Uropathogens According to the Trimesters, and Their Effects on Pregnancy Outcomes: A Retrospective Clinical Study

Trimesterlere Göre Üropatojenler ve Gebelik Sonuçlarına Etkileri: Retrospektif Bir Klinik Çalışma

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ABSTRACT Objective: The present study aimed to examine the relationship between gestational urinary tract infection (UTI) cases and pregnancy complications such as preterm delivery and/or low birth weight, and to address the possible increase in risk from these aspects. **Material and Methods:** Seventy-one pregnant women who were diagnosed with UTI, and 102 healthy pregnant women were included in the study. Gestational week, delivery week, delivery method and newborns's birth weight data of women with positive urine culture were compared. **Results:** The median week of delivery was found to be significantly higher in those who had a UTI in the first trimester compared to those who had a UTI in the next trimester (p=0.005). The median week of gestation was significantly higher in those with Gram-positive bacterial growth than those with other microorganisms (p=0.006). The median gestational week was found to be significantly lower in those with Gram-negative bacteria growth compared to those with growth of other microorganisms (p=0.008). The groups were similar in terms of the rates of preterm delivery (p=0.799) and low birth weight (p=0.347). **Conclusion:** These findings show that UTI during pregnancy, particularly after the first trimester, may be associated with preterm delivery. It was also observed that the risk of preterm delivery significantly increased in pregnant women over the age of 35 and development of UTI after the first trimester.

Keywords: Pregnancy; urinary tract infection; preterm delivery; low birth weight

ÖZET Amaç: Bu çalışmada, gestasyonel idrar yolu enfeksiyonu (İYE) olguları ile erken doğum ve/veya düşük doğum ağırlığı gibi gebelik komplikasyonları arasındaki ilişkinin incelenmesi ve olası risk artışının bu yönlerden ele alınması amaçlanmıştır. **Gereç ve Yöntemler:** İYE tanısı almış 71 gebe ve 102 sağlıklı gebe çalışmaya dâhil edildi. İdrar kültürü pozitif olan kadınların gebelik haftası, doğum haftası, doğum şekli ve bebeğin doğum ağırlığı verileri karşılaştırıldı. **Bulgular:** İlk trimesterde İYE geçirenlerde ortanca doğum haftası sonraki trimesterde İYE geçirenlere göre anlamlı olarak yüksek bulundu (p=0,005). Medyan gebelik haftası Gram pozitif bakteri üremesi olanlarda diğer mikroorganizmaları olanlara göre anlamlı olarak daha yüksekti (p=0,006). Medyan gebelik haftası Gram negatif bakteri üremesi olanlarda diğer mikroorganizmaların üremesi olanlara göre anlamlı olarak daha düşük bulundu [15 (çeyrekler açıklığı:15) hafta vs. 25,5 (IQR:13) hafta] (p=0,008). *E. coli* üremesi görülenlerde de ortanca gestasyon haftası diğer mikroorganizma üremesi görülenlere göre anlamlı düşük bulundu [8 (çeyrekler açıklığı: 14) hafta vs. 25 (çeyrekler açıklığı: 17) hafta] (p=0,013). Gruplar erken doğum (p=0,799) ve düşük doğum ağırlığı (p=0,347) açısından benzerdi. **Sonuç:** Bu bulgular, ilk trimesterden sonra gelişen İYE'nin erken doğumla ilişkili olabileceğini göstermektedir. Ayrıca 35 yaş üstü ve ilk trimesterden sonra İYE gelişen gebelerde erken doğum riskinin anlamlı olarak arttığı gözlenmiştir.

Anahtar Kelimeler: Gebelik; idrar yolu enfeksiyonu; erken doğum; düşük ağırlıklı doğum

Physiopathological and hormonal changes that occur in the body during pregnancy increase the risk of some problems. Changes in the urogenital system may cause the frequency of asymptomatic bacteriuria or urinary tract infection (UTI) to be higher than the normal population.[1,2]

UTIs that are not treated during pregnancy can lead to many complications during pregnancy. These complications are preeclampsia, preterm birth, intrauterine growth retardation and low birth weight. UTI seen during pregnancy was more common with diabetes mellitus, chronic inflammatory diseases, urolithiasis, autoimmune disorders, recurrent UTI, urinary tract abnormalities in studies.[1-5]

Some studies reported that UTI during pregnancy was especially associated with preterm delivery and low birth weight.[6,7] However, data regarding whether the risk of preterm delivery and/or low birth weight is related to the trimester of the infection, whether it is related to gravida or parity, whether it has specificity to a microorganism and whether it changes with age have not been enough yet. In our study, it was aimed to examine the relationship between gestational UTI cases and pregnancy complications such as preterm delivery and/or low birth weight, and to address the possible increase in risk from these aspects.

MATERIAL AND METHODS

Our retrospectively planned study complies with the 1964 Declaration of Helsinki and ethical standards, and all procedures performed in studies involving human participants comply with the ethical standards of the institutional research committee. The approval of the ethics committee was obtained from the board of Yeni Yüzyıl University as the approval no: 12.08.2021/26 (date: March 30, 2021).

PATIENTS

A total of 71 pregnant women who admitted to the obstetrics and gynecology outpatient clinics of our hospital between January 2015 and December 2020 and diagnosed as UTI, and 102 healthy pregnant women who admitted for control and whose urine cultures were negative were included in the study.

The diagnosis of UTI was made according to the criteria of clinical nausea, dysuria, vomiting, frequency and positive urine tests (complete urinalysis and urine culture). Patients with at least two positive urine cultures (meaning of bacterial growth) were considered as positive urine cultures. Patients with

complicated UTI, a history of stones and urinary congenital anomalies were excluded from the study. Response to treaatment of UTI has not been evaluated. Data of the women with positive urine culture, including the gestational week, delivery week, delivery method and birth weight of the baby were taken from the hospital system records.

STATISTICAL ANALYSIS

The sample size in the study was calculated by power analysis using G-Power (version 3.1.9.6, Franz Foul, Universitat Kiel, Germany). Effect size 2.5; The Type 1 error was taken as 0.05 and the test power as 0.8, and the sample size calculated as 143 in total. So, when we reached 71 patients as the half of that target, we added the controls applied to the clinics at the same time period.

In our study, statistical analyzes were performed with SPSS 25.0 software (IBM SPSS, Chicago, IL, USA). Pearson's chi square test and Fisher's exact test were applied for intergroup comparisons in terms of categorical variables. Descriptive data were explained as percentages and numbers. In the Kolmogorov-Smirnov test, it was shown whether continuous variables were suitable for normal distribution. Comparisons were made for the variables that did not show normal distribution in the Mann-Whitney U test. Differences between groups in terms of continuous variables were analyzed with Student's t test. Comparison of mean values between multiple groups was analyzed by analysis of variance. Obtained results were analyzed at 95% confidence interval and $p < 0.05$ values were considered significant. Corrections were made with Bonferroni where appropriate.

RESULTS

A total of 59.7% of the pregnant women were primigravida. Delivery method of 117 (67.6%) of the pregnant women was cesarean method, and of 56 (32.4%) was normal spontaneous vaginal delivery. The most frequently isolated microorganisms were *Escherichia coli* (52.1%) and *Candida* spp. (11.3%).

The mean age of the pregnant women was 30.1±5.0. The mean gestation week was 18.5±10.9

weeks, and the mean delivery week was 37.9±3 weeks. The mean birth weight of the newborns was 3160.9±614.7 grams.

The rates of UTI development were found to be similar in pregnant women aged 35 years or younger and those above 35 years (p=0.139). In addition, there was no differences between primigravida and multigravida pregnants (p=0.065), between primiparous and multiparous pregnants (p=0.201), and between trimesters (p=0.287) in terms of rates of UTI development.

UTI and the control groups were found similar in terms of numbers of gravida, parity, preterm birth, newborns with low birth weight, newborns with IUGR, cases had preeclampsia during pregnancy, and perinatal morbidity and in terms of median gestational week, delivery week, birth weight, and 1st and 5th minute APGAR scores (p>0.05 for each) (Table 1).

Preterm delivery rate was significantly higher in multigravida pregnants compared to primigravida women (20.3% vs. 8.7%; p=0.027). The pregnant women with UTI and the control group were found to be similar in terms of the rates of preterm delivery (12.7% vs. 14.1%; p=0.799) and low birth weight (8.5% vs. 4.9%; p=0.347). The groups made according to *E. coli* growth, Gram (+) and Gram (-) bacterial growth in urine culture were similar in terms of preterm delivery and low birth weight rates (p>0.05 for each) (Table 2).

The median week of birth weight (3,320 g vs. 3,325 g; p=0.949) and delivery week (38 vs. 38 weeks; p=0.955) were similar between UTI and control groups. The median week of birth was found to be significantly higher in those who had UTI in the first trimester than those who had UTI in the next trimesters (39 weeks, 38 weeks, 38 weeks, respectively; p=0.005). The median week of gestation was significantly higher in those with Gram-positive bacterial growth than those with growth of other microorganisms (25.5 vs. 15 weeks; p=0.006). The median week of gestation was found to be significantly lower in Gram-negative bacteria growth than those with growth of other microorganisms [15 (interquartile range; IQR: 15) week vs. 25.5 (IQR: 13)

TABLE 1: Distributions of some variables according to UTI and control groups.

	Pregnants with UTI		Controls		
	n	%	n	%	p value
Total	71	100	102	100	
Gravida					0.090
1	37	52.1	67	65.7	
2	19	26.8	26	25.5	
3	7	9.9	5	4.9	
4	8	11.3	3	2.9	
6	0	0.0	1	1.0	
Gravida					0.139
1	38	53.5	66	64.7	
≥2	33	46.5	36	35.3	
Parity					0.259
0	42	59.2	74	72.5	
1	21	29.6	22	21.6	
2	7	9.9	4	3.9	
3	1	1.4	1	1.0	
4	0	0.0	1	1.0	
Parity					0.065
0	42	59.2	74	72.5	
≥1	29	40.8	28	27.5	
Parity					0.201
≤1	63	88.7	96	94.1	
≥2	8	11.3	6	5.9	
Delivery time					0.799
Term delivery	61	85.9	89	87.3	
Preterm delivery	10	14.1	13	12.7	
Delivery time					0.869
Term delivery	61	85.9	89	87.3	
Late preterm delivery	6	8.5	9	8.8	
Early preterm delivery	4	5.6	4	3.9	
Birth weight					0.391
Normal	65	91.5	97	95.1	
Low	3	4.2	4	3.9	
Very low	1	1.4	1	1.0	
Extremely low	2	2.8	0	0.0	
Birth weight					0.347
Normal	65	91.5	97	95.1	
Low-extremely low	6	8.5	5	4.9	
IUGR	5	7.0	4	3.9	0.363
Preeclampsia	5	7.0	5	4.9	0.553
Perinatal morbidity	7	9.9	10	9.8	0.990
	Median	IQR	Median	IQR	p value
Gestational week	17	18	18.5	20	0.905
Delivery week	38	1	38	2	0.955
Birth weight (grams)	3320	570	3325	400	0.949
APGAR score 1st minute	9	1	9	3	0.913
APGAR score 5th minute	10	5	10	3	0.995

Pearson's chi square and Mann-Whitney U tests were used; UTI: Urinary tract infection; IUGR: Intrauterin growth restriction; IQR: Inter-quartile range; APGAR: Appearance, pulse, grimace, activity, respiration.

TABLE 2: Distributions of some variables according to preterm delivery and low weighted birth.						
	Preterm delivery			Low weighted birth		
	n	%	p value	n	%	p value
Total	23	13.3		11	6.4	
Gravida			0.089			0.921
1	9	8.7		7	6.7	
2	8	17.8		3	6.7	
3	2	16.7		1	8.3	
4	4	36.4		0	0	
6	0	0		0	0	
Gravida			0.027			0.805
1	9	8.7		7	6.7	
≥2	14	20.3		4	5.8	
Parity			0.001			0.754
0	10	8.6		9	7.8	
1	10	23.3		1	2.3	
2	1	9.1		1	9.1	
3	2	100		0	0	
4	0	0		0	0	
Parity			0.01			0.282
0	10	8.6		9	7.8	
≥1	13	22.8		2	3.5	
Parity			0.35			0.9
≤1	20	12.6		10	6.3	
≥2	3	21.4		1	7.1	
Trimester			0.134			0.975
1st trimester	7	9.5		5	6.8	
2nc trimester	11	21.2		3	5.8	
3rd trimester	5	10.6		3	6.4	
Uropathogen growth			0.752			0.325
Absent	13	12.6		5	4.9	
Present	10	14.3		6	8.6	
Groups according to presence of UTI			0.799			0.347
Control	13	12.7		5	4.9	
UTI	10	14.1		6	8.5	
Escherichia coli			0.555			0.211
Absent	17	12.5		7	5.1	
Present	6	16.2		4	10.8	
Gram-positive			0.384			0.985
Absent	22	14		10	6.4	
Present	1	6.3		1	6.3	
Gram-negative			0.643			0.67
Absent	15	12.5		7	5.8	
Present	8	15.1		4	7.5	

UTI: Urinary tract infection.

week] (p=0.008). The median week of gestation was found to be significantly lower in those with growth of *E. coli* compared to those with growth of other microorganisms [8 (IQR: 14) weeks vs. 25 (IQR: 17) weeks] (p=0.013) (Table 3).

The rate of preterm delivery among the 35-year-olds was similar in the control group (p=0.941), but the preterm delivery rate was significantly higher in pregnant women over 35 years of age who had UTI than those aged 35 or younger (10.2% vs. 33.3%)

	Gestational week [median (IQR)]	Delivery week [median (IQR)]	Birth weight [median (IQR)]
Groups			
UTI	17 (18)	38 (1)	3320 (570)
Control	18.5 (20)	38 (2)	3325 (400)
p value	0.905	0.955	0.949
Trimester with a UTI			
1.	-	**39 (2)**	3300 (568)
2.	-	**38 (0)**	3260 (573)
3.	-	38 (1)	3400 (500)
p value	-	**0.005**	0.336
Gram-positive growth	25.5 (14)	38 (1)	3375 (475)
Growth of other microorganisms	15 (16)	38 (1)	3300 (590)
p value	**0.006**	0.808	0.728
Gram-negative growth	15 (15)	38 (1)	3320 (545)
Growth of other microorganisms	25.5 (13)	38 (1)	3380 (560)
p value	**0.008**	0.846	0.732
Escherichia coli	8 (14)	38 (2)	3300 (505)
Growth of other microorganisms	25 (17)	38 (1)	3355 (543)
p value	**0.013**	0.234	0.725

TABLE 3: Comparisons by median gestational week, gestational week, and birth weight.

Mann Whitney U test was used; *Compared only for UTI patients; IQR: Inter-quatile range; UTI: Urinary tract infection.

(p=0.035). In terms of preterm delivery and low birth weight rates, age groups made according to the trimester distinction were found to be similar both in general, in pregnant women in the control group and in those with UTI (p>0.05 for each) (Table 4).

Comparisons between the groups of parity, Gram positive growth in urine culture and *E. coli* growth in terms of some variables are shown on Table 5.

DISCUSSION

Changes in the urogenital organs during pregnancy cause pregnant women to have a higher risk of developing UTI compared to non-pregnant women. In addition, many hormonal and physiological developments during pregnancy can trigger the formation of UTIs.[5] Infections in pregnancy are of critical importance considering that they may cause pregnancy complications different from the normal population. Some infections can cause severe complications such as miscarriage, preterm delivery, congenital anomalies, low birth weight, intrauterine growth restriction, amnionitis, and maternal or fetal death.[3,4] It has been stated that UTIs during pregnancy do not have very serious complications but may lead to low birth weight or preterm delivery.[6-8] In the present study, the relationship of UTI during pregnancy with low birth weight and preterm delivery according to trimesters has been examined from various aspects.

Studies have shown that the most common cause of UTI in pregnant women is *E. coli*, similar to the normal population.[9] The most common microorganisms in the present study were *E. coli* and *Candida* spp. The trimester distribution of the frequency of UTI has been reported to be very variable in studies.[7,9-12] Although UTI was seen most frequently in the first trimester in the present study, the general distribution was observed to be similar in all trimesters. In addition, Gram-negative bacteria were determined as the causative agents mostly in the preterm stages of pregnancy, while Gram-positive bacteria were determined as the agent mostly in the late stages.

It has been stated that a history of previous UTI, sexual activity, low socioeconomic level and multiparity are factors that increase the risk for the development of UTI in pregnant women.[10] In the present study, the rates of UTI development were found to be similar in those aged 35 and under and those over 35

	n	Preterm delivery [n (%)]	p value	Low weighted birth [n (%)]	p value
TABLE 4: Comparisons between control and UTI groups, trimester groups, and age groups in terms of preterm and low birth weight rates.					
Controls			0.941		0.556
≤35 years of age	87	11 (12.6)		4 (4.6)	
>35 years of age	15	2 (13.3)		1 (6.7)	
UTI			**0.035***		>0.999
≤35 years of age	59	6 (10.2)		5 (8.5)	
>35 years of age	12	4 (33.3)		1 (8.3)	
1st trimester			0.163		>0.999
≤35 years of age	65	5 (7.7)		5 (7.7)	
>35 years of age	9	2 (22.2)		0 (0)	
2nd trimester			0.605		0.358
≤35 years of age	45	9 (20)		2 (4.4)	
>35 years of age	7	2 (28.6)		1 (14.3)	
3rd trimester			0.578		0.560
≤35 years of age	36	3 (8.3)		2 (5.6)	
>35 years of age	11	2 (18.2)		1 (9.1)	
1st trimester			>0.999		0.360
Controls	46	4 (8.7)		2 (4.3)	
UTI	28	3 (10.7)		3 (10.7)	
2nd trimester			0.734		>0.999
Controls	26	5 (19.2)		1 (3.8)	
UTI	26	6 (23.1)		2 (7.7)	
3rd trimester			0.64		>0.999
Controls	30	4 (13.3)		2 (6.7)	
UTI	17	1 (5.9)		1 (5.9)	
Controls					
1st trimester			0.44		>0.999
≤35 years of age	40	3 (7.5)		2 (5)	
>35 years of age	6	1 (16.7)		0 (0)	
2nd trimester			>0.999		>0.999
≤35 years of age	25	5 (20)		1 (4)	
>35 years of age	1	0 (0)		0 (0)	
3rd trimester			>0.999		0.469
≤35 years of age	22	3 (13.6)		1 (4.5)	
>35 years of age	8	1 (12.5)		1 (12.5)	
UTI					
1st trimester			0.298		>0.999
≤35 years of age	25	2 (8)		4 (16)	
>35 years of age	3	1 (33.3)		1 (33.3)	
2nd trimester			0.596		0.415
≤35 years of age	20	4 (20)		3 (15)	
>35 years of age	6	2 (33.3)		0 (0)	
3rd trimester			0.058		>0.999
≤35 years of age	14	0 (0)		1 (7.1)	
>35 years of age	3	1 (33.3)		1 (33.3)	
Gravida (1)			0.835		0.256
UTI		3 (7.9)		4 (10.5)	
Controls		6 (9.1)		3 (4.5)	
Gravida (≥2)			0.855		0.929
UTI	33	7 (19.4)		2 (6.1)	
Controls	36	7 (21.1)		2 (5.6)	

Chi square and Fisher's exact test were used; *Odds ratio=4.4 (95% CI: 1.0-19.2); UTI: Urinary tract infection.

	Nulliparous (n=42)		Multiparous (n=29)		
	n	%	n	%	p value
Delivery time					0.953
Term delivery	36	85.7	25	86.2	
Preterm delivery	6	14.3	4	13.8	
Delivery time					0.110
Term delivery	36	85.7	25	86.2	
Late preterm delivery	2	4.8	4	13.8	
Early preterm delivery	4	9.5	0	0.0	
Birth weight					0.517
Normal	37	88.1	28	96.6	
Low	2	4.8	1	3.4	
Very low	1	2.4	0	0.0	
Extremely low	2	4.8	0	0.0	
Birth weight					0.390
Normal	5	11.9	1	3.4	
Low-extremely low	37	88.1	28	96.6	
IUGR	5	11.9	0	0.0	0.074
	Median	IQR	Median	IQR	p value
Age (years)	29	6	31	7	0.018
Gestational week	16	23	20	16	0.721
Delivery week	38	2	38	2	0.928
Birth weight (grams)	3375	528	3300	575	0.824
APGAR score 1st minute	9	1	9	1	0.771
APGAR score 5th minute	1	1	10	1	0.902
	No Gram positive growth growth		Gram positive growth		
	n	%	n	%	p value
Delivery time					0.836
Term delivery	47	85.5	14	87.5	
Preterm delivery	8	14.5	2	12.5	
Delivery time					0.933
Term delivery	47	85.5	14	87.5	
Late preterm delivery	5	9.1	1	6.3	
Early preterm delivery	3	5.5	1	6.3	
Birth weight					0.781
Normal	50	90.9	15	51.7	
Low	2	3.6	1	3.4	
Very low	1	1.8	0	0.0	
Extremely low	2	3.6	0	0.0	
Birth weight					>0.999
Normal	50	90.9	15	93.8	
Low-extremely low	5	9.1	1	6.3	
IUGR	Median	IQR	Median	IQR	p value
Age (years)	30	6	29.5	9	0.689
Gestational week	15	16	25.5	14	0.003
Delivery week	38	2	38	1	0.583
Birth weight (grams)	3300	590	3375	475	0.535
APGAR score 1st minute	9	1	9	1	0.632
APGAR score 5th minute	10	1	10	1	0.577

TABLE 5: Distributions of some variables according to some groups in the pregnant women with UTI.

	Growth other than Escherichia coli (n=18)		Escherichia coli growth (n=53)		
	n	%	n	%	p value
Delivery time					0.590
Term delivery	30	54.5	31	83.8	
Preterm delivery	4	7.3	6	16.2	
Delivery time					0.640
Term delivery	30	88.2	31	83.8	
Late preterm delivery	3	8.8	3	8.1	
Early preterm delivery	1	2.9	3	8.1	
Birth weight					0.358
Normal	32	94.1	33	89.2	
Low	2	5.9	1	2.7	
Very low	0	0.0	1	2.7	
Extremely low	0	0.0	2	5.4	
Birth weight					0.675
Normal	32	94.1	33	89.2	
Low-extremely low	2	5.9	4	10.8	
IUGR					0.359
	Median	**IQR**	**Median**	**IQR**	**p value**
Age (years)	29	5	30	8	0.123
Gestational week	25	17	8	14	<0.001
Delivery week	38	2	38	2	0.404
Birth weight (grams)	3355	543	3300	505	0.407
APGAR score 1st minute	9	1	9	2	0.559
APGAR score 5th minute	10	1	10	1	0.566

Pearson's chi square, Fisher's exact test and Mann-Whitney U test were used; UTI: Urinary tract infection; IUGR: Intrauterin growth restriction; IQR: Inter-quartile range; APGAR: Appearance, pulse, grimace, activity, respiration.

years old. In addition, there was no differences between primigravida and multigravida pregnants, between primiparous and multiparous pregnants, and between trimesters in terms of rate of UTI development. These findings show that the development of UTI in pregnant women is not directly related to the gravida, parity or gestational week, so these factors do not significantly increase the risk of developing UTI.

It has been shown that UTI during pregnancy may be associated with preterm birth, and in some studies, the rate of preterm delivery increases significantly in pregnancies with a diagnosis of UTI.[6,8,11-16] However, some studies have reported that UTI during pregnancy does not cause preterm delivery.[17-19] Two studies have shown that UTI increases the risk of premature birth by 1.6 times and the risk of low birth weight by 1.4 times.[6] In the present study, preterm delivery rates were found to be similar between pregnant women with UTI and the control group. In addition, the groups made according to *E. coli* growth, Gram (+) and Gram (-) bacterial growth in urine culture were similar in terms of preterm delivery and low birth weight rates. When we examined the median values in terms of week of birth, the UTI and control groups were similar.

It has been suggested that there may be a relationship between the period of UTI in pregnancy and pregnancy complications.[20] Baer et al. found that the risk of preterm delivery increased 1.4-fold in pregnant women hospitalized due to UTI in the first trimester, 1.7-fold in those hospitalized in the 2nd trimester, and 2.1-fold in those hospitalized in the 3rd trimester.[20] In the present study, trimesters with UTI were found to be similar in terms of preterm delivery and low birth weight rates. In addition, those with UTI and control groups were found to be similar in

terms of trimester and complication rates with UTI. There was no significant difference in the rates of preterm delivery and low birth weight between age groups, according to the incidence of UTI in the trimester. However, the median week of birth was found to be significantly higher in those who had UTI in the first trimester than those who had UTI in the next trimester. Although these findings generally suggest that UTI does not cause premature birth in pregnancies, it shows that UTI developed after the first trimester may be associated with preterm delivery.

In cases of UTI during pregnancy, there is no direct relationship between the causative microorganism and the trimester of infection.[9,10] In a study, it was reported that the rate of UTI caused by *E. coli* decreased statistically in the third trimester compared to the first two trimesters.[21] In our study, the median gestational week in patients with Gram-positive bacterial growth in urine culture was found to be significantly higher than those with growth of other microorganisms. The median value of the gestational week was found to be statistically lower in those with Gram-negative bacteria growth than in those with growth of other microorganisms. The median gestational week was found to be statistically lower in those with growth of *E. coli* compared to those with growth of other microorganisms. All these findings show that after the first trimester of pregnancy, Gram-negative bacteria, especially *E. coli*, cause UTIs less frequently. This suggests that Gram-negative bacteria are not responsible for the relationship between UTI and preterm delivery in the 2nd and 3rd trimesters.

There is no evidence that the development of UTI during pregnancy is directly related to the age of the pregnant.[10] One study found similar UTI rates among pregnant age groups.[10] In the control group of the present study, the rate of preterm delivery was similar between the 35-year-old group but the rate of preterm delivery in pregnant women over 35 with UTI was found to be statistically higher than those aged 35 years or younger. In addition, it was observed that being over the age of 35 increased the risk of preterm delivery 4.4 times in those who had UTI. These findings show that UTI poses a significant risk for preterm delivery, especially in pregnant women over the age of 35.

In a study examining pregnant women who had a UTI, the number of gravida was also shown among the risk factors.[22] In another study, it was shown that multiparous pregnants had a higher rate of UTI than primiparous pregnant.[10] In our study, the rate of preterm delivery in multigravida pregnants was found to be statistically higher than in primigravida pregnants. However, there was no differences between primigravida and multigravida pregnants, and between UTI and control groups in terms of preterm delivery rate. Therefore, it shows that the relationship between UTI and preterm delivery in pregnant women over 35 years old is independent of the number of gravida, and so, UTI may be directly responsible for preterm delivery.

It has been shown that UTI during pregnancy can lead to low birth weight and preterm delivery babies. However, it was emphasized that this relationship could not be demonstrated.[6,23] Some studies have shown that UTI in pregnant women causes low birth weight.[14-16] However, Chen et al. reported that pregnancy UTI cases did not cause low birth weight.[17] In the present study, low birth weight rates were found to be similar between pregnant women with UTI and the control group. Groups made according to Gram-negative bacterial growth were found to be similar in terms of low birth weight. The median birth weight was similar between the UTI and control groups. These findings suggest that UTI during pregnancy has no direct relationship low birth weight. However, the lower number of low birth weight births in this study may have affected this analysis negatively.

Our study had some strengths and limitations. Low number of low birth weight births in this study limited the analysis of risk factors in this regard. In the study, the large distribution of microorganisms other than *E. coli* grown in urine cultures but low numbers made it impossible to analyze whether these microorganisms directly cause adverse pregnancy outcomes.

CONCLUSION

According to the data of our study, UTI during pregnancy, especially after the first trimester, may be associated with preterm delivery. In addition, it was observed that the risk of preterm delivery increased

significantly in pregnant women who developed UTI after the first trimester, especially over the age of 35.

Source of Finance

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

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