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Prevalence, risk factors and maternal-neonatal outcome in pregnant women presenting intrapartum with urinary tract infection: A retrospective chart review study

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Abstract

This study aims to assess the prevalence, risk factors, and maternal-neonatal outcomes associated with urinary tract infections (UTIs) in pregnant women presenting intrapartum. A retrospective cross-sectional chart review was conducted at King Fahad Hospital of the University (KFHU), Dammam, Saudi Arabia, including 200 pregnant women in labor from January 2023 to December 2024. Data on demographics, comorbidities, obstetric history, and neonatal outcomes were collected. Statistical analysis included logistic and linear regression using SPSS v28. The prevalence of UTIs during labor was 5.5%. Prior history of UTI was the only significant risk factor (adjusted OR=29.43; 95% CI: 2.03–427; P=0.013). No significant associations were found between UTI status and neonatal birth weight, APGAR scores, or NICU admission. However, older maternal age was significantly associated with higher 1-minute APGAR scores (P=0.022). Prior history of UTI is a strong predictor for UTIs during labor. Although neonatal outcomes were generally favorable, the findings highlight the importance of targeted screening and management for high-risk women. This study supports incorporating routine screening for UTIs in antenatal care, particularly for those with prior infections, to improve maternal and neonatal outcomes.

Keywords: APGAR score, Intrapartum infection, Maternal outcomes, Neonatal outcomes, NICU admission, Pregnancy, Intrapartum, Retrospective study, Risk factors, Saudi Arabia, Urinary tract infection.

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1. Introduction

Pregnancy induces physiological changes, elevating susceptibility to urinary tract infections (UTIs) [1]. Untreated bacteriuria in pregnancy poses risks to both the foetus and the mother, including pyelonephritis, preterm birth, low birth

weight, and potentially increased pre-eclampsia and perinatal mortality [2]. Screening pregnant women for UTI can mitigate these complications. UTI in pregnancy is a risk factor associated with advanced maternal age, multiparity, sexual intercourse, diabetes, sickle cell anaemia, previous UTI history, immunodeficiency, and urinary tract abnormalities, impacting perinatal outcomes [3].

With a prevalence exceeding 20%, UTIs remain a prevalent medical disorder affecting pregnancy [4]. Diagnosis occurs with bacterial overgrowth in the urinary system ($\geq 10^5$ counts/mL), irrespective of clinical symptoms [5]. UTIs encompass lower urinary tract conditions (e.g., asymptomatic bacteriuria, cystitis) and kidney conditions (e.g., pyelonephritis) [6]. Asymptomatic bacteriuria's prevalence ranges from 2% to 10%, with a 20% to 30% risk of progressing to pyelonephritis if untreated, reduced by 80% with early antibiotic intervention [7]. Causative bacteria, such as Escherichia coli, Klebsiella pneumonia, Proteus, Acinetobacter, Staphylococcus saprophyticus, Group B Streptococcus (GBS), and Pseudomonas aeruginosa, are consistent in pregnant and non-pregnant women [8]. Risk factors associated with UTI in pregnancy encompass advanced maternal age, multiparity, sexual activity, diabetes, sickle cell anemia, prior UTI history, immunodeficiency, and urinary tract abnormalities. UTI during pregnancy is considered a potential risk for unfavourable maternal and perinatal outcomes [9]. Studies have shown that women who had a UTI during pregnancy had more preterm deliveries than those without a UTI (adjusted OR 2.5; 95% CI 1.7-3.5) as well as a spontaneous preterm birth at <37 weeks is significantly higher (adjusted OR 2.3; 95% CI 1.5-3.5) [10, 11], not only that the study has also found a statistically significant higher rate of urinary tract infection among the neonates delivered to mothers having UTI during pregnancy [12].

Effective management strategies can mitigate complications such as pyelonephritis and adverse perinatal outcomes. The existing evidence underscores the importance of routine screening for asymptomatic bacteriuria (ASB) in early pregnancy to mitigate complications and identify women at substantial risk for preterm delivery. Given the conflicting findings in the literature, this research aims to investigate any adverse maternal and perinatal morbidity associated with UTIs in pregnancy.

2. Materials and Methods

This study is a retrospective cross sectional chart review conducted in department of Obstetric and Gynaecologic at King Faisal Hospital of University (KFHU) in Saudi Arabia after approval from the institutional review board at Imam Abdulrahman Bin Faisal University(IRB-2022-01-550). The study population consisted of 200 pregnant women who presented in labor over two years from Jan 2023 till December 2024. The study sample was calculated by using a Fisher's formula cited by Mugenda & Mugenda (1999); where $n = Z^2pq / e^2$ Where n = the desired sample size, Z = the standard normal deviate at 95% confidence level (1.96). P = the estimated prevalence of UTI infection during pregnancy in a similar study which is 20% .and q= 1-p.The calculated sample size will be n=1.96x1.96x.020x (1-0.20)/0.0025=245 patients. The sampling was done by non-probability random convenient purposive sampling. Data were collected on a data collection sheet specially prepared for this study. The data collection sheet consisted three sections. Section 1 consisted of the demographic characteristics of the participants such as age , BMI, any associated co morbidities , previous history of UTI and involved organism diagnosed, The section 2 contained the obstetrical history of the participants such as gravid , parity, gestational age at the time of UTI detection and mode of delivery .The section 3 contained the information on the outcome of the delivery such as APGAR score of the neonate , birth weight , NICU admission and presence of infection in the neonate. Regarding the criteria used for determining positive urine cultures in pregnant women during labara positive urine culture was defined by the number of bacterial colonies present in a given volume of urine, usually expressed as colony-forming units per millilitre (CFU/mL). The specific threshold for defining a positive culture was set at 10^5 CFU/mL for midstream clean-catch sample. The interpretation of urine culture was considered in conjunction with the patient's clinical symptoms. In the context of UTIs in pregnant women, symptoms included frequent urination, urgency, dysuria (painful urination), and lower abdominal discomfort. The data were entered and statistical analysis was done by using SPSS Version 28 (IBM Co., Armonk, NY, USA). Numerical data were presented as the median and interquartile range (IQR), analysed using the Mann Whitney-test. Categorical data were presented as frequency and percentage, analysed using the Chi-square test or Fisher's exact test when appropriate. Logistic regression analysis was performed to assess different factors associated with maternal UTI. Linear regression analysis was performed to assess different factors associated with neonatal APGAR score and birth weight. A two-tailed P value <0.05 was considered statistically significant. Ethical approval was obtained from the Research Ethics Committee before starting the research. Explanation concerning the purpose of the study and informed consent were accepted and written by the participants to utilize their data for research purposes.

3. Results

The medical records of 200 patients could be retrieved during the study period. The median age of the study subjects was 31 years (27-35.75 years) with the range of 19-48 years. A bout fifty five percent (54.5%) of the subjects had BMI less than 30 kg/m^2 while the rest 45.5% were having BMI > 30 kg/m^2 . As far as co morbidity among the participants are concerned 6% were suffering from GDM followed by 2% with hypothyroidism and 1.5% each from IDA and asthma. One percent each were having the history of^ GPD deficiency, Hypertension ,Rheumatoid arthritis and Sickle cell disease. Minorities of the patients (0.5% each) were suffering from DVT, Hyperthyroidism, Multiple sclerosis, PIH, thalassemia and myasthenia gravis. Only 1.5% of the study sample had previous history of UTI while 5.5% of the participants had UTI at presentation. The details of the characteristics of the studied patients is shown in Table 1.

Table 1.
Characteristics of the studied patients (n=200).

Variable	N	%
Age (years)		
Median (IQR)	31 (27 – 35.75)	
Range	19 - 48	
BMI (kg/m^2)		
<30	109	54.5
>30	91	45.5
Comorbidity	34	17.0
GDM	12	6.0
Hypothyroidism	4	2.0
IDA	3	1.5
Asthma	3	1.5
G6PD deficiency	2	1.0
HTN	2	1.0
Rheumatoid arthritis	2	1.0
Sickle cell disease	2	1.0
DVT	1	0.5
Hyperthyroidism	1	0.5
Multiple sclerosis	1	0.5
PIH	1	0.5
Thalassemia	1	0.5
Myasthenia gravis	1	0.5
Previous history of UTI	3	1.5
Presence of UTI	11	5.5
Group B streptococcus	4	2.0
Staphylococcus	2	1.0
Citrobacter koseri	1	0.5
E.coli	1	0.5
Enterococcus faecalis	1	0.5
Lactococcus gravidae	1	0.5
Mixed growth of more than 4 organisms	1	0.5

Note: BMI: Body mass index, GDM: Gestational diabetes mellitus, IDA: Iron deficiency anaemia, G6PD: Glucose-6-phosphate dehydrogenase, HTN: Hypertension, DVT: Deep vein thrombosis, PIH: Pregnancy induced hypertension.

The majority of the studied women (87%) were multigravida, the median parity was 2 births (IQR between 1 and 3 births) and the median GA was 39 weeks (IQR between 37 and 40 weeks). Over two thirds of patients (69.5%) had normal vaginal delivery while 26.5% and 4% were respectively subjected to C-section and vacuum-assisted delivery. The details of the obstetric history of the studied patients is shown in Table 2.

Table 2.
Obstetric history of the studied patients.

Variable	N	%
Gravidity		
Primigravida	26	13.0
Multigravida	174	87.0
Parity		
Median (IQR)	2 (1 – 3)	
Range	0 - 8	
GA (weeks)		
Median (IQR)	39 (37 – 40)	
Range	26 - 41	
Mode of delivery		
NVD	139	69.5
C-section	53	26.5
Vacuum assisted delivery	8	4.0

Note: GA: Gestational age, NVD: Normal vaginal delivery.

Neonates had a median APGAR score after 1 minute of 9 (IQR between 8 – 9) and after 5 minutes of 10 (IQR between 9 – 10) with a median birth weight of 3080 gm (IQR between 2690 – 3420 gm). Additionally, NICU admission rate was 13.5%. The details of the neonatal outcome of the studied patents is shown in Table 3.

Table 3.
Neonatal outcome of the studied patients.

Variable	N	%
1-min APGAR		
Median (IQR)	9 (8 – 9)	
Range	0 – 10	
5-min APGAR		
Median (IQR)	10 (9 – 10)	
Range	5 – 10	
Birth weight (gm)		
Median (IQR)	3080 (2690 – 3420)	
Range	272 - 4500	
NICU admission	27	13.5

Note: APGAR: Appearance, pulse, grimace, activity, and respiration, NICU: Neonatal Intensive Care Unit.

As far as the association of demographic characteristics of the participants with the prevalence of UTI is concerned, neither age (P value 0.37) nor BMI (P=0.998) and co morbidity (P=0.403) were significantly associated with the increased with increased prevalence of UTI. However the previous history of UTI was significantly associated with the UT infection among the pregnant participants (P=0.008). The details of the comparison of characteristics between patients with and without UTI is shown in Table 4.

Table 4.
Comparison of characteristics between patients with and without UTI.

Variable	UTI		P value
	No (n=189)	Yes (n=11)	
Age (years)			
Median (IQR)	31 (27 - 36)	29 (26 - 35)	0.37
BMI (kg/m^2)			
<30	103 (54.5%)	6 (54.5%)	0.998
>30	86 (45.5%)	5 (45.5%)	
Comorbidity	31 (16.4%)	3 (27.3%)	0.403
Previous history of UTI	1 (0.5%)	2 (18.2%)	0.008*

Note: Data are presented as frequency (%) unless otherwise mentioned, *: Statistically significant as P value<0.05.

Women in either group were multigravida (86.8% of patients with no UTI vs 90.9% of those with UTI), the median parity was 2 vs 1, respectively and the median GA was 39 weeks in both groups and those differences were not statistically significant. Mode of delivery was predominantly vaginal (68.3% of patients with no UTI vs 90.9% of those with UTI), showing no statistically significant difference between both groups. The details of the comparison of obstetric history between patients with and without UTI is shown in Table 5.

Table 5.
Comparison of obstetric history between patients with and without UTI.

Variable	UTI		P value
	No (n=189)	Yes (n=11)	
Gravidity			
Primigravida	25 (13.2%)	1 (9.1%)	>0.999
Multigravida	164 (86.8%)	10 (90.9%)	
Parity			
Median (IQR)	2 (1 - 3)	1 (1 - 3)	0.075
GA (weeks)			
Median (IQR)	39 (37 - 40)	39 (39 - 40)	0.146
Mode of delivery			
NVD	129 (68.3%)	10 (90.9%)	0.228
C-section	52 (27.5%)	1 (9.1%)	
Vacuum assisted delivery	8 (4.2%)	0 (0%)	

Note: Data are presented as frequency (%) unless otherwise mentioned.

As far as neonatal outcome is concerned, the median APGAR score was 9 and 10 in both groups at 1 and 5 minutes respectively, with no statistically significant difference. The median birth weight of neonates born to mothers with no UTI was 3080 gm and that of neonates whose mothers had UTI was 3100 gm, with no statistically significant difference

between both groups. The Odds of NICU admission was slightly higher among neonates born to mothers with UTI than those whose mothers had no UTI, yet insignificantly different (18.2% vs 13.2% with OR of 1.46, 95%CI: 0.3 to 7.14). The details of association of neonatal outcome between patients with and without UTI is shown in Table 6.

Table 6.
Comparison of neonatal outcome between patients with and without UTI.

	UTI		P value	OR (95%CI)
	No (n=189)	Yes (n=11)		
1-min APGAR				
Median (IQR)	9 (8 - 9)	9 (9 - 9)	0.205	
5-min APGAR				
Median (IQR)	10 (9 - 10)	10 (9 - 10)	0.533	
Birth weight (gm)				
Median (IQR)	3080 (2670 - 3420)	3100 (2792.5 - 3442.5)	0.618	
NICU admission	25 (13.2%)	2 (18.2%)	0.647	1.46 (0.3 to 7.14)

Note: Data are presented as frequency (%) unless otherwise mentioned, OR: Odds ratio, CI: Confidence interval

In univariate regression analysis, prior history of UTI was significantly associated with UTI during pregnant women in labor as patients with previous history of UTI had higher odds of developing UTI during pregnancy than those with no history (OR=41.78, 95%CI: 3.46 to 504.84, P=0.003).Likewise in multiple regression analysis, having a prior history of UTI was the only risk factor significantly associated with UTI during pregnancy as patients with previous history of UTI had higher odds of developing UTI during pregnancy than those with no history (OR=29.43, 95%CI: 2.03 to 427, P=0.013). Based on univariate regression analysis, none of the included characteristics of mothers with UTI (age, BMI, comorbidities, previous history of UTI, parity, GA and mode of delivery) was significantly associated with 1-minute neonatal APGAR score. In multiple regression analysis, maternal age was the only factor significantly associated with neonatal APGAR score as older maternal age was associated with increased 1-minute APGAR score (coefficient= 0.09, 95%CI: 0.03 to 0.14, P=0.022). The details of the Logistic regression analysis for risk factors associated with maternal UTI is shown in Table 7.

Table 7.
Logistic regression analysis for risk factors associated with maternal UTI.

Variable	Univariate analysis			Multivariable analysis		
	Unadjusted OR	95%CI	P value	Adjusted OR	95%CI	P value
Age (years)	0.95	0.85 to 1.06	0.376	1.004	0.87 to 1.16	0.959
BMI (kg/m^2)						
<30	Ref			Ref		
>30	1	0.29 to 3.38	0.998	2.08	0.45 to 9.61	0.346
Comorbidity	1.91	0.48 to 7.61	0.358	2	0.36 to 11.19	0.432
Previous history of UTI	41.78	3.46 to 504.84	0.003*	29.43	2.03 to 427	0.013*
Parity	0.63	0.37 to 1.08	0.096	0.64	0.34 to 1.22	0.174
GA (weeks)	1.25	0.84 to 1.86	0.264	1.15	0.79 to 1.68	0.471

Note: OR: Odds ratio, CI: Confidence interval, *: Statistically significant as P value<0.05.

4. Discussion

The present study has found that occurrence of urinary tract infections (UTIs) during pregnancy was relatively low, with only 1.5% having a previous history and 5.5% presenting with current UTIs, primarily attributed to Group B streptococcus (2%) and Staphylococcus (1%). The BMI has a significant impact on existence of comorbidities particularly during pregnancy as noted by Rahman et al, whose findings verified the presence of a dual malnourishment burden among Bangladeshi rural women. Overweight women were more likely to have certain pregnancy problems such as UTI. However in the present study BMI was not significantly associated with increased prevalence of UTI among the pregnant women [13].

The obstetric profile of the present study revealed that 87% of the women were multigravida, and the median parity was 2 births. The majority underwent normal vaginal delivery (69.5%), while 26.5% and 4% underwent C-section and Vacum-assisted delivery, respectively. Neonatal outcomes demonstrated favorable APGAR scores and birth weights, with a median APGAR score of 9 after 1 minute and 10 after 5 minutes. The median birth weight was 3080 gm, and the neonatal intensive care unit (NICU) admission rate was 13.5%, with no reported neonatal infections. A study conducted by Reem et al revealed that there is no correlation between the frequency of cesarean births and age or parity. Nevertheless, a statistically significant correlation was seen with BMI, a history of diabetes mellitus and gestational diabetes, and a perineal tear following a prior vaginal birth [14].

Comparison between women with and without UTIs during labor revealed no statistically significant differences in maternal age, parity, gestational age (GA), and mode of delivery. Neonatal outcomes, including APGAR scores, birth

weight, and NICU admission rates, exhibited no significant disparities between the two groups. Similar results were shown by Lekshmi et al, which showed that renal calculi, nulliparity, and UTI are important predictors of bacteriuria in pregnancy history. Preterm birth is more common in pregnant women with urinary tract infections. Adequate care, however, can reduce the risk of additional problems, such as unfavorable neonatal outcomes and pyelonephritis. The information that is now available supports the suggestion that early in pregnancy, a woman be routinely screened for asymptomatic bacteriuria (ASB) in order to reduce problems and identify individuals who are seriously at risk of premature birth [15].

The analysis identified a significant association between a prior history of UTI and the development of UTIs during labor. Both univariate and multiple regression analyses consistently indicated that women with a history of UTIs had significantly higher odds of experiencing UTIs during pregnancy. An epidemiological study demonstrated that a prior UTI was substantially linked to a higher risk of UTI. Similar results were reported by Pastore et al., who determined that antepartum UTI before to prenatal treatment and a history of UTI previous to pregnancy were the two greatest predictors of bacteriuria in prenatal care [16].

Further investigation into the impact of maternal characteristics on neonatal outcomes revealed that maternal age was the sole factor significantly associated with the 1-minute APGAR score. Older maternal age was positively correlated with an increased 1-minute APGAR score. Analysis conducted by Carla Jorge Machado on 73,820 birth data from the 1998 birth cohort served as the basis for the analyses with the exception of the fact that ages 15 to 19 decreased the likelihood of a low one-minute score, there was no correlation observed between maternal ages and Apgar score. Maternal ages below 20 and above 30 were strongly linked to the risks of low birth weight and preterm delivery. Although the results appear to be contradictory, it should be noted that low birth weight, preterm delivery, and poor Apgar scores all assess distinct aspects of the well-being of the infant, and their relationships with mother age should differ r [17].

Notably, the study did not find any statistically significant associations between maternal characteristics in the UTI group and neonatal birth weight. Descriptive analysis revealed a significantly higher rate of prior UTI history in mothers presenting with UTIs compared to those without UTIs (18.2% vs 0.5%). On contrary, a study conducted by Seiner et al, showed that Low birth weight, premature delivery, and intrauterine growth restriction (IUGR) are all linked to maternal UTI. Preterm newborn deliveries are also more common in cases with asymptomatic bacteriuria. In children of all ages, UTIs are a common clinical issue that account for one-third of bacterial infections in neonates [18].

Schieve, et al. [10] identified a correlation between UTI and adverse conditions like preterm labor, hypertensive disorders, anemia, and amnionitis Schieve, et al. [10]. Delzell and Lefevre [19] supported these findings, including low birth weight (LBW) as an additional outcome [19]. Conversely, Chen, et al. [20] statewide investigation in Taiwan revealed no elevated risk of LBW, neonatal short stature, or preterm birth in women with prenatal UTI Chen, et al. [20]. Habak and Griggs Jr [1] study advocates universal UTI screening for pregnant women, integrating urine culture sensitivity into routine antenatal care. Regular public educational programs emphasizing personal hygiene and environmental sanitation are recommended Habak and Griggs Jr [1]. Ramos, et al. [21] identified Escherichia coli as the predominant uropathogenic agent in pregnancy-related UTIs. Maternal consequences encompassed puerperal pyelonephritis and preterm labor, while fetal outcomes included low birth weight, neonatal infection, and admission to neonatal intensive care. Timely diagnosis is pivotal for averting adverse consequences [21]. A recent study in Sylhet, Bangladesh, revealed a UTI prevalence of one in 11 pregnant women, with around half being asymptomatic [22]. There is an imperative need for cost-effective and precise UTI screening methods in pregnancy, coupled with strategies to counter escalating antibiotic resistance in low- and middle-income countries (LMICs). Yan, Bin MDd's study underscores the association between UTI during pregnancy and an elevated risk of preeclampsia (PE). Screening and managing UTIs should be integral components of routine antenatal care, particularly in developing nations Yan, et al. [23]. Balachandran, et al. [24] identified UTI, renal calculi, and nulliparity as significant predictors of bacteriuria in pregnancy history. Pregnant women with UTIs during labor are more prone to experiencing preterm delivery [12].

5. Research Implications

The study provides valuable insights into the prevalence and consequences of urinary tract infections (UTIs) in pregnant women during labor. The identification of a significant association between a prior history of UTI and the development of UTIs during pregnancy has critical implications for antenatal care. Healthcare practitioners should prioritize screening and preventive measures for pregnant women with a history of UTIs to minimize associated risks. The study underscores the importance of tailored interventions to manage UTIs in this vulnerable population. The findings underscore the importance of considering a prior history of UTIs as a substantial risk factor for UTIs during pregnancy. The study contributes valuable insights into the obstetric and neonatal outcomes associated with UTIs in this cohort, emphasizing the need for targeted interventions and monitoring, especially among women with a history of UTIs

6. Conclusion

The present study has found that prior history of UTI emerged as a pivotal risk factor, revealing significantly higher odds for UTI during pregnancy. This highlights the critical importance of recognizing and addressing a history of UTI in antenatal care. Encouragingly, the study portrayed generally favorable maternal outcomes, minimizing neonatal complications. The association between older maternal age and increased 1-minute APGAR scores accentuates the role of age in neonatal well-being. This insight into the Saudi Arabian context contributes valuable information for healthcare practitioners, emphasizing the need for targeted screening and management strategies, particularly for pregnant women with a history of UTIs. Overall, the study underscores the significance of proactive measures to enhance maternal and neonatal well-being in the context of UTIs during pregnancy. The study emphasizes the need for tailored interventions and

heightened vigilance during antenatal care, particularly for pregnant women with a history of UTIs. The comprehensive analysis of risk factors and outcomes provides a foundation for informed decision-making in clinical settings. The identified implications, strengths, limitations, and recommendations collectively contribute to advancing our understanding of UTIs during pregnancy, ultimately paving the way for improved maternal and neonatal healthcare practices.

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