Prediction of Preterm Labor in Pregnant Women with Threatened Preterm Birth by Measuring Cervical Length and Uterocervical Angle

Ali Elshabrawy Ali, Youssef Abo Elwan Elsayed, Hala Mohamed Hesham Abdallah, Basem Mohamed Hamed

Department of Obstetrics and Gynecology, Faculty of Medicine, Zagazig University, Egypt

***Corresponding author:** Hala Mohamed Hesham Abdallah ,

E-mail: halahesham199@gmail.com

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ABSTRACT

Background: Labor pains that start before 37 weeks of pregnancy but don't coincide with cervical changes are referred to as threatened preterm labor. Preterm birth occurs in around 25–30% of cases with threatened preterm labor. **Objectives**: The aim of the present study was to early predict preterm delivery in patients with uterine contractions, and to evaluate and compare the sensitivity of uterocervical angle and cervical length to anticipate premature labor. **Patients and methods**: This prospective observational cohort The Obstetrics and Gynecology Department of Zagazig University Hospital conducted the study. and at Al-Sahel Teaching Hospital, Egypt, during the period from April 2022 to October 2022 and performed on 70 pregnant women who were susceptible to premature labor between 28 and 37 weeks of gestation. The evaluation of eligible participants included collecting a thorough medical history, having a qualified sonographer do a complete anatomical scan to establish their gestational age and rule out any structural defects, and having cardiotocography performed to track changes in fetal heart rate and variability. Transvaginal ultrasound was done for evaluation of the uterocervical angle and cervical length were measured. **Results**: The most common risk factor in the studied group was polyhydramnios and previous history of preterm labor respectively. We found that the cut-off points of cervical length and uterocervical angle were <35.5mm mm and ≥105 degree respectively in predicting preterm birth. Results of the study showed that the cervical length was more accurate than uterocervical angle. **Conclusion:** When preterm labor is threatened, measurements of the cervical length and uterocervical angle can both be thought of as helpful instruments for forecasting preterm birth.

Keywords: Threatened Preterm Labor, Uterocervical Angle, Cervical Length

INTRODUCTION

Preterm labor is a medical emergency, a major contributor to perinatal mortality and disability, and a significant public health issue on a global scale. The cause of 75% of baby deaths is premature birth. In addition to causing the family financial and emotional hardship, preterm labor can leave infants permanently disabled (due to physical or brain damage) [(1)].

In one in every ten pregnancies, there will be a premature birth. Each year, there are over 13 million PTBs worldwide. In 2011, 9% of all babies born in Germany arrived before GA 37[(2)].

Labor pains that start before 37 weeks of pregnancy but don't coincide with cervical changes are referred to as threatened preterm labor. Preterm birth occurs in around 25–30% of cases with threatened preterm labor [(3)].

Preterm births account for 50% of children with cerebral palsy, 1/3 of children with impaired vision, 1/4 of children with

chronic lung illness, and 5% of children with mental retardation. In maturity, there is a higher risk of behavioral issues, a lower rate of educational success, a lower rate of successful reproduction, and a higher prevalence of PTB in the second generation. Given the significant and wide-ranging effects of preterm delivery, it is crucial to identify patients who are more likely to develop PTB [(4)].

Any pregnancy with suspected labor discomfort that is less than 37 weeks gestation requires a vaginal or speculum examination to determine cervical dilation and determine whether preterm or threatened preterm labor is present [(5)].

Our study's objectives included evaluating and comparing the sensitivity of cervical length and uterocervical angle in predicting preterm labor, as well as early preterm birth in patients with uterine contractions.

PATIENT AND METHODS

This prospective observational cohort In Egypt, a study was carried out between April and June at the Obstetrics and Gynecology Department of Zagazig University Hospital and at Al-Sahel Teaching Hospital 2022 to October 2022. Before start the study, permission was obtained from institution review board IRB (#ZUIRB 9079- 4/1/2022) of faculty of medicine Zagazig University. All of the subjects' written informed permission was acquired. The study's protocol complied with the Helsinki Declaration, which is the World Medical Association's code of ethics for research on humans.

The study recruited 70 women with uncomplicated singleton pregnancies between 28 and 37 weeks of gestation who were at risk of premature birth. Patients with preterm uterine contractions were also those who were at risk for preterm labor. While patients with placenta previa or any contact bleeding diseases, such as endocervical polyp, infection, or bleeding disorders, were not included in the study.

After obtaining the consent of participants, demographic data were collected. Images were taken by 2 ultrasound machines Siemen Acuson NX2 Elite (7.5 – 10 MHz transvaginal probe) and Mindray DC 70 expert (7.5 – 10 MHz transvaginal probe).

Transvaginal ultrasonography was used to assess A sagittal view of the cervix with the echogenic endocervical mucosa along the length of the cervical canal was obtained. The calipers were then used to measure the distance of the cervical canal between the furthest point at which the cervical wall were juxtaposed. Cervical length was measured by the transducer, which was placed in the vagina approximately 3 cm proximal to the cervix to avoid any cervical distortion of its position.

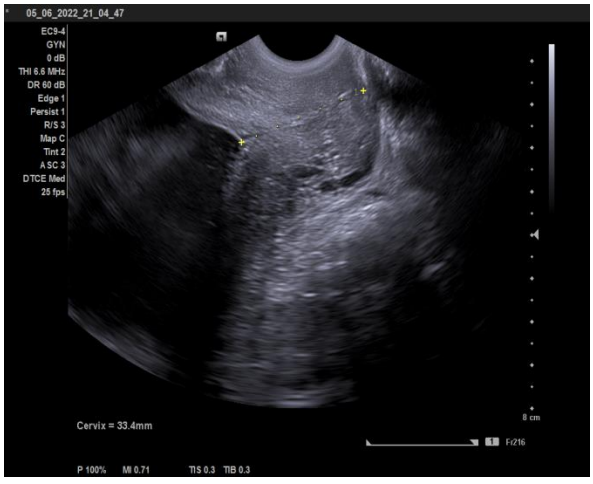

Fig. (1): (cervical length in pregnant women 33 wk with threatened preterm labor) measuring 33.4mm

Outcome:

Maternal outcomes were followed up as regard timing of delivery, mode of delivery, relation of multiple risk factors to timing of delivery.

Fetal outcomes were also recorded as regard to incidence of admission to the

neonatal intensive care unit (NICU), respiratory distress syndrome (RDS), and transient tachypnea of newborns (TTN). Comparison of term and preterm babies in relation to cervical length and uterocervical angle.

Statistical analysis

Using IBM SPSS statistical software (version 22.0; SPSS Inc., Chicago, Illinois, USA for windows), the data were statistically analyzed, and continuous data were presented as the mean ±SD and 95% CIs. The significance of the link between iron status and vitamin D levels was assessed using Spearman's correlation at P=0.05.

RESULT

Table (1): Descriptive data of the studied group: n. = 70

Variables	*Range*	*Mean±SD*
Age (years)	(19-38)	**27.4±5.9**
Gravidity	(1-8)	**2.27±1.4**
Abortion	(0-2)	**0.21±0.4**
Gestational age at examination (weeks)	(28-36)	**31.5± 2.7**
Parity		
Nulliparous	0 – 1	**34 (48.6%)**
Multiparous	2 – 5	**36 (51.4%)**
Number of previous C.S		
No	0	**48 (68.6%)**
Once	7	**7 (10.0%)**
Twice	10	**10 (14.3%)**
Three times	3	**3 (4.3%)**
Four times	2	**2 (2.9%)**

Table 1; showed that the average age of the studied group was (27.4±5.9) ranging from (19 to 38) years, their gravidity was (2.27±1.4) ranging from 1 to 8, their average abortion was (0.21±0.4) ranging from 0 to 2, gestational age at examination was 31.5±2.7 ranging from 28 to 36 (weeks), about half of the studied group was multiparous (51.4%), (31.4%) had previous cesarean section and (14.3%) had previous twice C.S.

Table (2): The pregnancy outcome among the studied group:

Variables	***The studied group*** ***No= 70 (%)*** ***Mean±SD*** ***Median*** ***(Range)***
Gestational age at delivery (weeks)	**36.2±2.5** **(28-37)**
Mode of delivery	
Vaginal	**24 (34.3%)**
C.S	**46 (65.7%)**
Maternal outcome	
Conservative	**62 (88.6%)**
PTL	**8 (11.4%)**
Maturity	

term≥37	**42 (60.0%)**
preterm<37	**28 (40.0%)**
Neonatal outcome	
Take home	**49 (70.0%)**
NICU	**21 (30.0%)**
➢ ***RDS***	**10 (14.0%)**
➢ ***TTN***	**7 (10.0%)**
➢ ***Died***	**4 (6.0%)**

Table 2; showed that the average gestational age at delivery was 36.2±2.5 ranging from 28 to 37 (weeks), more than half of the studied group had C.S (65.7%), (40.0%) had preterm babies and (70.0%) of the studied group didn't need hospital admission**.**

Table (3): Comparison between the term and preterm babies regarding socio- demographic characteristics:

Variables	***The term No= 42 (%) Mean±SD (Range)***	***The preterm No=28 (%) Mean±SD (Range)***	**Test**	**P-value**
Gravidity	1.69±0.99 1 (1-4)	3.1±1.6 3 (1-8)	M.W=4.5	**0.001****
Parity **Nulliparous** **Multiparous**	 27 (64.3%) 15 (35.7%)	 7 (25.0%) 21 (75.0%)	χ^2=10.3	**0.001****
Previous C.S **No** **Yes**	 31 (73.8%) 11 (26.2%)	 17 (60.7%) 11 (39.3%)	χ^2=1.3	**0.3**
Number of previous C.S **No** **Once** **Twice** **Three times** **Four times**	 31 (73.8%) 5 (11.9%) 6 (14.3%) 0 (0.0%) 0 (0.0%)	 17 (60.7%) 2 (7.1%) 4 (14.3%) 3 (10.7%) 2 (7.1%)	χ^2=8.3	**0.08**

M.W= Mann-Witenny test, T-test=T independent test Statistically significant difference (p<0.05), ** Highly statistically significant difference (p<0.05).*

Table 3; showed that there was statistically significant more gravidity, and higher percent of multiparous among preterm babies than term ones with no statistically significant difference regarding the previous number of C.S.

Table (4): Comparison between the term and preterm babies regarding the cervical length and utero-cervical angle:

Variables	***The term No= 42 (%) Mean±SD Median (Range)***	***The preterm No=28 (%) Mean±SD Median (Range)***	**Test**	**P-value**
Cervical length (mm)	39.7±8.6 41 (23-57)	32.5±12.5 32.5 (3-57)	M.W= 2.6	**0.01***

Utero-cervical angle	97.1±23.9 94.5 (50-146)	105.9±25.6 23 (56-159)	T= 1.4	**0.19**

M.W= Mann-Witenny test, T-test=T independent test Statistically significant difference (p<0.05).*

Table 4; showed that there was a statistically significant lesser cervical length among preterm babies than term ones while regarding the utero-cervical angle, there was no statistically significant difference between preterm and term babies.

Table (5): Univariate binary logistic regression for the predictive factors affecting preterm labor among the studied group

Predictors	Odds ratio	SIG	95% CI
Maternal old age	2.7	0.01*	(0.097-0.076)
Gravidity	10.8	0.001**	(0.029-0.48)
Parity	0.18	0.001**	(0.06-0.53)
Previous C.S	0.64	1.3	(0.19-1.53)
Cervical length (mm)	4.2	0.005*	1.52-11.7
Uterocervical angle	1.1	0.8	0.41-2.98
Mode of delivery	4.2	0.001**	(1.5-12.1)

Binary logistic regression shows that maternal age, higher gravidity, high parity, cervical length, and mode of delivery were statistically significant predictor factors for preterm labor table 5.

Table (6): The cut-off point of cervical length and uterocervical angle to predict preterm labor.

Variables	Cut off point	AUC	SIG	95% CI
Cervical length (mm)	<35.5	0.68	**0.009***	**0.55-0.81**
Uterocervical angle	≥ 105	0.59	0.1	**0.45-0.73**

Table 6; showed that the cut-off points of cervical length and uterocervical angle among the studied group between 28wk and 37wk were <35.5 and ≥ 105 respectively.

Table (7): The diagnostic ability of cervical length and uterocervical angle to predict preterm labor.

Variables	Sensitivity	Specificity	PVP	PVN	Accuracy
Cervical length (mm)	67.9%	66.7%	57.6%	75.7%	**67.1%**
Uterocervical angle	64.3%	39.1%	40.9%	61.5%	**58.6%**

Table 7; showed that the sensitivity and specificity of cervical length and uterocervical angle were (67.9% & 66.7%), (64.3% & 39.1%), predictive value positive (57.6% & 40.9%), predictive value negative (75.7% & 61.5%) and accuracy (67.1% & 58.6%) respectively.

DISCUSSION

Regarding the socio-demographic parameters, it was discovered that the average age of the group under study was (27.4±5.9) ranging from (19 to 38) years, their gravidity was (2.27±1.4) ranging from 1 to 8, their average abortion was (0.21±0.4) ranging from 0 to 2, gestational age at examination was 31.5± 2.7 ranging from 28 to 37 (weeks). The average cervical length was (36.8±10.8) ranging from 3 to 57 (mm) and the average uterocervical angle was (100.7±26.1) ranging from (50 to159), about half of the studied group was multiparous (51.4%), (31.4%) had previous cesarean section and (14.3%) had previous twice C.S.

In the current study we found that there were 28 (40%) of cases were preterm, and 42 (60%) were term, the comparison of term and preterm groups showed that there was statistically significant older maternal age, more gravidity, abortion, more gestational age at examination, and higher percent of multiparous among preterm babies than term ones with no statistically significant difference regarding the previous number of C.S.

Binary logistic regression shows that maternal age, higher gravidity and high parity, and mode of delivery were statistically significant predictor factors for preterm labor.

The current study can be supported by **Khamees *et al*** [6] aimed to assess how well the uterocervical angle and cervical length predicted preterm birth. 167 women at high risk of preterm birth were enrolled in the trial. 44/167 women (26.3%) experienced preterm delivery. According to subgroup analysis, women who delivered preterm had significantly lower body mass indices than those who did so at term ($p = 0.023$). In contrast to our results, they revealed that maternal age, Mode of delivery and parity were non-significantly differed between the studied groups.

Furthermore, **Wagner *et al*** [7] sought to determine whether the uterocervical angle (UCA) might be used to predict preterm birth in women who experienced painful, regular uterine contractions and a cervical length of 25 mm or less. The research consisted of 213 singleton pregnancies. In Univariate and multivariate logistic regression, the study revealed that maternal age, weight and parity were non-significant predictors of preterm birth in 2 days.

Comparison between the term and preterm babies regarding the cervical length and utero-cervical angle showed that there was a statistically significant lesser cervical length among preterm babies than term ones while regarding the utero-cervical angle, Preterm and term newborns had no statistically significant differences. Binary logistic regression shows that cervical length, was statistically significant predictor factors for preterm labor.

In agreement with the current study **Luechathananon *et al*** [8] found that the preterm group's median CL was 0.4 cm ($p = 0.03$) substantially shorter than the term group's median CL. In both groups, the median UCA was 113 degrees ($p = 0.93$); however, the widest UCA of the preterm group was more than the widest UCA of the term group.

In harmony with our results **Wagner *et al*** [7] in Univariate and multivariate logistic regression, revealed that CL but not UCA was a significant predictor of preterm birth in 2 days.

Also, in consistency with our results **Khamees *et al*** [6] found that the CL was not significantly different between the preterm birth group and the term birth group (27.94.0 and 29.14.1 mm, respectively, $p = 0.067$). The frequency of patients in the preterm group who had a CL of 25.0 mm or less was noticeably higher ($p < 0.001$). But in contrast to our results the mean UCA was significantly greater in those who had

PTB (115.4°±9.1° vs. 101.1°±8.3°, p< 0.001). The UCA strongly predicted the occurrence of PTB in single and multiple regression models using regression models (p < 0.001, 95% confidence interval [CI] 1.053–1.125, and p = 0.016, 95% CI 1.009–1.088, respectively). The CL played a negligible part in the PTB prediction (p = 0.316, 95% CI 0.933–1.023).

Regarding pregnancy outcome among the studied group, we found that the average gestational age at delivery was 36.2±2.5 ranging from 28 to 39 (weeks), more than half of the studied group had C.S (65.7%), (40.0%) had preterm babies and (70.0%) of the studied group didn't need hospital admission.

The current study showed that there was a statistically significant decreased gestational age at delivery, a higher percent of vaginal delivery, a higher percent of TOP, and a higher percent of NICU admission among preterm babies than term ones.

In agreement with our results **Sawaddisan *et al*[9]** a statistically significant drop in gestational age at birth and a larger percentage of preterm babies admitted to the NICU than term babies.

To test the predictive ability of cervical length and utero-cervical angle in predicting preterm birth, ROC curve analysis was performed and we found that the cut-off points of cervical length and uterocervical angle were <35.5 and ≥ 105 respectively. The sensitivity and specificity of cervical length and uterocervical angle were (67.9% & 66.7%), (64.3% & 39.1%), predictive value positive (57.6% & 40.9%), predictive value negative (75.7% & 61.5%) and accuracy (67.1% & 58.6%) respectively.

Our results showed that cervical length have superior accuracy than utero-cervical angle in predicting preterm birth.

Our results were supported by **Luechathananon *et al*[8]** showed that the ROC curve's best UCA cut-off point for predicting preterm birth was 110.97 degrees. For the UCA 110.97 degrees preterm birth screening, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were 65.1%, 43.6%, 29.8%, and 77.3%, respectively. The ROC curve's area under it was 0.50. The 3.4 centimeter CL cut-off point was the most effective one for using the ROC curve to predict preterm birth. The sensitivity, specificity, PPV, and NPV of CL 3.4 cm for predicting preterm birth were, respectively, 72.1%, 46.2%, 33.3%, and 81.8%. Therefore, cervical length predicts preterm birth more accurately than utero-cervical angle.

Also, **Gründler *et al*[10]** stated that the mean UCA in the preterm and term groups did not differ substantially (P =.924), and that it was on average 103°. Even when only singletons were taken into account, the UCA was not predictive for imminent preterm birth. With sensitivity 0.50, specificity 0.80, positive predictive value 0.30, negative predictive value 0.90, positive likelihood ratio 2.4, negative likelihood ratio 0.6, and an odds ratio of 3.9 (95% confidence interval), CL had the best predictive accuracy for preterm birth 34 weeks 1.3-11.7, P = .016).

As well, **Reyna-Villasmil *et al*[11]** revealed that the UCA showed an area under the curve value of 0.864 (95% CI; 0.800 to 0.952) while the value of the area under the CL curve was 0.985 (95% CI; 0.733 to 1.000). The predictive ability of the UCA was lower than the CL.

Also, **Makled *et al*[12]** showed that The UCA was a significant preterm labor discriminator. When the cut-off value is ≥ 105, The UCA produced results for the discriminating of preterm and term deliveries with a sensitivity of 86.7% and a

specificity of 89%. Similar to this, the CL produced a sensitivity of 83.3% and a specificity of 74% for the distinction between preterm and term deliveries at a cut-off value of 25mm.

CONCLUSION

We came to the conclusion that UCA and CL can both be utilized to forecast preterm birth risks and support doctors' choices for the administration of tocolytic medications in preterm labor that is imminent. Our findings need to be confirmed by more comparative research with larger sample sizes and longer follow-up in order to pinpoint additional preterm birth risk factors.

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