Importance of Transabdominal Cervical Length Measurement in Predicting Preterm Birth

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Abstract

Aim. The major aim of our study was to determine the predictive value of cervical length measured transabdominally, a more acceptable method for pregnant women, in preterm birth

Materials and Methods: Our retrospective study included 156 patients who were pregnant between 18-24 weeks and applied to our clinic for routine antenatal screening between March 2018 and March 2021. Cervical length was measured by transabdominal ultrasonography along with routine anatomical scanning. Demographic data of the patients (age, number of gravida, BMI, mode of delivery, smoking, last menstrual period, cervical length measured by transabdominal ultrasonography and week of birth) were obtained from file records.

Results: In our study, 18.2% of patients (2 patients) with cervical length measurement<25 mm gave birth between 24 -32 weeks, 27.3% (3 patients) gave birth between 33-36 weeks, 54.5% (6 patients) gave birth at 37 weeks and beyond. 12.5% of the patients with cervical length measurement of 25-30 mm (2 patients) gave birth between 24 -32 weeks, 12.5% (2 patients) gave birth between 33-36 weeks, 75% (12 patients) gave birth at 37 weeks and beyond. 5.6% (2 patients) of the patients with a cervical length measurement of 30-35 mm gave birth between 33-36 weeks, 94.4% (34 patients) gave birth at 37 weeks and beyond. 1.1% of the patients with cervical length measurement >36 mm (1 patient) gave birth between 24 -32 weeks, 1.1% (1 patient) gave birth Dec 33-36 weeks, 97.8% (91 patients) at 37 weeks and beyond.

Conclusion: Our results proves that cervical length measurement with transabdominal ultrasonography might be used as a first-line method for short cervix screening, which is the most important predictive factor for preterm delivery. However, if the cervix cannot be fully monitored with TA USG and optimum conditions cannot be created, it is necessary to measure with TV USG.

Keywords: Preterm birth, transabdominal ultrasonography, cervical insufficiency, transvaginal ultrasonography

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Introduction

Less than 10% of pregnancies give birth before 37 weeks, but this group accounts for more than 75% of all neonatal deaths(1). Preterm birth occurring before 37 weeks of pregnancy is an important cause of perinatal morbidity and mortality(2). In about one-third of cases, births are iatrogenic, while the other two-thirds occur spontaneously. The survival of premature infants is mainly dependent on the pregnancy age at birth, and the survival rate is less than 5% for those born at 23 weeks and exceeds 95% at 32 weeks(3,4). Premature births, as well as the morbidities they cause, are also common causes of long-term morbidity in infants without congenital anomalies (5,6). The risk of serious disability in survivors is more than 60% in those born at 23 weeks. However,

it decreases below 5% at 32 weeks(5-7). Chronic lung diseases, visual defects and growth retardation are the main sequelae for preterm fetuses in the long term (8). Preterm birth constitutes approximately 12% of all births (9).

Early scanning and proper management of pregnant women at risk of prematurity are essential in reducing perinatal mortality and morbidity associated with prematurity. Nonetheless, the precise prediction and prevention of preterm birth is still an important issue for obstetricians (8). Many methods such as previous obstetric history, monitoring of uterine contractions, biochemical parameters, and ultrasonography are used for preterm birth risk scanning (10). However, obstetric history and monitoring of uterine contractions are of low value in predicting preterm labor.

Studies have shown that the presence of a short cervix is an important risk factor for preterm birth, and cervical length scanning in the second trimester is an important predictor separately in predicting preterm birth(11-14). In another study, it was stated that obstetric history alone predicted only 10% of preterm births(15). In the middle trimester, cervical length measurement can be performed either transvaginally or transabdominally. Transvaginal cervical length is considered the gold standard for predicting preterm birth due to the advantage of direct and clear visualization of the cervix (16). Recent studies have shown that transabdominal ultrasonography can be useful for scanning for the detection of a short cervix (17,18). Furthermore, the time-consuming nature of transvaginal ultrasonography and the anxiety and discomfort experienced by some women during this procedure are disadvantages (19). Our aim in this study is to investigate the value of cervical length measured transabdominally, which is a more acceptable method for pregnant women, in predicting preterm labor.

Materials and Methods

In this retrospective study, the data obtained by examining the files of 156 patients who applied to the Obstetrics and Gynecology Polyclinic of our hospital for routine antenatal scanning between March 2018 and March 2021, who were pregnant between 18-24 weeks, and whose cervical length measurement was performed by routine anatomical screening together with transabdominal ultrasonography were used. At the time of malformation ultrasound for all patients, cervical length measurement was done and recorded by the radiology doctor of our hospital via the transabdominal method. Subsequently, pregnancy follow-ups were made by the obstetrician and gynecologist.

The collection of patients, the cervical assessment method, the acceptability and repeatability of cervical length measurement, the relationship of cervical length with demographic characteristics, and previous obstetric history have been described previously(20). The data of uncomplicated and low-risk pregnancies for spontaneous preterm birth were included in the study, while pregnancies terminated iatrogenically due to fetal or maternal reasons, history of cervical surgery, presence of a history of preterm birth in a previous pregnancy, multiple pregnancy, uterine anomaly, uterine contractions and vaginal bleeding were accepted as exclusion criteria from the study.

In addition to demographic data such as age, gravidity, BMI, type of delivery, smoking habit, and last menstrual period, cervical length measured by transabdominal ultrasonography and delivery weeks were obtained from file records. The mean pregnancy week of the fetus was calculated using the last menstrual period or the head-buttock distance measurements in the first trimester. Births before 37 weeks of pregnancy were defined as preterm births.

Scanning the fetus in terms of anatomical integrity and cervical length measurement by ultrasonography were performed with the abdominal convex probe of the ultrasonography device (Voluson-E10 eM6C-G2). Data obtained from the files of patients whose cervical lengths were measured while routine anatomical scanning was performed in the middle trimester were evaluated. Cervix lengths are separated into 4 main groups: < 25 mm, 25-30 mm, 30-35 mm, >36 mm. The relationship of these measurements in predicting preterm birth was calculated. Statistical data analysis of the research data was done with SPSS 20.0 package programs.

Findings

Primarily, in the research, descriptive statistics about the participants were included. Continuous variables were given as mean, standard deviation, minimum and maximum. Categorical variables were expressed as numbers and percentages. Then, hypothesis tests were carried out. First of all, continuous data were analyzed with Kolmogorov-Smirnov and it was determined that the data were normally distributed ($p>0.05$). Chi-squared test was used in the relationships between categorical variables, and t-test and ANOVA were used in the comparison of group means in independent groups.

Table-1: Descriptive Statistics of Continuous Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Age	156	19,00	40,00	29,8718	5,65995
BMI	156	18,60	36,10	22,6885	1,99043
Week of pregnancy at which USG was performed	156	20,00	24,00	21,8654	1,18641

The mean age of the participants is 29.87±5.65, the mean BMI is 22.68±1.99, and the pregnancy week at which USG was performed is 21.86±1.18.

Table- 2 : Descriptive Statistics of Categorical Variables

		Frequency	Percentage
Gravida	**Primigravida**	43	27,6
	Multigravida	113	72,4
Smoking Habit	**No**	140	89,7
	Yes	16	10,3
Previous type of delivery	**None**	42	26,9
	NSPD	64	41,0
	C/S	50	32,1
Cervical length	**Less than 25 mm**	11	7,1
	Between 25-30 mm	16	10,3
	Between 30-35 mm	36	23,1
	36mm and above	93	59,6
Week of birth	**24-32 Weeks**	5	3,2
	33-36 Weeks	8	5,1
	37 weeks and more	143	91,7

According to Table 2, 72.4% of the participants have a history of multigravida and 27.6% of them have a history of primigravida. It is shown in the table that 89.7% of the patients do not smoke, while 10.3% of them are smokers. It is also reported that 41% have a history of normal spontaneous delivery (NSPD) and 32.1% have a history of caesarean section. The cervical length of 59.6% of the participants is more than 36 mm. The week of birth of 97.1% is 37 weeks and more.

Table -3. Comparison of Means of BMI and Age According to Week of Birth

		Week of birth				
		24-32 weeks	**33-36 weeks**	**37 weeks and more**	**F**	**P**
BMI	N	5	8	143	0,942	0,392
	Mean	23,68	23,18	22,62		
	Std Deviation	1,95	3,42	1,89		
	Min	22,40	18,60	18,60		
	Max	27,10	28,60	36,10		
Age	N	5	8	143	0,794	0,454
	Mean	28,4	27,75	30,04		
	Std Deviation	4,56	9,16	5,46		
	Min	24	20	19		
	Max	36	40	39		

BMI and age means of the participants according to the week of birth do not show a statistically significant difference.

Table – 4. The Relationship Between Gravida, Smoking Habit, and Cervical Length According to the Week of Birth of the Participants

		Week of Birth			**X^2**	**df**	**p**
		24-32 (%)	33-36 (%)	37 and more (%)			
Gravida	Primigravida	3 (7)	5 (11,6)	35 (81,4)	8,208	2	0,017
	Multigravida	2 (1,8)	3 (2,7)	108 (95,6)			
Smoking Habit	No	3 (2,1)	4 (2,9)	133 (95)	20,189	2	0,000
	Yes	2 (12,5)	4 (25)	10 (62,5)			
Cervical Length	Less than 25 mm	2 (18,2)	3 (27,3)	6 (54,5)	32,243	6	0,000
	Between 25-30 mm	2 (12,5)	2 (12,5)	12 (75)			
	Between 30-35 mm	0 (0)	2 (5,6)	34 (94,4)			
	36 mm and more	1 (1,1)	1 (1,1)	91 (97,8)			

It was found that there is a statistically significant relationship between the week of delivery of the participants and gravida, smoking habits and cervical length ($p<0.05$). Multigravida, not having a smoking habit, and a cervical length, which is greater than 36, are proportionally associated with the week of delivery of 37 weeks and more.

Table – 5. The Relationship Between Previous Type of Delivery and Week of Birth in Patients with Multigravida

		Week of Birth			X^2	df	p
		24-32 (%)	33-36 (%)	37 and more (%)			
Previous type of delivery	NSPD	2 (3,1)	1 (1,6)	61 (95,3)	2,196	2	0,334
	C/S	0 (0)	2 (4,1)	47 (95,9)			

There is no statistically significant relationship between the previous type of delivery and the week of birth in patients with multigravida ($p>0.05$).

Table – 6. Comparison of Means of BMI and Age According to Week of Birth in Patients with Cervical Length of < 25 mm

		Week of Birth				
		24-32	**33-36**	**37 and more**	**F**	**P**
BMI	N	2	3	6	0,994	0,411
	Mean	23,05	20,76	22,28		
	Std Deviation	0,63	1,95	2,05		
	Min	22,60	18,60	19,10		
	Max	23,50	22,40	24,50		
Age	N	2	3	6	3,314	0,089
	Mean	27	21,66	29,50		
	Std Deviation	1,41	2,08	5,24		
	Min	26	20	23		
	Max	28	24	36		

It is indicated in Table 6 that there is no statistically significant difference between means of BMI and age according to the week of birth of the participants with a cervical length less than 25 mm ($p>0.05$).

Table -7. The Relationship Between Week of Birth and Smoking Habit in Patients with Cervical Length of < 25 mm

		Week of Birth			X^2	df	p
		24-32 (%)	33-36 (%)	37 and more (%)			
Smoking habit	No	1 (%12,5)	1 (12,5)	6 (75)	6,299	2	0,043
	Yes	1 (33,3)	2 (66,7)	0 (0)			

According to the findings stated in Table 7, there is a statistically significant relationship between the week of birth and smoking habit of the participants whose cervical length is less than 25 mm ($p<0.05$). Not having a smoking habit is proportionally associated with 37 weeks and more weeks of birth.

Table – 8. Comparison of Means of BMI and Age According to Week of Birth in Patients with Cervical Length of 25-30 mm

		Week of Birth				
		24-32	**33-36**	**37 and more**	**F**	**P**
BMI	N	2	2	12	1,192	0,187
	Mean	22,60	25,3	23,53		
	Std Deviation	0,28	2,68	1,55		
	Min	22,40	23,4	21,50		
	Max	22,80	27,2	26,10		
Age	N	2	2	12	0,011	0,989
	Mean	30	29	29,5		
	Std Deviation	8,48	11,31	5,83		
	Min	24	21	20		
	Max	36	37	38		

The means of BMI and age of the participants with a cervical length between 25-30 mm according to the week of birth do not show a statistically significant difference ($p>0.05$).

Table – 9. The Relationship Between Week of Birth and Smoking Habit in Patients with Cervical Length of 25-30 mm

		Week of Birth			X^2	df	p
		24-32 (%)	33-36 (%)	37 and more (%)			
Smoking Habit	No	2 (14,3)	1 (7,1)	11 (78,6)	3,048	2	0,218
	Yes	0 (0)	1 (50)	1 (50)			

There is no statistically significant relationship between the week of birth and smoking habit of the participants with a cervical length of 25-30 mm ($p>0.05$).

Table – 10. Comparison of Means of BMI and Age According to Week of Birth in Patients with Cervical Length of 30-35 mm

		Week of Birth			
		33-36	**37 and more**	**t**	**P**
BMI	N	2	34	-0,204	0,840
	Mean	22	22,45		
	Std Deviation	2,96	3,03		
	Min	19,90	19,10		
	Max	24,10	36,10		
Age	N	2	34	0,088	0,944
	Mean	30	29,11		
	Std Deviation	14,14	6,25		
	Min	20	19		
	Max	40	39		

The means of BMI and age of the participants with a cervical length of 30-35 mm do not differ in terms of the week of birth (p>0.05).

Table – 11. The Relationship Between Week of Birth and Smoking Habit in Patients with Cervical Length of 30-35 mm

		Week of Birth		X^2	df	p
		33-36 (%)	37 and more (%)			
Smoking habit	No	2 (5,9)	32 (94,1)	0,125	1	0,724
	Yes	0 (0)	2 (100)			

Table 11 has shown that there is no statistically significant relationship between the week of birth and the smoking habit of the participants with a cervical length of 30-35 mm (p>0.05).

Table – 12. Comparison of Means of BMI and Age According to the Week of Birth in Patients with Cervical Length of >36 mm

		Week of Birth				
		24-32	33-36	37 and more	F	P
BMI	N	1	1	91	15,916	0,000
	Mean	27,10	28,60	22,61		
	Std Deviation	-	-	1,31		
	Min	27,10	28,60	18,60		
	Max	27,10	28,60	27,20		
Age	N	1	1	91	1,474	0,234
	Mean	28	39	30,49		
	Std Deviation	-	-	5,14		
	Min	28	39	21		
	Max	28	39	39		

The mean BMI of the participants with a cervical length greater than 36 mm in terms of the week of birth shows a statistically significant difference (p<0.05). Accordingly, the group with the lowest mean BMI is the group with the birth at 37 weeks and more. On the other hand, the mean age according to the week of birth does not show a statistically significant difference (p>0.05).

Table – 13. The Relationship Between Week of Birth and Smoking Habit in Patients with Cervical Length of >36 mm

		Week of Birth			X^2	df	p
		24-32 (%)	33-36 (%)	37 and more (%)			
Smoking habit	No	0 (0)	0 (0)	84 (100)	19,077	2	0,000
	Yes	1 (11,1)	1 (11,1)	7 (77,8)			

With regards to the findings in the table above, there is a statistically significant relationship between the week of birth and smoking habit of the participants with a cervical length greater than 36 mm ($p<0.05$). Correspondingly, it was determined that the non-smoker group has a higher rate of birth at 37 weeks and more.

Discussion

Transabdominal cervical length assessment is less invasive, less inconvenient and more acceptable to patients than transvaginal ultrasonography. Recent studies have showed that cervical length scanning at 22-24 weeks is a sensitive method in predicting spontaneous preterm birth(20). In a study in which 703 pregnant women were evaluated, the mean pregnancy was 20.1 weeks, and the mean cervical length measured transabdominally was 34 mm(21). In another study, the mean transabdominal cervical length was found to be 36 mm between 20-24 weeks(8). In our study, 59.6% of the participants had a cervical length greater than 36 mm. It was stated in a further study that transabdominal cervical length measurements were 3.85±0.65 cm in primiparas and 3.92±0.84 cm in multiparas (22).

The prevalence of having a short cervix in the unselected sample is low (23). In order to prevent a single preterm birth, hundreds of women should be scanned with transvaginal ultrasonography (21). However, some women may refuse this scanning method due to anxiety about the procedure (19). There are studies indicating that scanning with transabdominal ultrasonography may be a useful method for scanning the short cervix (17,18).

This method may be a less invasive alternative method for women who refuse short cervical scanning with TV USG (transvaginal ultrasonography). When the literature is reviewed, there are studies comparing TA - CL and TV - CL measurements to define short cervix.

In a study, it was shown that the rate of detecting a short cervix on TV USG increased when TA CL was ≤ 30 mm, and the chance of TV CL ≤ 20 mm was 29.2% when TA CL was ≤ 30 mm (21).

In another study, in which the relationship between TA-CL and TV-CL measurements in 203 patients in the middle trimester was investigated, TA-CL lengths were consistently measured as shorter than TV-CL measurements and it was shown that these values were correlated. The study concluded that TA-CL measurement can be used initially for cervical evaluation, but TV-CL evaluation is needed when this value is below the 5th percentile (<27 mm)(18). In a different study, 255 patients between 20-29 weeks were evaluated. When TA-CL and TV-CL methods were compared, it was stated that no significant difference between the mean cervical lengths between the two groups was found. However, TA-CL values were measured as shorter than TV-CL values in cases where the presenting fetal part covered the internal cervical os and when the external cervical os was not fully observed (22).

In a study examining the importance of cervical length measurement in predicting preterm delivery, the percentages of pregnancies terminated at ≤36, ≤34, ≤32, ≤30, ≤28, ≤26 weeks were reported to be 5%, 2.3%, 1.5%, 0.9%, 0.6%, and 0.3%, respectively. The percentages of having TV CL ≤ 15 mm at the 23rd week of pregnancy in all these pregnancies resulting in preterm birth were found to be 20%, 38%, 58%, 82%, 86% and 100%, respectively. It was found that TV CL measurements were important parameters in predicting preterm birth(20).

In our study, 18.2% of patients with cervical length measurement of <25 mm (2 patients) were between 24-32 weeks, 27.3% (3 patients) were between 33-36 weeks, and 54.5% (6 patients) were in the 37th week or later when they gave birth.

In this study, 12.5% (2 patients) of patients with a cervical length measurement of 25-30 mm gave birth between 24-32 weeks, 12.5% (2 patients) between 33-36 weeks, and 75% (12 patients) in the 37th week or later.

Also, in the present study, 5.6% (2 patients) of patients with a cervical length measurement of 30-35 mm gave birth between 33-36 weeks, and 94.4% (34 patients) gave birth at 37 weeks or later.

In the current study, 1.1% of patients with cervical length measurement of >36 mm (1 patient) gave birth between 24-32 weeks, 1.1% (1 patient) gave birth between 33-36 weeks, and 97.8% (91 patients) gave birth in their 37th week or later.

In a study examining the importance of cervical length measurement between 18-22 weeks in predicting spontaneous preterm birth in a risk population, the sensitivity of cervical length in predicting preterm birth in cases with TV CL ≤ 30 mm was 36.8%, specificity was 90.1%, positive predictive value was 2.4% and negative predictive value was 99.6%. As a result of the study, it was stated that short cervical length may be useful in predicting spontaneous preterm birth, but its use in low-risk population may be limited due to its low positive predictive value (24).

In another study, which examined the differences of TV-CL and TA-CL measurements and the factors associated with these differences, there was a statistically significant difference between the two measurements in primiparous pregnant women in cases where the presenting fetal part completely covers the internal cervical os and only the internal cervical os is observed. (22).

In another research, when the TA-CL measurement was made, the cervix was able to be fully observed in only 40% of the patients when the urinary volume in the bladder was <50 ml, while the cervix could be fully observed in 80% of the cases when the urine volume in the bladder was >150 ml(25).

In the light of all information, the relationship of the presenting fetal part with the internal cervical os, urine volume in the bladder and the number of pregnancies should be optimized in order to measure TA-CL accurately. Although it was stated in the literature that TA-CL measurement was a method that could define short TV-CL measurements, no statistically strong correlation was observed with preterm birth.

According to the findings of another study, a model of individual risk estimation for spontaneous delivery at ≤32 weeks based on cervical length of 23 weeks was provided. The estimated risk for severe preterm birth increases exponentially as cervical length decreases from approximately 0.2% at 60 mm to 0.8% at 30 mm, 4.0% at 15 mm, and 78% at 5 mm(20) . Another study conducted on a group of patients showed that cervical length was associated with ethnic group, maternal age, ponderal index, drug abuse, and past obstetric history(20). In the same study, the contribution of past obstetric history and the sensitivity of the short cervix at 23 weeks were found to be only 20% in births at ≤ 36 weeks, in contrast to births at ≤32 weeks. Only one of 43 women who gave birth spontaneously at 33-36 weeks was in the group with a cervix of ≤ 15 mm(20).

There is extensive evidence suggesting that the underlying cause of the majority of pregnancies complicated by preterm birth may be an ascending infection originating from the lower genital tract. Intrauterine infection can stimulate the production of prostaglandins that induce uterine contractions directly or through the host response with the release of cytokines(26-27). In our study, infectious factors, especially bacterial vaginosis, were not evaluated separately.

This study has some limitations. The lack of standardization of the cervical length measurement technique by transabdominal ultrasonography is one of these limitations. This standardization can be achieved with the information obtained from the literature.

In conclusion, cervical length measurement with transabdominal ultrasonography can be used as a first-line method for short cervical scanning, which is the most important predictive factor for preterm birth. However, if the cervix cannot be fully scanned with TA USG and optimum conditions cannot be established, we think that measurement should be made with TV USG.

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