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Socio-Demographic Determinants of Urinary Tract Infection and it's Association with Preterm Birth

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ABSTRACT

Objective: To determine socio-demographic and other predictors of urinary tract infection in pregnancy and their association with preterm labour and delivery.

Methodology: The cross-sectional study was conducted in gynaecology department of Rawal Institute of Health Sciences from 1st September 2023 till 30th September 2024. In this study 450 patients, fulfilling inclusion criteria, were included. All patients presenting from 24 till 36+6 weeks in labor or threatened preterm labor, with confirmed UTI as isolated risk factor, were enrolled. Each confirmed case of UTI was treated in accordance with established medical guideline. Patients were followed till delivery. Data were evaluated using SPSS VS 25 and p value <0.05 was taken as statistically significant.

Results: Among total of 385 patients diagnosed with UTI, 300 cases ended up having preterm delivery. Majority cases were between 26-33 years of age 160(42%), uneducated 215(56%), resident of rural area 320 (83%), belonged to lower middle class 173(45%) and no- booked 288 (75%). Regarding obstetrics history majority [175 (45%),] were P4 and above. Predominant pathogen of UTI was reported Ecoli in 78%. It is evident that females with associated risk factors of UTI such as parity 4 and above, uneducated, rural resident belonging to lower middle class, non-booked cases, recurrent UTI and anemic had preterm delivery with statistically significant p value <0.05.

Conclusion: Considering the strong link between urinary tract infection and preterm labor, early detection and management in high-risk population with UTI risk factors is vital to improve maternal and neonatal outcomes.

Key words: Preterm birth, Socioeconomic Factors, Urinary tract infection

Authors' Contribution:
[1,2]Conception; Literature research; manuscript design and drafting; [2,3]Critical analysis and manuscript review; [1,3]Data analysis; Manuscript Editing.

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Introduction

Urinary tract infection in pregnancy poses a multifaceted challenge in maternal-fetal health and is extensively investigated clinical condition in pregnancy, with global prevalence of 23.9% predominantly affecting developing countries.[1,2] In a study conducted at a tertiary care facility in Pakistan, the prevalence of urinary tract infection during pregnancy was found to be 16%.[3] The prevalence of urinary tract infections escalates during pregnancy as elevated progesterone levels induce decreased ureteric peristalsis, augmented bladder capacity, and subsequent urinary stasis.[4]

A robust association exists between urinary tract infections in pregnant women and an increased incidence of preterm deliveries.[5] According to a meta-analysis, pregnant women with urinary tract infections are 2.19 times more likely to have preterm labor than pregnant women without UTI.[6] Escherichia coli is the most frequently identified

bacterial pathogen in urine samples obtained from pregnant individuals suffering from UTI.[7] Several socio-demographic determinants exert a significant influence on the occurrence of urinary tract infections in pregnancy, including age, education level, employment status, income, gestational age, marital status, residence and parity.[8,9]

Considering the substantial burden of preterm birth on perinatal morbidity and mortality, this study aims at identifying preventable precipitating factor of urinary tract infection and its socio-demographic determinants, leading to preterm labor. This, in turn, can facilitate implementing preventive strategies and targeted interventions, thereby optimizing maternal and neonatal outcomes.

Methodology

This cross-sectional study was conducted in the department of obstetrics and gynecology of Rawal Institute of Health Sciences from 1st September 2023 till 30th September 2024 after taking approval from ethical committee.

Sample size was calculated using WHO calculator, keeping population proportion of 50% confidence level of 95% and with margin of error± 5%, sample size turned out to be 385. A non-probability consecutive sampling technique was used, in which all pregnant women meeting the inclusion criteria and presenting to the antenatal clinic during the study period were recruited until the predetermined sample size was attained. This approach was chosen to ensure feasibility and to minimize selection bias by including all eligible cases.

Preterm labor was defined by the World Health Organization (WHO) onset of labor before 37 completed weeks or 259 days of gestation, after the gestation of viability (22–28 weeks dependent on definition and setting). The onset of labor referred to regular uterine contractions (at least one every 10 minutes), associated with documented cervical change or rupture of fetal membranes .[10] With the above criteria in the absence of cervical change or ruptured membranes diagnosis of threatened preterm labor was made.

All the pregnant ladies with singleton pregnancy, after 24+0 weeks till 36+6 weeks, with urinary tract infection confirmed on laboratory test with threatened and established preterm labor, were included in study.

All pregnant ladies already having risk factor for preterm delivery like twins, IUGR, PIH, Bacterial vaginosis, Antepartum hemorrhage, polyhydramnios and gestational diabetes were excluded from study.

Total of 385 patients fulfilling the inclusion criteria were included in study. Mid- stream urine samples from all women were collected as part of antenatal investigations and in accordance with complaint (urinary symptoms) of patients, sent to laboratory for urine test and on confirmation of infection (10^{+5} CFU leukocytes), urine cultures were sent to identify pathogen. Treatment was given in accordance with departmental protocol as defined in guideline .[11]

After taking informed consent data were collected on pre-structured proforma. Basic Socio demographic information including (age, parity, gestation, education, Socio-economic status, residence (rural/urban), Booking at RIHS, non-booked (booked with some other health facility), social status were recorded

Data regarding risk factors of urinary tract infection was collected and percentages were calculated for descriptive variables like socio-economic status (based on family income), non-booked cases, multi parity (>4), recurrent UTI in terms of non-compliance to treatment, rural residence, educational status and anemia. Percentages of various pathogens, causing urinary tract infection on culture result, were also calculated. Data were analyzed on SPSS-version-25. For test of hypothesis (cause and effect relation-ship) Chi-sq test was applied to see association of detriments of UTI and preterm labor and $p \leq 0.05$ was taken as statistically significant.

Ethical approval for the study was obtained from the institutional review board of Rawal Institute of health sciences, Rawalpindi (Ref number RIHS/DME/07/2023) dated 28th August 2023.

Results

According to selection criteria all those cases were selected who had urinary tract infection as a risk factor and they presented with preterm labor and threatened preterm labor (N=385)

Amongst 385 participants most cases were between 26-33 years of age 160(42%), uneducated 215(56%), resident of rural area 320 (83%), belonged to lower middle class 173(45%) with income (up-till 50,000) and no booked cases 288 (75%). Regarding obstetrics history, majority 175 (45%), were P4 and above.

Predominant pathogen isolated from women with urinary tract infection presenting with pre-term or threatened preterm labor, was EColi 78% (300). Other pathogens were Klebsiella in 11% (42), Satph aureus in 9% (35) and Pseudomonas in 2% (8) cases.

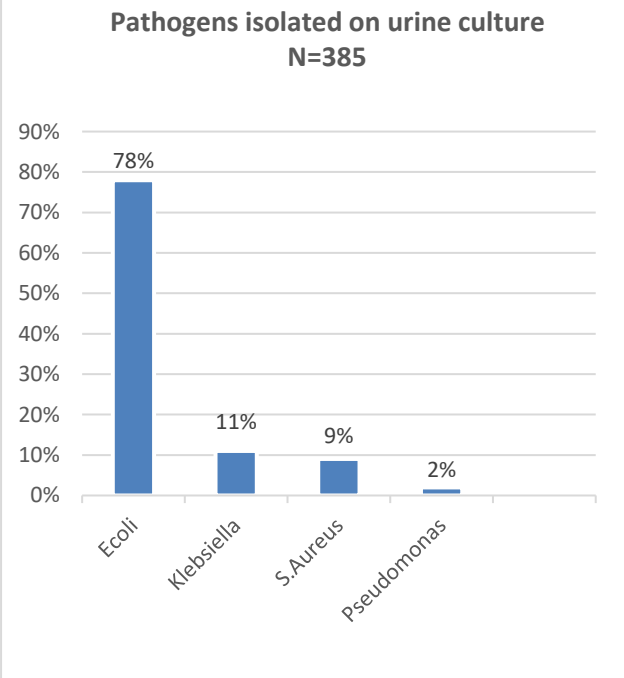

Figure 1: Pathogens isolated on urine culture of patients

Table I: Socio-demographic and obstetric characteristics of the study participants with preterm delivery (Total cases N= 385)

Variable	Category	N (%)
Age	18-25 years	160(42)
	26-33 years	155 (40)
	34-41 years	65 (17)
	>41 years	5 (1)
Parity	Primigravida	95 (25)
	2&3	115 (30)
	4 and above	175 (45)
Education	Uneducated	215 (56)
	Primary	75 (20)
	Middle	55 (14)
	Graduate	40 (10)
Residence	Rural	320 (83)
	Urban	65 (17)
Socio-economic Status According to income/month	Upper middle class > (60,000)	126 (33)
	Lower middle class (up-till 50,000)	173(45)
	Lower class (< 45,000)	86 (22)
Booking of cases	Booked at RIHS Regular antenatal visits	97 (25)
	Cases Booked at other health facility (Non booked with irregular visits)	288 (75)

Out of 385 cases 380 underwent preterm labour and 85 cases of threatened preterm labour after treatment became stable and didn't undergo labour. Regarding determinants of urinary tract infection in women presenting with established preterm labour, test of hypothesis (cause and effect relation-ship) Chi-sq test was applied and $p \leq 0.05$ was taken as statistically significant. It is evident that females with associated risk factors of UTI such as parity 4 and above, uneducated, rural resident belonging to

lower middle class, non-booked cases, recurrent UTI and anemic had preterm delivery with statistically significant p value <0.05.

Table II: Association of detriments of UTI with preterm labour				
Risk factor	**Category with number of cases N= 385**	**Preterm labor (n=300)**	**No preterm labor (n=85)**	**P value Chi-sq test**
Parity	Primigravida 95	45(47%)	50(53%)	
	P 2&3 (115)	95(83%)	20(17%)	
	P 4 and above (175)	160(91%)	15(8%)	P<0.05
Education	Uneducated (215)	197(92%)	18(8%)	P<0.05
	Primary and Above (170)	103(61%)	67(39%)	
Residence	Rural (320)	298(93%)	22(7%)	P<0.05
	Urban (65)	2(3%)	63(97%)	
Socioeconomic status	Upper middle class>60000 (126)	55(44%)	71(56%)	
	Middle& lower middle class ≤50000 (259)	245(95%)	14(5%)	P<0.05
Booking of cases	Booked cases at RIHS (97)	55(57%)	42(43%)	
	Non booked cases (288)	245(85%)	43(14%)	P<0.05
Recurrent UTI	Yes (220)	201(91%)	19(8%)	
	No (165)	99(6%)	66(4%)	
Anemia	Hb<11g/dl (250)	235(94%)	15(6%)	P<0.05
No anemia	Hb>11g/dl (135)	65(48%)	70(52%)	

Discussion

The present study demonstrates a clear association between urinary tract infection and increased risk of preterm labor in the studied population. The sequelae of preterm birth impose a substantial strain on the already constrained healthcare infrastructure of developing countries like ours. Our study demonstrated that out of 385 cases with UTI only 85 (22%) got settled with treatment rest 300 (78%) had preterm delivery. This high number is owing to fact that we included all cases having UTI as a sole risk factor of preterm or threatened preterm labour/delivery. A study from Lahore showed, urinary tract infections (22.5%) as the leading risk factors contributing to preterm delivery.[12]

Regarding sociodemographic factors most of cases of preterm delivery (160 42%) were between 18-25 years. This is in consistent with study by Mahor et al[13] showing prevalence of UTI in young pregnant ladies between 15-25 years. Reason being they are more sexually active leading to recurrent genito urinary infections.

A hospital-based cohort study reported that grand multiparity is associated with an increased risk of preterm delivery compared with lower parity groups.[14] Nutritional depletion, physical strain, and reduced healthcare engagement in later pregnancies lead to complication in pregnancy. This is also evident in our study that parity > 4 is associated with preterm birth. Reason being

Multiple population based studies have shown that women with low educational attainment, rural or remote area residents as compared to urban settings, un-booked mothers (no or few antenatal visits), have a significantly higher incidence of preterm birth than booked mothers who received routine antenatal care are often linked to preterm labour.[15] These findings are in strong co relation with our study as majority of case 56% uneducated, 83% rural residents, 67% lower middle class and 75% non- booked cases presented with preterm labour.

Less awareness on importance of antenatal care and preventive measures, increasing susceptibility to untreated infections, limited access to healthcare facilities and diagnostic services, results in higher infection rates during pregnancy thus leading to preterm labour.[16] Same is with non-booked status, absence of routine antenatal surveillance delays diagnosis and treatment of conditions such as urinary tract infections, elevating preterm labor risk.[17] In our study predominant pathogens isolated from women with urinary tract infection presenting

with pre-term or threatened preterm labor, was Ecoli in 78% of cases. Consistent with our findings, Taha et al[18] also identified Escherichia coli as the predominant urinary pathogen among pregnant women. The proximity of the urethral opening to the rectum, coupled with increased urinary stasis during pregnancy, enhances colonization by uro-pathogenic E. coli. During pregnancy, a myriad of factors predisposes individuals to urinary tract infections. Established determinants encompass maternal age, advancing gestational age, sexual intercourse frequency, multigravidity, multiparity, prior history of urinary tract infections, socioeconomic deprivation .[19]

The present study was designed to systematically evaluate the contributory risk factors associated with urinary tract infection in pregnancy. Our study also shows that females with risk factors of UTI such as multiparity (parity of four or more), lacking formal education, residing in rural areas, belonging to the lower middle socioeconomic class, and unregistered (non-booked) cases had high percentage of preterm delivery with statistically significant p value. Anemia emerged as a salient predisposing factor for urinary tract infection in our study, wherein 94% of anemic individuals manifested UTIs culminating in preterm delivery, paralleling findings from multisite case–control investigation in Iran, which reported that maternal anemia independently increased the adjusted odds of preterm birth by approximately 2.7-fold.[20] Likewise, recurrent urinary tract infections demonstrated a comparable adverse trajectory, with 91% of such cases culminating in premature delivery, echoing a large meta-analysis that established urinary tract infections during pregnancy double the risk of pre term birth .[20]

Conclusion

In conclusion, this study delineates a robust association between gestational urinary tract infection and preterm parturition. Despite progressive refinements in obstetric practice, preterm birth endures as a substantive global health problem. Timely identification of the detriments of urinary tract infection, coupled with proactive surveillance and prompt therapeutic intervention, is indispensable to mitigating this risk and enhancing perinatal outcomes.

Recommendation: Multicentric studies incorporating diverse sociodemographic strata are warranted to enhance the generalizability of findings and to identify context-specific risk modifiers.

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