Uterocervical angle and cervical length as predictors for preterm birth in low-risk women

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Abstract

Background: Cervical length measurement is widely used to estimate the risk of preterm birth. Another potential predictor of preterm birth is the uterocervical angle, and this additional measurement may improve the risk assessment.

Objectives: To evaluate the role of the uterocervical angle compared to the cervical length measurements in preterm birth prediction.

Study design: This prospective cohort study was carried out on 120 asymptomatic primigravida women at low risk of preterm labor attending the Gynecology and Obstetrics department at Fayoum University Hospital. Uterocervical angle and cervical length were measured by transvaginal ultrasound. Maternal history and pregnancy data were recorded. Delivery data were subsequently collected.

Results: The mean age, BMI, and gestational age at delivery were 21.79 ± 3.3, 24.6 ± 5.8, and 38.46 ± 1.98, respectively. Fifteen out of 120 women (12.5%) experienced preterm birth. The uterocervical angle was significantly larger among the preterm group than the term group (110.17 ±14.93 vs. 125.00 ±15.35, p<0.001). The cervical length was significantly shorter among preterm women as compared with term. An inverse linear moderate correlation existed between gestational age and the uterocervical angle (r= -0.370, p<0.001). A positive linear moderate correlation existed between gestational age and the CL-one line (r= 0.260, p=0.004). Also, a positive linear strong correlation between GA and CL-two lines (r= 0.716, p<0.001).

Conclusions: The uterocervical angle is a potential novel screening tool for predicting preterm birth better than cervical length.

Keywords: Uterocervical Angle; Cervical Length; Asymptomatic Preterm Labor.

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Introduction

Preterm birth (PTB) seriously affects about 10.6% of live births globally. It is defined as birth before the 37th week of gestation (1). It has multiple risk factors but may occur without any possible explanation (2). Determining women at risk is challenging as the sensitivity of demographic and behavioral risk factors is low (3). Additionally, PTB is a multifactorial condition with a previous history of PTB, the powerful predictive of recurrent PTB (4). Accordingly, there is a continued need to determine tools accurate in predicting PTB in low-risk women (5). Cervical length (CL) measurement and fetal fibronectin were used to predict PTB, with conflicting results about its utility in low-risk women (6). A novel ultrasound parameter- the uterocervical angle (UCA) - was introduced as a predictor for PTB with reported improved accuracy than CL measurement (7). Both modalities are easy to perform and inexpensive; however, the UCA was not evaluated among low-risk women (8). Therefore, this study was conducted to evaluate the accuracy of UCA in predicting PTB in low-risk women.

Methods

This prospective cohort study was conducted at the obstetrics and gynecology department at Fayoum University from February 2022 to July 2022. We recruited primiparous women attending the outpatient clinic and low-risk for PTB according to specific inclusion and exclusion criteria. Inclusion criteria: a) age from 18-35 years, b) gestational age from 20-28 weeks, and c) asymptomatic women with no uterine contractions, lower abdominal pain, low back pain, pelvic pressure, vaginal bleeding, or leakage of amniotic fluid. Exclusion criteria: a) women with multiple gestations, b) cervical cerclage, c) tocolysis intake or cervical manipulation as vaginal douche, intercourse, or digital vaginal examination in the last 24 hours, and d) history of medical disorders in the current pregnancy as diabetes and hypertensive disorders with pregnancy.

Eligible women were evaluated as follows:

- Detailed history taking, including maternal age, gestational age determination at recruitment and at time of delivery, and detailed obstetric history.
- A transabdominal ultrasound was performed to determine fetal biometry, estimated fetal weight, and amniotic fluid index at delivery time.
- A transvaginal ultrasound was performed on all participants using a high-frequency endovaginal probe (3–9 MHz) on a (voluson s10 expert, EG) ultrasound system. The urinary bladder was empty, and women were laid in the lithotomy position. The vaginal probe was introduced in the anterior fornix smoothly without pressure. A sagittal view of the cervix and the anterior uterine wall was obtained. The endocervical canal was identified as the hypoechoic zone of the cervical mucosa. The external and internal cervical os was identified where the anterior and posterior lips of the cervix meet together at the vaginal canal and the lower uterine segment, respectively.
- The CL was measured using two methods: a) the single line measurement as a line extending from the internal to the external os (9), b) the two-line method where the CL was measured as the line from the internal os to the point of maximum excursion of the cervical curvature and then from this point to the external os (10).
- If a difference > 5mm was detected between the two methods, the two-line method was adopted to guarantee accurate measurements.
- The UCA was measured as the angle between a line drawn from the internal to the external cervical os and a line drawn parallel to the anterior uterine wall and passing through the internal cervical os (11).

All women were followed up according to regular antenatal care visits recommended by NICE guidelines (12). The GA at delivery was recorded, and accordingly, the cohort was divided into two groups: Group A, who delivered before 37 weeks gestation (PTB) (3), and Group B, who delivered after 37 weeks gestation.

The primary outcome measure was the predictive role of the UCA compared to the CL in PTB. Other outcome measures included determining cutoff levels for the CL and UCA in predicting PTB.

Sample size calculation was done using the Egyptian 13 % Preterm birth rate (births <37 weeks per 100 live births), (13) a minimal total hypothesized sample size of 100 asymptomatic pregnant women was calculated at a two-sided confidence level (1-alpha) 95%, power 80%, taking into consideration 5% level of significance and 5% precision using Z- test (14). This calculation estimated a total sample size of 120 participants after adding a 20% dropout rate during follow-up.

Statistical analysis

Data were collected, revised, coded, and entered into the Statistical Package for Social Science (IBM SPSS) version 24. The qualitative data were presented as numbers and percentages, while quantitative data were presented as mean and standard deviations when their distribution was found to be parametric. The comparison between two groups with qualitative data was made using the **Chi-square test** and/or **Fisher exact test** instead of the Chi-square test when the expected count in any cell was found less than 5. The comparison between two independent groups with quantitative data and parametric distribution was made using an **independent sample t-test** and **Mann-Whitney U test** with the non-parametric distribution. We used receiver operating characteristic (ROC) curve analysis, giving a level of sensitivity and specificity, to evaluate the CL and UCA cutoff value as predictors for PTB. It was estimated as the area under the curve (AUC) with a 95% confidence interval (CI). The AUC ranged from 0.5 (no predictive ability) to 1 (predictive value). Pearson's correlation analysis was done to evaluate the linear relationship between the CL and UCA, and the GA at delivery. P value was considered significant when below 0.05.

Results

Table (1) shows the baseline characteristics of the studied women. Woman's ages ranged from 18 to 33 with an average of 21.79 ± 3.3. Their BMI ranged from 22.3 to 30.4, averaging 24.6 ±5.8 kg/ m2. The mean gestational age at delivery was 38.46 ± 1.98 weeks.

Out of the studied 120 women, fifteen (12.5%) experienced a preterm birth, while the remaining 105 (87.5%) women had term birth after 37 weeks gestation.

The UCA according to pregnancy outcome (term vs. preterm) was significantly more prominent among the preterm group as compared with the term group (110.17 ±14.93 vs. 125.00 ±15.35, p<0.001). The CL was significantly shorter among preterm women than the term (3.39 ±0.59 vs. 2.93 ±0.48, p= 0.004). We further assessed the CL by the two-line method in 22 participants, and the CL by the 2-line method was significantly shorter among preterm compared to term women (4.25 ±0.42 vs. 3.71 ±0.27, p=0.025) **(Table 2)**.

There was an inverse linear moderate correlation between GA and UCA (r= -0.370, p<0.001). Additionally, a positive linear moderate correlation existed between GA and CL-one line and CL- two lines (r= 0.260, p=0.004 and r= 0.716, p<0.001, respectively).

The area under the curve (AUC) of UCA for prediction of preterm was (AUC = 0.810, SE = 0.065, 95% CI: 0.683–0.938). UCA degrees of ≥110 could predict preterm with a sensitivity of 83.3%% and a specificity of 74.8% (Figure-). The (AUC) of the CL-one line for prediction of preterm was (AUC =

0.724, SE = 0.066, 95% CI: 0.595–0.854). A CL-one line of ≤2.9 cm could predict preterm with a sensitivity of 75.2% and a specificity of 70%. The AUC of CL-two lines for prediction of preterm was (AUC = 0.882, SE = 0.078, 95% CI: 0.729–1.000). A CL-two line of ≤3.9 cm could predict preterm with a sensitivity of 77.8% and a specificity of 99% (Table 3).

Discussion

Preterm rates were reported as 12.5%. This differed from other results (9.6%) (14), while in Egypt, higher rates were reported (28% and 26%) (16, 17). Different sample sizes and definitions used in different studies would explain these variable results.

The UCA was inversely correlated with the GA at birth. It was significantly higher among women who delivered prematurely. It also predicted PTB significantly at measurements > 110. A previous study reported a significant inverse relation between the UCA and GA at birth (18). This denotes that an increased UCA was associated with earlier gestation at delivery. Additionally, an earlier study reported a UCA measurement of 115.4◦ which was significantly higher than in women who delivered at term. A cutoff value > 105.5◦ predicted PTB significantly (19). Another one reported a cutoff value > 105 (17). However, contradictory results were reported by another researcher who stated that UCA measurement in the second trimester was a poor predictor for PTB (20).

The relation between the UCA and PTB would be explained by the exposure of the cervix to mechanical forces exerted by the pelvic organs and the uterus. An obtuse UCA commonly allows pressure transmission exerted by these forces to the cervix leading to its dilatation. However, an acute UCA would hinder force transmission to the cervix keeping its standard shape and closure (21). However, different results would be rendered to the decreased incidence of PTB in each study, different gestational ages for obtaining measurements, and different races and histories of the studied populations.

The current study reported that the CL was significantly shorter among preterm compared with term women when measured by one- and two-line methods. Also, there was a statistically significant linear positive correlation between the CL at the time of assessment (16+ 0 to 24+ 0 weeks gestation) and the GA at delivery. This agreed with previous results (22, 23), emphasizing the role of the CL in the prediction of PTB. Contradicting results reported an insignificant difference in the CL among women who delivered preterm than those who delivered at term (15, 17).

A cutoff value <2.9 cm predicted PTB with a sensitivity of 75.2% and a specificity of 70%. Another study reported a cutoff value of <2.5cm (18). The other performance of the CL was reported with a sensitivity and specificity of 27.8% and 85.8%, respectively (17). Another study reported poor performance of the CL (15). Inconsistent results would be attributed to different sample sizes, races, and patient histories among studies.

Conclusion

The CL and UCA predicted PTB with better performance reported by the UCA.

Conflict of interest

None.

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Table (1): Baseline data of the studied women; (N= 120)

		Descriptive Statistics
Age; (years)	Mean ±SD	21.79 ±3.3
	Minimum	18
	Maximum	33
BMI; (kg/ m²)	Mean ±SD	24.6 ±5.8
	Minimum	22.3
	Maximum	30.4
GA; (weeks)	Mean ±SD	38.46 ±1.98
	Minimum	28.50
	Maximum	42.00

Table (2): comparison of Uterocervical angle between studied women according to outcome (term vs. preterm); (N= 120)

		Outcome		p-value
		Term N= 105	Preterm N= 15	
Uterocervical angle (degrees)	**Mean ±SD**	110.17±14.93	125.00±15.35	**<0.001***
	Minimum	67.00	76.00	
	Maximum	144.00	140.00	
		Outcome		**p-value**
		Term N= 105	**Preterm N= 15**	
Cervical Length (CL)-one line	**Mean ±SD**	3.39±0.59	2.93±0.48	**0.004***
	Minimum	2.24	2.31	
	Maximum	4.61	3.73	
		Outcome		**p-value**
		Term N= 18	**Preterm N= 4**	
Cervical Length (CL)- two lines	**Mean ±SD**	4.25±0.42	3.71±0.27	**0.025***
	Minimum	3.51	3.45	
	Maximum	4.89	3.97	

Table (3): Results of ROC curve analysis for sensitivity and specificity of UCA and CL for prediction of preterm birth

	AUC	95% CI of AUC	Cutoff	p-value	Sensitivity	Specificity
UCA	0.810	0.683 - 0.938	≥110	<0.001*	83.3%	74.8%
CL-one	0.724	0.595 - 0.854	≤2.9	0.005*	75.2%	70%
CL-two	0.882	0.729 - 1.000	≤3.9	0.019*	77.8%	99%

AUC: Area under the curve, **CI:** Asymptotic 95% Confidence Interval of AUC, **UCA:** Uterocervical angle, **CL-one:** Cervical Length-one line, **CL-two:** Cervical Length-Two lines.