Association between Anterior Uterocervical Angle and Preterm Birth

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Abstract

Background
Predicting preterm delivery can help obstetricians and midwives for better management of pregnancy care. Therefore, we aimed to investigate the relationship between cervical length and uteroservical angle with the occurrence of preterm delivery.

Materials and Methods: The present cohort study was conducted on 100 pregnant women with singleton pregnancy referred for routine control to perinatology ward of Imam Khomeini Hospital in Tehran between Jan 2019-Apr, 2019. All included cases were undergoing transvaginal sonography to measure the anterior cervical angle and length. Maternal demographic and clinical data, as well as delivery data of pregnant women, were obtained from their medical records. Logistic regression was conducted to estimate the predictors of pre-term delivery. All analyses were performed using Stata 14.0.

Results: Among 100 pregnant women, 17 had preterm delivery. Pregnant women with bleeding during pregnancy were reported with a higher preterm delivery rate (23.53% vs. 4.82%) (*P*=0.01) . The difference of mean cervical angle between pregnant women with the term and preterm delivery was statistically different (102.12° in women who delivered pre-term vs. 86.15° in term group, $P<0.001$).

Conclusion
According to the results, pregnant women with bleeding during pregnancy and those with a higher mean of cervical angle were more prone to pre-term delivery. Therefore, the anterior cervical angle and bleeding during pregnancy can be considered as predictors for preterm birth.

Key Words: Cervical Length, Cervical Curvature, Preterm Birth, Uterocervical Angle.

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1- INTRODUCTION

Pre-term labor is the emergence of regular uterine contractions with the concomitant cervical change that is needed to promote effusion and dilation of the cervix between 20-37 weeks (1). The rate of preterm delivery has been declining in recent years; however, it is still the leading cause of neonatal morbidity and hospitalization during pregnancy (2, 3). The rate of preterm delivery in the United States in 2015 was 9.6%, ranged from 7.7% for single gestation to 50% of twins and 90% of triplets (3). According to the pieces of evidence, bacterial vaginosis, cocaine or heroin use, history of abdominal surgery, history of preterm delivery, infections of the urinary and genital tracts, intrauterine infection, low Body Mass Index (BMI), the physically strenuous work of mothers, periodontal disease, Sexually Transmitted Infection (STI), polyhydramnios, shortened cervix, and uterine anomalies are known as the risk factors of preterm delivery (3-6).

It is not possible to accurately predict preterm delivery; however, the methods such as measuring fetal fibronectin as well as measuring cervical length can help obstetricians and midwives to predict preterm delivery (7). One of the diagnostic methods is vaginal ultrasound, which is a proper instrument for morphological evaluation of the cervix and measuring the details with high accuracy (8, 9). Over the past decade, ultrasound measurement of cervical length has been an important predictive marker for predicting preterm delivery. The sensitivity and positive predictive value of cervical length for preterm delivery are acceptable among high-risk patients; nevertheless, it did not report acceptable results among the general population (10, 11). The cervical function can greatly affect the anatomy of the cervix (12). Just as the cervical length can be related to preterm delivery, uterocervical angles can also affect

cervical function. Several studies have shown that an open uteroservical angle creates a direct outlet, whereas a sharp uteroservical angle can act as anatomical support, reducing pressure, and preventing cervical deformation (13). The early diagnosis of preterm birth is crucial, both in terms of public health and the cost to the health care system. Evaluation of cervical features during anomalous scanning ultrasound is one of these methods (14-16). Due to the relationship between preterm delivery and increased mortality among infants and the rare number of studies on the effect of uteroservical angle on preterm delivery, the present study was designed to investigate the relationship between cervical features including cervical length, curvature, and anterior uteroservical angle with preterm delivery.

2- MATERIALS AND METHODS

2-1. Study design and population

The present cohort study was conducted on 100 pregnant women with singleton pregnancy referred for routine control purposes to perinatology ward of Imam Khomeini Hospital in Tehran, Iran, between Jan 2019-Apr 2019.

2-2. Methods

All included cases were undergoing transvaginal sonography (Samsung ws80, Made in South Korea) to measure the anterior uterocervical angle, curvature, and length. The anterior uterine wall was imaged, the internal and external cervical ora, including the isthmus, was recognized, and a line between them was drawn. A second line was drawn parallel to the lower aspect of the anterior uterine wall passing through the internal cervical os. The angle created by the two lines at the internal os was measured, and the length of the cervix was defined as a linear measurement from the internal os to the external os of the cervix (17). The cut point for anterior cervical angle and the

cervical length was considered as 95° and 25 mm.

2-3. Measuring tools: Laboratory measurements

Measurements of cervical length, curvature, and anterior uterocervical angle were carried out using a single maternal-fetal medicine physician during the reference of pregnant women for routine control. Maternal demographic and clinical data (such as age, education, job, BMI, and intercourse per week), as well as delivery data (weight of neonate, bleeding and history of abortion, history of abortion, gravidity, and parity) of pregnant women, was obtained from their medical records. In the present study, delivery time was considered as an outcome of interest. We defined pre-term delivery as gestational age at birth of fewer than 37 weeks.

2.4-Ethical consideration

The ethics committee of Tehran University of Medical Sciences approved the study (code: IR.TUMS.IKHC.REC.1398.002). The written informed consent was taken from all participants before, including in the study.

2-5. Inclusion and exclusion criteria

Pregnant women with the gestational age of 18-23 weeks and six days were included in the study, and those with multiple pregnancies, polyhydramnios, fetal anomalies, placenta Previa, placental abnormalities, decolman, preeclampsia, preterm history, gestational diabetes, and hypertension were excluded from the study.

2-6. Data Analyses

Descriptive statistics were reported as number (%) for categorical variables and mean for continuous variables across participant's backgrounds in both groups. Univariable logistic regression was conducted to estimate the crude association between demographic and clinical data of pregnant women and pre-term delivery. Those with P-value < 0.05 were considered as potential significant determinants of pre-term delivery and were included in multivariable logistic regression. The results of the logistic regression model were presented using Odds Ratio (OR), and 95% Confidence Interval (CI). All analyses were performed using Stata 14.

3- RESULTS

A total of 100 pregnant women were included in the study. Seventeen of them had preterm delivery. A full comparison of demographic and clinical data in case and control groups are presented in **Table. 1**. Pregnant women with bleeding during pregnancy were reported with a higher proportion of pre-term delivery (23.53% vs. 4.82) (P=0.01). The difference of mean cervical angle between two groups was statistically different (102.12° in women who delivered pre-term vs. 86.15° in term group, P<0.001). There was not a significant difference between the two groups in regards to the history of abortion, the gender of the neonate, job, education, age, gravidity, parity, BMI, times of intercourse per week, cervical length, and curvature of the cervix (P>0.05).

Table-1: Comparison demographic and clinical characteristics of pregnant women with preterm and term delivery.

Variables		Preterm delivery	Term delivery	P-value
Categorical variables: Frequency (%)				
History of abortion	No	14 (82.35)	69 (83.13)	0.94
	Yes	3 (17.65)	14 (16.87)	
Bleeding	No	13 (76.47)	79 (95.18)	0.01
	Yes	4 (23.53)	4 (4.82)	
Neonate gender	Boy	10 (58.82)	46 (56.10)	0.84
	Girl	7 (41.18)	36 (43.90)	
Job status	House keeper	17 (100.00)	75 (90.36)	0.18
	Employee	0	8 (9.64)	
Education	Primary	4 (23.53)	8 (9.64)	0.15
	Guidance	2 (11.76)	10 (12.05)	
	Diploma	10 (58.82)	42 (50.60)	
	Academic	1 (5.88)	23(27.21)	
Continuous variables: Mean (SD)				
Age (year)		30.52 (6.88)	32.18 (6.61)	0.38
Gravidity		2.28 (1.00)	2.25 (0.77)	0.90
Parity		1.78 (0.67)	1.44 (0.63)	0.13
BMI (Kg/m^2)		26.75 (3.53)	25.56 (3.74)	0.23
Intercourse per-week		0.89 (0.84)	1.08 (0.94)	0.46
Weight of neonate (gr)		2505 (678.78)	3.300 (387.30)	**<0.001**
Cervical length		33.18 (3.61)	33.67 (4.25)	0.66
Curvature of cervix		147.88 (18.51)	148.64 (16.57)	0.87
Anterior utero servical angle		102.12 (7.13)	86.15 (5.78)	**<0.001**

BMI: Body mass index, SD: Standard deviation.

The effect of predictor variables on pre-term delivery is presented in **Table. 2**. After adjusting for the anterior cervical angle, those with bleeding during pregnancy had 13.35 fold higher odds of pre-term delivery ([OR=13.35, 95% CI: 1.89, 64.14)], P=0.09). Moreover, after controlling bleeding status, pregnant women with an anterior cervical angle of more than 95° had 3.34 fold higher odds of pre-term delivery ([OR=36.34, 95% CI: 8.25, 80.1)], P<0.001).

Table-2. The effect of predictor variables on preterm delivery.

Variables	Crude model		Adjusted model	
	OR (95% CI)	P-value	OR (95% CI)	P-value
History of abortion	1.05 (0.26, 4.17)	0.94	-	-
Bleeding	6.07 (1.35, 27.37)	0.02	13.35 (1.89, 64.14)	0.009
Cervical length	0.97 (0.86, 1.1)	0.66	-	-
Curvature of cervix	0.997 (0.97, 1.02)	0.87	-	-
Anterior cervical angle	26.06 (7.1, 95.53)	<0.001	36.34 (8.25, 80.1)	<0.001

OR: Odds ratio, CI: Confidence interval.

4- DISCUSSION

We performed a prospective cohort study to examine the relationship between cervical features, including cervical length, curvature, and uteroservical angle, with the occurrence of preterm delivery. In our study, the increase of uteroservical angle and bleeding during pregnancy was significantly associated with increased odds of preterm birth, but the association between cervical length and curvature with preterm delivery was not significant. Inconsistent our findings, previous studies have shown that women with shorter cervical lengths tend to experience shorter delivery times and are less likely to have a cesarean delivery (18, 19). However, the cervical length has a sensitivity ranging from 27-75% depending on the a priori risk for pre-term delivery of the sample population, the selected outcome measure, and the cervical length threshold (19, 20). Knight et al. (21), and Sur et al. (22) found that an increase in the anterior cervical angle was associated with increased risk of pre-term delivery, which was consistent with our findings. Also, Dziadosz et al. showed that a utero cervical angle>105° during the second trimester is associated with an increased risk of pre-term birth (23). However, depending on the angle of inclination of the cervix, the cervical canal may be considered either "closed" in cases of an acute uterocervical angle or "open"

in cases of an obtuse uterocervical angle. Evidence showed that modification of the anterior cervical angle had been associated with effective cervical pessary placement for the prevention of preterm delivery (24, 25). According to the literature review, no study has been conducted on the relationship between cervical curvature and pre-term delivery. Consequently, this study examined the relationship between them, however, no significant relationship was observed. Due to small sample size, it is suggested that the predicting role of cervical curvature to be examined in upcoming studies. The present study had several limitations. First, the small sample size of the study reduced the study power to determine the effect of independent variables on pre-term delivery. Second, selecting pregnant women from a single center can affect the generalizability of our findings. However, measurements of all cervical length and anterior angle using a single obstetrician for controlling inter-observer variability and the prospective nature of the study for controlling the risk of information bias can be considered as the strength of the study.

5- CONCLUSION

We found that pregnant women with bleeding during pregnancy and those with a higher means of cervical angle were more prone to pre-term delivery.

Therefore, the anterior cervical angle and bleeding during pregnancy can be considered as predictors for preterm birth.

6- ACKNOWLEDGMENTS

The authors would like to thank all participants who make this study project possible as well as the Deputy of Research and Technology of Tehran University of Medical Sciences for approving this study.

7- CONFLICT OF INTEREST: None.

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