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Association of Preterm Delivery with Urinary Tract Infection and Preventive Role of Ceftriaxone

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ABSTRACT

Urinary tract infections (UTIs) are the leading cause of maternal morbidity and poor birth outcomes. Pregnancy changes increase UTI risk. A larger bladder, less tone, and a shift in vaginal flora are changes. Eradicating pathogens in the urogenital tract can lower the risk of infection-related preterm labor by stopping the progression of asymptomatic bacteriuria into a more serious infection. **Objective:** To determine the association of preterm labor with urinary tract infection and the preventive role of ceftriaxone. **Methods:** A case-control study was conducted at the Department of Obstetrics and Gynecology, Khyber Teaching Hospital, Peshawar, from 14 December 2021 to 10 June 2022. 130 pregnant women who met the selection criteria were recruited from the hospital's post-delivery wards. The participants were then separated into a case group and a control group. Protocols for treating UTIs in female were followed. Ceftriaxone was administered to the group of participants who were UTI-positive. **Results:** The mean age of female in the case group was 28.88 ± 7.18 and in the controls group was 28.97 ± 6.85 years. The mean gestational age at delivery in cases was 34.28 ± 1.34 weeks and in controls 39.4 ± 1.11 weeks. There was a significant association between preterm labor and urinary tract infection (p= <0.05). Administration of ceftriaxone reduced the risk of preterm labor (p=0.001). **Conclusions:** It was concluded that there is a significant correlation between UTIs and premature labor and ceftriaxone plays an important role in reducing preterm delivery of UTI patients.

INTRODUCTION

Preterm labor is the onset of labor after 28 weeks and before 37 weeks of gestation as observed by regular uterine contractions leading to progressive cervical changes [1]. Some identified factors include anatomic abnormalities of the uterus and cervix, premature rupture of the membranes, placenta previa or abruption, trauma, excessive uterine enlargement, as in multiple gestation and hydramnios, and infection [2]. UTI is one of the many etiological factors of preterm labor. In pregnant women, UTIs are classified either as asymptomatic bacteriuria, or symptomatic infections such as acute cystitis and acute pyelonephritis [3, 4]. UTI during pregnancy has a significant impact on pregnancy outcomes, mainly premature labor and low birth weight [5, 6]. The unwanted sufferings of pregnant mothers and their offspring could easily be prevented by early screening and prompt treatment of UTI in pregnancy [7]. Multiple studies reported that those women who had UTIs during their

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pregnancy were approximately 2 times more likely to have preterm labor [8, 9]. It has been reported in studies that the frequency of UTI was significantly higher in female with preterm labor [5, 6, 10]. Another study showed that the frequency of UTI was 10.4% in female with preterm labor and 5.2% in female delivered at term [11]. One more study showed that the frequency of UTI was 5% in female with preterm labor while 2.5% in female delivered at term [12]. The existing literature reveals a discrepancy regarding the association between urinary tract infections (UTIs) and preterm labor, with limited research addressing this relationship. Furthermore, no local studies have been identified that could clarify whether UTIs are a risk factor for preterm labor and delivery. To provide local evidence on this association, which could inform future recommendations for more effective screening methods for UTIs in pregnant women. Early detection and treatment could prevent preterm labor, safeguarding the health of both mothers and their fetuses in our local context. By generating local evidence, this study seeks to enhance clinical practice. This study aimed to assess the association between preterm labor and UTIs and to evaluate the preventive role of ceftriaxone.

METHODS

A case-control study was conducted in the Department of Obstetrics and Gynecology at Khyber Teaching Hospital, Peshawar, from December 14, 2021, to June 10, 2022. After getting approval from the Hospital Ethical Committee with Reference No. CPSP/REU/OBG-2020-020-10263. 130 pregnant female who fulfilled selection criteria from post-delivery wards were recruited. A total sample size of 130 female was calculated, with 65 female in each group. The sample size was determined to achieve a study power of 80% and a significance level of 5%. The percentage of urinary tract infection (UTI) was noted as 13.46% in the cases and 1.92% in the controls. The sampling technique employed was non-probability, consecutive sampling. The inclusion criteria involved female aged 18-40 years, parity <5, delivered within the last 24 hours, and exclusion criteria involved female with multiple fetuses, congenital malformation, fetal demise, antepartum hemorrhage, gestational or chronic hypertension, diabetes, uterine fibroids, anemia, abortion in a previous pregnancy, history of preterm delivery in previous pregnancy and those with incomplete antenatal record. Cases were those female who underwent preterm delivery, which was defined as active labor (>3 contractions in 10 minutes with Bishop score >4 and cervical dilation <4cm), before completion of 37 weeks of gestation as per the last menstrual period date. Controls were those who delivered at term (>37 weeks of gestation as per last menstrual period) After taking informed consent their demographic profile like; name, age, gestational age, parity, BMI, gestational age at delivery, and mode of delivery and treatment with ceftriaxone will be noted. Then they were divided into two groups i.e. cases and controls. Then female were asked and the medical record was assessed for the presence or absence of UTI during pregnancy, which was labeled if there was the presence of a history of persistent UTI during pregnancy i.e. presence of fever (temperature >99oF), and pathogen detected in a urine sample on urine culture i.e. growth of more than 105 colony-forming units per milliliter of the bacterium as per antenatal record and history. Female with UTI were managed as per standard protocol. All this information was recorded on proforma. SPSS version 22.0 was used to enter and analyze the collected data. Mean ± Standard Deviation was computed for age, gestational age, and BMI. Frequency and percentage were computed for parity, mode of delivery, and UTI. The odds ratio was calculated to measure the association of preterm labor with UTI. OR >1 was taken as significant. Data were stratified for age, gestational age, parity, BMI, and mode of delivery. Post-stratification, the odds ratio was calculated to measure the association of preterm labor with UTI for each stratum. OR >1 was taken as significant.

RESULTS

The basic demographic characteristics of the female enrolled in the study, with 65 cases and 65 controls showed that the average age of participants in both groups was quite similar, with cases having a mean age of 28.88 ± 7.18 years and controls having a mean age of 28.97 ± 6.85 years. Gestational age at the time of study enrollment showed a notable difference, with cases having a mean gestational age of 34.28 ± 1.34 weeks compared to 39.40 ± 1.11 weeks in controls, indicating that the cases were generally earlier in their pregnancies than the controls. Regarding body mass index (BMI), the cases had a slightly lower average BMI (24.27 ± 3.20 kg/m^2) compared to the controls (24.92 ± 3.14 kg/m^2). This difference, although small, could be relevant in understanding the health and nutritional status of the study participants. When examining the mode of delivery, a higher percentage of cesarean sections was observed among cases (60%) compared to controls (49.2%). Conversely, vaginal delivery was more common in the control group (50.8%) than in the cases (40%). Parity distribution revealed that among cases, the highest percentage (33.85%) was of nulliparous women (parity 0), followed by (23.08%) of women with parity 2. In contrast, in the control group, parity 2 was the most common (29.23%), followed by parity 1 (26.15%). This distribution suggests that the cases included more first-time mothers compared to the controls (Table 1).

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Table 1: Basic Demographics of Female Enrolled in the Study (n = 130)

Variables		Cases (n= 65)	Controls (n=65)
Age (Years)		28.88 ± 7.18	28.97 ± 6.85
Gestational Age (Weeks)		34.28 ± 1.34	39.40 ± 1.11
BMI (kg/m^2)		24.27 ± 3.20	24.92 ± 3.14
Mode of Delivery	Vaginal Delivery	26 (40%)	33 (50.8%)
	Cesarean Section	39 (60%)	32 (49.2%)
Parity	0	22 (33.85%)	15 (23.08%)
	1	13 (20%)	17 (26.15%)
	2	15 (23.08%)	19 (29.23%)
	3	8 (12.31%)	9 (13.85%)
	4	7 (10.76%)	5 (7.69%)

The prevalence of urinary tract infections (UTIs) and related factors between the study groups was compared and showed a significant difference was observed in the occurrence of UTIs, with 30.8% of the cases having a UTI compared to only 6.2% of the controls. This result, with a p-value of 0.000 and an odds ratio (O.R) of 6.77 (95% CI: 2.167-21.203), indicates a strong association between UTIs and being in the case group. All 65 cases received treatment with ceftriaxone, while none of the controls required this treatment, highlighting the clinical management of UTIs in the study group (p-value = 0.001, O.R: 5.98, 95% CI: 3.278-22.404). When stratifying by age groups, 42.9% of the cases aged 18-30 years had a UTI compared to none in the control group, with a highly significant association (p-value = 0.00, O.R: 0.571, 95% CI: 0.429-0.761). In the 31-40 years' age group, the prevalence of UTIs was similar between cases (16.7%) and controls (14.8%), with no significant association (p-value = 1.00, O.R: 1.15, 95% CI: 0.275-4.813). Parity-wise analysis showed that among nulliparous women (parity 0), 36.4% of the cases had a UTI, while none of the controls did (p-value = 0.008, O.R: 0.636, 95% CI: 0.64-0.873). For women with one previous delivery (parity 1), 53.8% of the cases had a UTI compared to only 5.9% of the controls, showing a significant difference (p-value = 0.003, O.R: 18.66, 95% CI: 1.879-185.399). No significant associations were found in women with higher parity (parity 2-4). In terms of delivery mode, 23.1% of cases with vaginal delivery had a UTI compared to 9.1% of controls, but this difference was not statistically significant (p-value = 0.13, O.R: 3.000, 95% CI: 0.671-13.404). However, among those who underwent cesarean sections, 35.9% of cases had a UTI compared to just 3.1% of controls, which was statistically significant (p-value = 0.001, O.R: 17.36, 95% CI: 2.134-141.206). Finally, BMI analysis showed that 32.4% of cases with a BMI ≤ 25 had a UTI, compared to 12.1% of controls, with a borderline significant difference (p-value = 0.043, O.R: 3.48, 95% CI: 0.995-12.166). In women with a BMI > 25, 28.6% of cases had a UTI compared to none in the control group, indicating a significant association (p-value = 0.001, O.R: 0.714, 95% CI: 0.565-0.903)(Table 2).

Table 2: Comparison of UTI between Study Groups (n=130)

Variables		UTI	Study Groups		p-value	O.R (95% CI)
			Cases n (%)	Controls n (%)		
UTI		Yes	20 (30.8%)	4 (6.2%)	0.000	6.77 (2.167-21.203)
		No	45 (69.2%)	61 (93.8%)		
Treatment with Ceftriaxone		Yes	65 (100%)	0 (0%)	0.001	5.98 (3.278-22.404)
		No	0 (0%)	0 (0%)		
Age Groups	18-30	Yes	15 (42.9%)	0 (0%)	0.00	0.571 (0.429-0.761)
		No	20 (57.1%)	38 (100%)		
	31-40	Yes	5 (16.7%)	4 (14.8%)	1.00	1.15 (0.0275-4.813)
		No	25 (83.3%)	23 (85.2%)		
Parity	0	Yes	8 (36.4%)	0 (0%)	0.008	0.636 (0.64-0.873)
		No	14 (63.6%)	15 (100%)		
	1	Yes	7 (53.8%)	1 (5.9%)	0.003	18.66 (1.879-185.399)
		No	6 (46.2%)	16 (94.1%)		
	2	Yes	3 (20%)	2 (10.5%)	0.634	2.125 (0.307-14.725)
		No	12 (80%)	17 (89.5%)		
	3	Yes	1 (12.5%)	1 (11.1%)	1.000	1.143 (0.060-21.870)
		No	7 (87.5%)	8 (88.9%)		
	4	Yes	1 (14.3%)	0 (0%)	1.00	0.857 (0.633-1.160)
		No	6 (85.7%)	5 (100%)		
Delivery	Vaginal delivery	Yes	6 (23.1%)	3 (9.1%)	0.13	3.000 (0.671-13.404)
		No	20 (76.9%)	30 (90.9%)		
	C-sections	Yes	14 (35.9%)	1 (3.1%)	0.001	17.36 (2.134-141.206)
		No	25 (64.1%)	31 (96.9%)		

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BMI	≤25	Yes	12 (32.4%)	4 (12.1%)	0.043	3.48 (0.995-12.166)
		No	25 (67.6%)	29 (87.9%)		
	>25	Yes	8 (28.6%)	0 (0%)	0.001	0.714 (0.565-0.903)
		No	20 (71.4%)	32 (100%)		

DISCUSSION

In pregnant women, UTIs are the most prevalent kind of infection that may cause maternal morbidity and poor delivery outcomes. A higher risk of UTI is associated with the physiological changes that occur during pregnancy. These changes include an increased bladder volume, reduced bladder tone, and a shift in the vaginal flora. The first sign of an infection is often asymptomatic bacteriuria, which may develop into a lower tract infection (acute cystitis) in thirty percent of patients and can cause an upper tract infection (acute pyelonephritis) in as many as fifty percent of patients. Despite the obvious connection between UTIs and maternal and newborn morbidity, very little is known regarding the frequency of UTIs during pregnancy and their correlation with premature labour among women who are pregnant. The finding of this study contributes to the existing body of knowledge of UTI amongst pregnant women specifically about the findings of this research study and when compared to previous and recent studies. We noted a high prevalence of UTIs among pregnant women; a finding that is consistent with the studies done across the globe and leverages the fact that such infections pose a significant public health burden. According to the present study, the prevalence of UTIs in pregnant women was consistent with findings from other regions. A systematic review conducted by Mlugu EM *et al.*, on pregnant women in Latin America reported a UTI prevalence ranging from 1.78% to 56%, depending on the country and specific population studied [13]. This broad range highlights the variability in UTI prevalence due to geographical, socio-economic, and healthcare-related factors. Similarly, a study from Tanzania reported a UTI prevalence of 34.3% by dipstick urine analysis and 41% by culture, with no significant difference in prevalence between pregnant and non-pregnant women [14]. Out of all the isolated bacteria the highest percentage was observed with *E.coli* which was in line with the new global trends in leading uropathogenic bacteria causing UTIs. Studies by Jalil MB *et al.*, and Alzahrani MA *et al.*, showed that *E. coli* is the most predominant UTI pathogen cohabitant with other Gram-negative bacteria like *K. pneumonia*, and *P. Aeroginosa* [15, 16]. However, a concerning trend in antimicrobial resistance (AMR) was observed, with a significant proportion of uropathogens exhibiting multi-drug resistance (MDR). Mohamed, A. H *et al.*, conducted their study in Somalia and found out most of the isolated bacteria were found to have resistance levels to at least one agent belonging at least to three different antimicrobial categories hence making it difficult for the bacteria to be treated [17]. The findings of a study by KS HK, *et al.*, also coincided with the present investigation in which the majority of uropathogens exhibited MDR [18]. Several recent papers have examined the relationship between UTIs and pregnancy outcomes. Bacterial UTIs during pregnancy increase the risk of poor outcomes in pregnancy such as preterm delivery, low birth weight, and preeclampsia. As per the evidence of the research Werter DE *et al.*, stated that UTI particularly in pregnancy increases the risk of preterm delivery [5]. In another study done by Gebremedhin KB *et al.*, in Ethiopia, there is implies clear correlation between UTI, and preterm labor [19]. A study by Bee Bee Hajira HS *et al.*, also showed similar results [20]. Due to the increased concern of AMR, much importance is given to preventive strategies and the rational use of antibiotics. In the recent past, researchers have investigated the efficacy of cranberry supplements as well as probiotics as the other potential preventive measures for repeated UTIs among pregnant women. Further, the value of regular cross-sectional screening and the correct utilization of Antibiotics cannot be overemphasized because several scientific works recommend the versatility of treatments according to the local AMR profile to enhance effectiveness without increasing resistance.

CONCLUSIONS

The study concluded the interrelation between UTIs and pregnancy complications including preterm labor. The results also show that women with preterm labor were three times more likely to develop a UTI than women who did not have preterm labor, suggesting the need for pregnant women to be regularly screened for these conditions and to receive appropriate treatment should they develop. Given the use of Ceftriaxone in the singular fashion for the management of these conditions in this population, it's critical to devise diverse antibiotic algorithms to tackle increasing antimicrobial resistance. The study also identifies those particular patient characteristics that predispose patients to have an increased risk of developing UTIs; it finds that increasing age and previous history of pregnancy, or parity, are two important determinants and calls for prevention interventions to be targeted in the light of these findings.

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Authors Contribution

Conceptualization: SS, ST
Methodology: SS, SF, SW, LSN, BSH, ST
Formal analysis: LSN
Writing-review and editing: SS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Sameshima H. Definition and diagnosis of preterm labor. Preterm Labor and Delivery. 2020: 7-15. doi: 10.1007/978-981-13-9875-9_2.

[2] Sergi CM and Sergi CM. Placenta, Abnormal Conception, and Prematurity. Pathology of Childhood and Adolescence: An Illustrated Guide. 2020: 1409-569. doi: 10.1007/978-3-662-59169-7_18.

[3] Ansaldi Y and de Tejada Weber BM. Urinary tract infections in pregnancy. Clinical Microbiology and Infection. 2022 Aug. doi: 10.1016/j.cmi.2022.08.015.

[4] Kaur R and Kaur R. Symptoms, risk factors, diagnosis and treatment of urinary tract infections. Postgraduate Medical Journal. 2021 Dec; 97(1154): 803-12. doi: 10.1136/postgradmedj-2020-139090.

[5] Werter DE, Schneeberger C, Mol BW, De Groot CJ, Pajkrt E, Geerlings SE *et al.* The risk of preterm birth in low risk pregnant women with urinary tract infections. American Journal of Perinatology. 2023 Oct; 40(14): 1558-66. doi: 10.1055/s-0041-1739289.

[6] Micle O, Antal L, Naghi P, Tica O, Zaha DC, Zdrinca MM, Dobjanchi L, SABĂU M, Muresan M. The prevalence of urinary tract infections in pregnancy and implications on foetal development. Farmacia. 2020 May 1;68(3). doi: 10.31925/farmacia.2020.3.11.

[7] Iqbal F, Naqvi KZ, Ashfaq S, Memon E, Aziz S, Sultan S, Irfan SM. Association of Maternal Lower Urinary Tract Infection with Adverse Fetal Outcome in Terms of Preterm Labor and Low Birth Weight. Journal of The Society of Obstetricians and Gynaecologists of Pakistan. 2017 Jun; 7(1): 33-7.

[8] Werter DE, Kazemier BM, Schneeberger C, Mol BW, de Groot CJ, Geerlings SE *et al.* Risk indicators for urinary tract infections in low risk pregnancy and the subsequent risk of preterm birth. Antibiotics. 2021 Aug; 10(9): 1055. doi: 10.3390/antibiotics10091055.

[9] Baer RJ, Nidey N, Bandoli G, Chambers BD, Chambers CD, Feuer S *et al.* Risk of early birth among women with a urinary tract infection: a retrospective cohort study. American Journal of Perinatology Reports. 2021 Jan; 11(01): e5-14. doi: 10.1055/s-0040-1721668.

[10] Sayyoh MA, Hasan LI, Al-dali IM. The relationship between urinary tract infections and preterm labor for pregnant women in Syria. مجلة العلوم الطبية والصيدلانية. 2022 Jun; 6(2): 84-90. doi: 10.26389/AJSRP.S200921.

[11] Addisu D, Melkie A, Biru S. Prevalence of Preterm Premature Rupture of Membrane and Its Associated Factors among Pregnant Women Admitted in Debre Tabor General Hospital, North West Ethiopia: Institutional-Based Cross-Sectional Study. Obstetrics and Gynecology International. 2020; 2020(1): 4034680. doi: 10.1155/2020/4034680.

[12] Tedesco RP, Galvão RB, Guida JP, Passini-Júnior R, Lajos GJ, Nomura ML *et al.* The role of maternal infection in preterm birth: evidence from the Brazilian Multicentre Study on Preterm Birth (EMIP). Clinics. 2020 Mar; 75: e1508. doi: 10.6061/clinics/2020/e1508.

[13] de Souza HD, Diório GR, Peres SV, Francisco RP, Galletta MA. Bacterial profile and prevalence of urinary tract infections in pregnant women in Latin America: a systematic review and meta-analysis. BMC Pregnancy and Childbirth. 2023 Nov; 23(1): 774. doi: 10.1186/s12884-023-06060-z.

[14] Mlugu EM, Mohamedi JA, Sangeda RZ, Mwambete KD. Prevalence of urinary tract infection and antimicrobial resistance patterns of uropathogens with biofilm forming capacity among outpatients in morogoro, Tanzania: a cross-sectional study. BMC Infectious Diseases. 2023 Oct; 23(1): 660. doi: 10.1186/s12879-023-08641-x.

[15] Jalil MB and Al Atbee MY. The prevalence of multiple drug resistance Escherichia coli and Klebsiella pneumoniae isolated from patients with urinary tract infections. Journal of Clinical Laboratory Analysis. 2022 Sep; 36(9): e24619. doi: 10.1002/jcla.24619.

[16] Alzahrani MA, Ali MS, Anwar S. Bacteria causing urinary tract infections and its antibiotic susceptibility pattern at tertiary hospital in Al-Baha region, Saudi Arabia: a retrospective study. Journal of Pharmacy and BioAllied Sciences. 2020 Oct; 12(4): 449-56. doi: 10.4103/JPBS.JPBS_294_19.

[17] Mohamed AH, Sheikh Omar NM, Osman MM, Mohamud HA, Eraslan A, Gur M. Antimicrobial resistance and predisposing factors associated with catheter-associated UTI caused by uropathogens exhibiting multidrug-resistant patterns: a 3-year retrospective study at a tertiary hospital in Mogadishu, Somalia. Tropical Medicine and Infectious Disease. 2022 Mar; 7(3): 42. doi: 10.3390/tropicalmed7030042.

DOI: https://doi.org/10.54393/pjhs.v5i08.1870

[18] KS HK, Asina PA, Theckel PG, Divakaran B, Sathar S, Asalatha R *et al.* Prevalence of multidrug resistant uropathogens isolated from different age groups in South-India: a cross-sectional study. International Journal of Research in Medical Sciences. 2022 Apr;10(4):905. doi: 10.18203/2320-6012.ijrms20220984.

[19] Gebremedhin KB, Alemayehu H, Medhin G, Amogne W, Eguale T. Maternal complications and adverse pregnancy outcomes among pregnant women who acquired asymptomatic bacteriuria in Addis Ababa, Ethiopia. BioMed Research International. 2021; 2021(1): 5254997. doi: 10.1155/2021/5254997.

[20] Bee Bee Hajira HS, Imrana HS, Kamparaj SG. Evaluation of the incidence of pre-eclampsia, preterm labor in association with urinary tract infection (UTI) during pregnancy: An observational study. Medica Innovatica. 2023 Jul; 12(2).