregnant women between 12 and 37 weeks of gestation who attended the antenatal outpatient clinic, were admitted to the obstetric ward, or presented with symptoms suggestive of threatened preterm labor were considered eligible for recruitment.

Eligibility criteria were defined before enrollment. Inclusion criteria included women aged between 18 and 45 years, with a singleton pregnancy between 12 and 37 weeks of gestation, and those who provided written informed consent. Exclusion criteria comprised women with known renal or urological structural anomalies, chronic kidney disease (eGFR <60 mL/min/1.73 m²), immunocompromised states, recent antibiotic use within the past 14 days, a history of recurrent urinary tract infections, multiple pregnancies, or known cervical insufficiency requiring cerclage.

The sample size was calculated based on an assumed 10% prevalence of UTI in pregnancy, with a 95% confidence level and a 5% margin of error. This resulted in a minimum sample size requirement of 140 participants. To enhance statistical power, a total of 200 antenatal women were included. A non-probability consecutive sampling method was adopted, wherein all eligible participants presenting during the study period were recruited following informed consent.

Data collection was carried out using a structured case report form developed jointly by the Departments of Obstetrics and Urology. The protocol involved four key domains: documentation of demographic and clinical history, urine collection followed by microbiological testing, antenatal obstetric and fetal monitoring, and neonatal outcome assessment. Clean-catch midstream urine samples were obtained and sent for routine analysis and culture sensitivity testing. Urine culture results showing growth of $\geq 10^5$ colony-forming units (CFU)/mL of a single uropathogen, with or without clinical symptoms, were considered diagnostic for UTI.

Definitions used in the study included preterm labor, which was defined as the onset of regular uterine contractions with cervical changes before 37 completed weeks of gestation. Low birth weight was defined as a birth weight of less than 2500 grams. Neonatal sepsis was defined as a confirmed or clinically suspected infection within the first 72 hours of life.

Outcome Measures

Primary Outcome:

- Incidence of preterm labor in women with confirmed UTI vs. non-UTI group

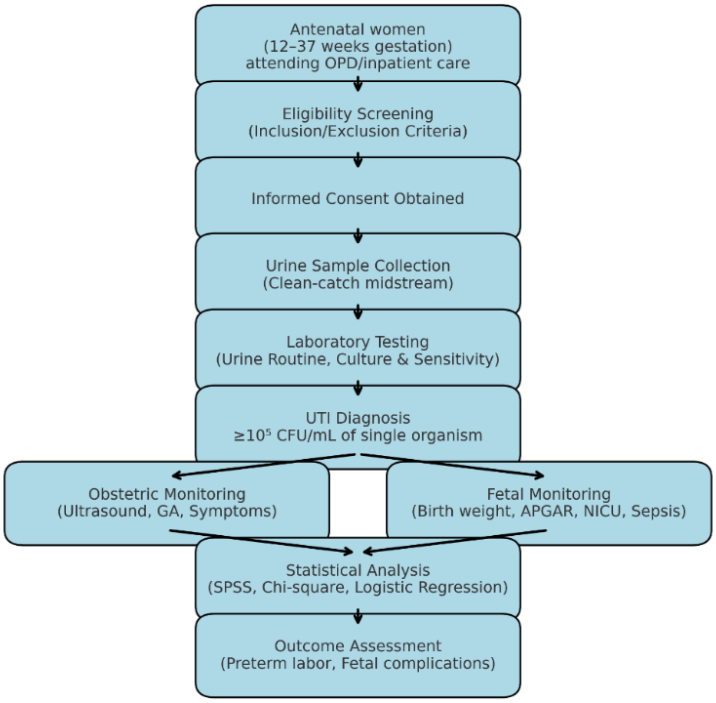
Secondary Outcomes:

- Common uropathogens and resistance patterns
- Incidence of adverse fetal outcomes
- Correlation between symptomatic vs. asymptomatic UTI and outcomes

Statistical Analysis

All data were entered into Microsoft Excel 2016 and analyzed using SPSS version 25.0. Descriptive statistics were used to summarize baseline characteristics. Inferential statistical tests such as the Chi-square test, Fisher's exact test, and independent t-tests were applied where appropriate. Logistic regression analysis was used to evaluate the association between UTI and preterm labor after adjusting for potential confounders. A p-value of less than 0.05 was considered statistically significant.

Flow Diagram of Participant Recruitment, UTI Evaluation, and Outcome Assessment



3. RESULTS

Table 1: Baseline Demographic and Clinical Characteristics

Variable	UTI Positive (n=70)	UTI Negative (n=130)	p-value
Mean Age (years)	26.4	27.1	0.22
Gravida	2.3 ± 1.1	2.0 ± 0.9	0.15
Gestational Age (weeks)	28.6 ± 3.2	29.2 ± 3.5	0.08
Socioeconomic Status (Low/High)	48/22	82/48	0.27
Symptomatic UTI (%)	62 (88.6%)	N/A	-
Hemoglobin (g/dL)	10.2 ± 1.3	10.6 ± 1.2	0.18
Previous H/o Preterm Delivery	18 (25.7%)	15 (11.5%)	0.01

Table 1 - Compares baseline characteristics between UTI-positive and UTI-negative antenatal women. Both groups were similar in age, parity, and gestational age. However, previous preterm deliveries were significantly higher in the UTI-positive group (p=0.01), indicating a possible association between UTI and recurrent preterm labor risk.

Table 2: Urine Culture and Sensitivity Profile

Pathogen Isolated	Frequency (n)	Percentage (%)	Most Sensitive Antibiotics
Escherichia coli	41	58.6	Nitrofurantoin, Amikacin
Klebsiella pneumoniae	13	18.6	Ceftriaxone, Amikacin

Enterococcus faecalis	7	10.0	Fosfomycin, Nitrofurantoin
Proteus mirabilis	4	5.7	Ciprofloxacin, Amoxicillin-Clav
No Growth	5	7.1	–

Table 2 - Reveals the microbiological profile of urinary tract infections among antenatal women. Escherichia coli was the most commonly isolated pathogen (58.6%), followed by Klebsiella pneumoniae and Enterococcus faecalis. These organisms showed high sensitivity to antibiotics like nitrofurantoin, amikacin, and fosfomycin, indicating effective first-line options. The presence of multidrug-resistant strains was minimal. Understanding local pathogen prevalence and antibiotic susceptibility is essential for guiding empirical therapy and preventing complications in pregnant women with UTIs.

Table 3: Obstetric Outcomes in UTI Positive vs. UTI Negative Groups

Outcome	UTI Positive (n=70)	UTI Negative (n=130)	p-value
Preterm Labor (%)	25 (35.7%)	18 (13.8%)	0.001
Term Delivery (%)	45 (64.3%)	112 (86.2%)	0.001
PPROM (%)	12 (17.1%)	7 (5.4%)	0.015
Mean Gestational Age at Delivery	36.1 ± 1.8	37.6 ± 1.2	0.003

Table 3 - Highlights a significantly higher incidence of preterm labor (35.7%) and PPROM (17.1%) among UTI-positive pregnant women compared to UTI-negative counterparts (13.8% and 5.4%, respectively; $p<0.05$). The mean gestational age at delivery was also lower in the UTI-positive group (36.1 ± 1.8 weeks vs. 37.6 ± 1.2 weeks), indicating a strong association between antenatal UTI and adverse obstetric outcomes. These findings support existing literature linking maternal UTI with early labor onset and complications.

Table 4: Neonatal Outcomes in Both Groups

Neonatal Outcome	UTI Positive (n=70)	UTI Negative (n=130)	p-value
Low Birth Weight (%)	20 (28.6%)	18 (13.8%)	0.008
NICU Admission (%)	14 (20.0%)	9 (6.9%)	0.01
Neonatal Sepsis (%)	6 (8.6%)	3 (2.3%)	0.04
Stillbirth / Neonatal Death	2 (2.9%)	0 (0%)	0.09

Table 4 - Shows a significantly higher incidence of adverse neonatal outcomes in the UTI-positive group. Low birth weight (28.6% vs. 13.8%), NICU admissions (20% vs. 6.9%), and neonatal sepsis (8.6% vs. 2.3%) were notably more frequent among neonates born to mothers with urinary tract infections. These differences were statistically significant, indicating that maternal UTI is a considerable risk factor for poor neonatal outcomes. Stillbirths occurred only in the UTI group, further underscoring the need for early detection and treatment.

4. DISCUSSION

This study supports the findings of Wang et al. (2024), who demonstrated that urinary tract infections during pregnancy significantly increase the risk of preterm birth, nearly doubling the odds (OR ≈ 1.9). Our results align with this association, reinforcing the importance of early detection and management of UTIs in antenatal care [2].

Our study's findings of increased neonatal complications—such as low birth weight, NICU admission, and neonatal sepsis—align with recent research indicating that maternal UTI or STI during pregnancy raises the risk of neonatal sepsis by approximately 2.5 times [7].

Supporting this, an Iraqi cohort demonstrated a significant association between third-trimester UTI and early-onset neonatal sepsis [8]. These observations highlight the critical impact of antenatal urinary infections on immediate neonatal outcomes and the need for timely screening and intervention.

Asymptomatic bacteriuria (ASB) has consistently been linked to adverse pregnancy outcomes, including preterm delivery and low birth weight. Studies suggest that untreated ASB may increase the risk of preterm birth by approximately 50% [9,10].

According to ACOG, UTIs affect nearly 8% of pregnancies and significantly raise the likelihood of both preterm delivery and low birth weight [11]. A recent review emphasized infection-driven preterm birth mechanisms and recommended improved antenatal screening and early intervention strategies [12].

Antibiotic resistance remains a critical concern, with recent studies showing that uropathogenic E. coli (UPEC) strains often harbor multidrug resistance and virulence genes, increasing the risk of neonatal sepsis [13].

Ethiopian cohort data further highlight that prolonged premature rupture of membranes (PROM) and maternal UTI or STI are significant independent predictors of neonatal sepsis (AOR = 2.5) [14]. Broader analyses consistently demonstrate that untreated maternal UTI contributes substantially to adverse obstetric and perinatal outcomes [15].

5. CONCLUSION

Urinary tract infections in pregnancy are significantly associated with increased risks of preterm labor, low birth weight, and neonatal complications. Routine screening, early diagnosis, and targeted antibiotic therapy are essential to mitigate these outcomes. Strengthening antenatal protocols and interdisciplinary collaboration can substantially reduce preventable maternal and neonatal morbidity.

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