OBSTETRICS

DOI 10.35630/2023/13/4.817

Received 11 July 2023;
Accepted 19 July 2023,
Published 15 August 2023

THE ROLE OF UTEROCERVICAL ANGLE IN DETERMINING THE THREAT OF PRETERM BIRTH

Ufuk Atlıhan ✉ , ***Umit Derundere***

Private Karatas Hospital, Izmir, Turkey

✉ ***cfl.ufuk@gmail.com***

ABSTRACT

Preterm labor is one of the leading causes of perinatal morbidity and mortality and is thought to complicate approximately 10-12% of pregnancies. Defined as birth before 37 weeks of gestation, preterm labor is one of the most common obstetric complications worldwide. Although the pathogenesis of preterm labor is not fully understood, intraamniotic infection or hemorrhage, uteroplacental ischemia, uterine overstretching and immunologic processes have been proposed in its etiology. However, there is still no definitive prediction tool. Sonographic assessment of the cervical structure by measuring cervical length (CL) has been used as a popular prediction tool to predict preterm labor. The uterocervical angle (UCA) is defined as the angle between the lower anterior uterine segment and the endocervical canal. Recently, UCA has been proposed as an alternative to CL for predicting preterm labor. In recent years, several studies have investigated the potential impact of UCA for preterm labor prediction. Our study aimed to determine whether the uterocervical angle, a new ultrasonographic marker for predicting preterm labor, is associated with the risk of spontaneous preterm delivery. The present study included 186 singleton pregnant women who gave birth in our hospital between January 2018 and December 2022. The data of the included patients were retrospectively evaluated from the hospital database and patient files. Regarding the primary outcome of our study, we found that there was a statistically significant difference in UCA and cervical length between women who delivered spontaneously preterm and women who delivered at term ($p<0.05$). In the second trimester ultrasonography evaluation, the mean UCA was wider and the mean cervical length was shorter in the preterm group. Contrary to other studies in the literature, smoking and history of preterm delivery as risk factors were not included in our study. The exact reasons for some of the differences between our findings and the studies reported in the literature are not clear, but may be attributed to several factors. First, the patient type was heterogeneously selected in the cited studies. There are large differences in terms of sample size and studies that may be attributed to such heterogeneity. In conclusion, wider UCA and shorter cervical length in the second trimester are associated with spontaneous preterm delivery. Measurement of UCA is a reproducible technique and the UCA value was found to increase from the first trimester to the second trimester. We recommend the inclusion of UCA in current clinical practice in addition to cervical length measurement as a predictive factor that can be used in decision-making regarding the management of women at risk of preterm delivery. However, future studies are needed to assess the diagnostic accuracy of this index and should specifically consider the use of thresholds and related outcomes (preterm birth rates based on specific gestational weeks).

Keywords: Preterm, Birth, Uterocervical, Angle, Cervical

INTRODUCTION

Preterm birth is one of the leading causes of perinatal morbidity and mortality and is thought to complicate approximately 10-12% of pregnancies (1-3). Prematurity is responsible for 75-90% of neonatal deaths except congenital malformations (3). Defined as birth before 37 weeks of gestation, preterm labor is one of

the most common obstetric complications worldwide (4). According to World Health Organization (WHO) data, approximately 15 million babies are born preterm (<37 weeks of gestation) every year and this number corresponds to one in every 10 babies born alive. In surviving newborns, the risk of sequelae related to prematurity is high (5). Although the pathogenesis of preterm labor is not fully understood, intraamniotic infection or hemorrhage, uteroplacental ischemia, uterine overstretching and immunologic processes have been proposed in its etiology. However, there is still no precise prediction tool (6). Approximately one million children die each year due to complications of preterm birth, and many of the survivors have visual and hearing problems and mental or physical disabilities (2). Many obstetricians have proposed different ultrasonographic measurements and biochemical markers to predict true preterm labor. Sonographic assessment of the cervical structure by measuring cervical length (CL) has been used as a popular predictive tool to estimate preterm labor. The uterocervical angle (UCA) is defined as the angle between the lower anterior uterine segment and the endocervical canal. Recently, UCA has been proposed as an alternative to CL for predicting preterm labor. In addition, UCA is thought to play a predictive role in induction success, primary dysmenorrhea, cerclage failure, unexplained infertility and second trimester pregnancy termination (7-9). Unfortunately, the data on the relationship between wider UCA and induction success are not clear (10,11).

To date, the optimal strategy for pregnancies at risk of preterm delivery remains unclear. Progesterone, cervical cerclage and Arabin pessary have been used as potential management strategies in singleton pregnancies with a short cervix and a prior history of spontaneous preterm delivery (12). Screening of pregnancies also remains problematic, as many of the available strategies lack optimal diagnostic accuracy. Fetal fibronectin has been suggested as a potential biomarker for the prevention of preterm birth, but its sensitivity is relatively low (34%) (13-15). Available data also suggest that measurement of cervical length (CL) may help identify these women, as it can accurately predict pregnancies at risk of preterm delivery (16, 17).

Measurement of cervical length by ultrasonography is now part of the current routine as an objective and non-invasive method for the evaluation of preterm labor. In addition to the length of the cervix, it is possible to make structural and functional assessments such as the status and appearance of the internal os (e.g. funneling), cervical dilatation with herniation of the membranes, uterine contractions and the response of the cervix to fundal compression. Necessary or unnecessary, many pregnant women presenting to obstetric emergency units have to be treated and managed without differentiating between false/ineffective and true/effective contractions. The uterocervical angle (UCA) represents a new ultrasonography marker defined as the triangular segment measured between the lower uterine segment and the cervical canal. It is measured by using a line starting from the internal cervical ostia (extending along the cervical canal) and a second line following the inner segment of the anterior uterine wall. In recent years, several studies have investigated the potential impact of UCA for preterm labor prediction. The rationale behind the hypothesis of this relationship is based on the potential mechanical properties of this angle, which appears to act as a preventive barrier when acute. This study aimed to determine whether the uterocervical angle, a new ultrasonographic marker for predicting preterm labor, is associated with the risk of spontaneous preterm delivery.

MATERIALS AND METHODS

A total of 186 singly pregnant women who gave birth in our hospital between January 2018 and December 2022 were included in the study. The data of the patients included in the study were retrospectively evaluated from the hospital database and patient files. Preterm labor was defined as labor that occurred before 37 weeks of gestation. Inclusion criteria were as follows: Singleton pregnancies between 18-40 years of age, being in the second trimester of pregnancy, having a fetus in vertex presentation, having sonographic CL and UCA measurements, and delivering in a hospital. Pregnant women under 18 years of age, with chronic diseases, uterine anomalies, previous hysterectomy, multiple pregnancies, smoking and alcohol use were excluded. In addition, pregnant women with a history of preterm delivery were excluded. CL and UCA measurements were performed simultaneously by a radiologist and an obstetrician between 18 and 24 weeks of gestation. Transvaginal sonography was performed in the lithotomy position after emptying the bladder. The vaginal probe of the Voluson E10 Model Ultrasonography Device was inserted into the vagina without pressure on the cervix. UCA was defined as the angle between the anterior uterine segment and the internal cervical os. Then the distance between the internal os and external cervical os was recorded as CL. When defining CL, a cross-sectional image was taken in the sagittal plane in which the internal cervical os, external cervical os, cervical canal and endocervical mucosa could be seen simultaneously and the image covered 3/4 of the screen. If the two os were placed on a single line, the distance between them was measured directly. If not on the same line, the linear portions were measured separately and summed to obtain the CL. Each measurement for CL and UCA was performed three times. Then, mean values were calculated in the analysis. Patients' age, body mass index, gravida, parity, gestational week, mode of delivery and birth weight, sonographic characteristics and sonography week, CL and UCA values were recorded. Categorical variables obtained in the study were summarized as numbers and percentages, and continuous data were summarized as minimum, maximum, mean and standard

deviations. Independent samples t test and chi-square test were used to test the hypotheses. Finally, sensitivity and specificity were calculated for UCA: 105° and CL 25 mm cut off. Statistical analysis was performed using SPSS Version 22.0.

FINDINGS

In the study group, 78.5% of the patients had a term pregnancy. 74.7% of the patients had a normal delivery. The uterocervical angle was <105° in 83.3% and cervical length >25 mm in 96.2% of the participants. The mean age of the participants was 30.01±5.28 years, mean BMI was 22.69±2.11, mean gravida was 1.97±0.79, mean parity was 0.95±0.78, mean gestational age was 37.12±2.66, mean UCA was 98.30±6.62, and mean CL (mm) was 32.29±3.57 (Table 1).

Table 1

			Frequency	**Percentage**	
Birth Time	Preterm		40	21,5	
	Term		146	78,5	
Mode of delivery	Normal		139	74,7	
	Caesarean section		47	25,3	
UCA°	<105°		155	83,3	
	>105°		31	16,7	
CL(mm)	<25 mm		7	3,8	
	>25 mm		179	96,2	
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Age	186	20,00	43,00	30,0108	5,28127
BMI	186	18,60	36,10	22,6968	2,11560
Gravida	186	1,00	3,00	1,9785	,79836
Parity	186	,00	2,00	,9516	,78694
Birth week	186	28,00	40,00	37,1290	2,66195
UCA°	186	86,60	112,20	98,3038	6,62134
CL (mm)	186	23,00	39,00	32,2903	3,57493

There were no statistically significant differences between the means of age, BMI, parity and gravida according to the history of term or preterm delivery (p>0.05) (Table 2).

Table 2

	Birth Time		t	p
	Preterm	Term		
Age	30,80±6,03	29,79±5,05	1,067	0,287
BMI	22,94±2,93	22,62±1,83	0,837	0,404
Parity	0,92±0,79	0,95±0,78	-0,241	0,810
Gravida	1,97±0,80	1,97±0,80	-0,031	0,975

The mean weeks of gestation were evaluated according to whether the participants gave birth at term or preterm. On the other hand, although the type of normal delivery was proportionally higher in term delivery

and the type of cesarean delivery was higher in preterm delivery, no statistically significant relationship was found between the time of delivery and the mode of delivery (p>0.05) (Table 3).

Table 3.

		Birth Time		t/X^2	p
		Preterm	Term		
Birth week		32,70±2,01	38,34±1,02	-24,308	0,000
Mode of delivery	Normal	27 (%67,5)	112 (76,7)	1,411	0,235
	Caesarean section	13 (%32,5)	34 (%23,3)		

Significant differences were found in both UCA° and CL (mm) means according to whether the participants gave birth at term or preterm (p<0.05). UCA was found to be higher in preterm labor and CL (mm) was found to be higher in term labor. On the other hand, there was a statistically significant relationship between UCA and CL grouping and time of delivery (p<0.05). UCA >105° group was found to be higher in preterm labor and CL>25 mm group was found to be higher in term labor. The sensitivity and specificity for UCA° were 0.600 and 0.952, respectively, while the sensitivity and specificity for CL(mm) were 0.825 and 1, respectively (Table 4).

Table 4.

		Birth Time		t/X^2	p
		Preterm	Term		
UCA°		106,23±3,90	96,13±5,45	10,971	0,000
CL (mm)		29,20±3,70	33,13±3,04	-6,906	0,000
UCA °	<105°	16 (%40)	139 (%95,2)	68,896	0,000
	>105°	24 (%60)	7 (%4,8)		
CL (mm)	<25 mm	7 (%17,5)	0 (%0)	26,549	0,000
	>25 mm	33 (%82,5)	146 (%100)		

DISCUSSION

Defined as deliveries before 37 weeks of gestation, preterm births are a growing global public health problem. Preterm birth is the leading cause of death in children under 5 years of age and is the direct cause of at least 27% of all neonatal deaths. It is estimated that 11.1% (14.9 million) of live births reported worldwide were preterm births (18). Screening of pregnancies also remains problematic, as most current strategies lack optimal diagnostic accuracy. Fetal fibronectin has been suggested as a potential biomarker for the prevention of preterm birth, but its sensitivity is relatively low (34%). Available data also suggest that cervical length measurement can help identify these women as it can accurately predict pregnancies at risk of preterm delivery. Accordingly, current guidelines suggest that cerclage or progesterone treatment should be offered to women with a short cervix (<25 mm) on transvaginal ultrasound scan between 16 and 24 weeks of gestation, as well as women with a history of spontaneous preterm birth or second trimester loss (19).

The uterocervical angle (UCA) represents a new ultrasonography marker defined as the triangular segment measured between the lower uterine segment and the cervical canal. It is measured using a line starting from the internal cervical ostia (extending along the cervical canal) and a second line following the inner segment of the anterior uterine wall. In recent years, several studies have investigated the potential impact of UCA for preterm labor prediction. The rationale behind the hypothesis of this relationship is based on the potential mechanical properties of this angle, which appears to act as a preventive barrier when acute (20).

There is a paucity of studies in the published literature to determine whether UCA correlates with the risk of spontaneous preterm delivery. Therefore, we conducted this retrospective study to evaluate the ability of second trimester UCA to predict spontaneous preterm labor in singleton pregnant women at risk. In the

present retrospective study, 186 singleton pregnant women delivered in our hospital were included. The mean age of the included women was 30.01±5.28 years, mean parity was 0.95±0.78, and mean BMI was 22.69±2.11. Risk factors for preterm labor include a history of preterm delivery, short cervix, infection, smoking and African-American race. One study in the literature reported that smoking and a history of preterm delivery were significantly associated with an increased risk of preterm delivery (21). In another study, single preterm and term deliveries were retrospectively analyzed and most of the women in the study were either primiparous or multiparous and most of them were delivered by cesarean section. This study reported that smoking and a history of preterm delivery were significantly associated with an increased risk of preterm delivery (22). In our study, data on smoking and history of preterm delivery were not evaluated.

The importance of preterm birth lies in the complications of prematurity sustained by the infant and their impact on infant survival and subsequent development. The leading causes of infant mortality in the United States are preterm birth, low birth weight and birth defects. Therefore, preterm birth and low birth weight are the major contributors to infant mortality (23). Notably, another study assessed the extent to which the associations between early gestational age and infant mortality and morbidity were the result of confounding factors. A population-based cohort study combining Swedish registries was conducted to identify all individuals born in Sweden from 1973 to 2008 and link them to multiple outcomes, and the results showed a dose-response relationship between preterm birth risks and infant mortality (24).

In another study, newborns born younger than 37 weeks and admitted to the neonatal intensive care unit (NICU) were examined. The authors reported that 12% of the babies died after admission to the NICU (25). Regarding the primary outcome of our study, we found a statistically significant difference in UCA and cervical length between women with spontaneous preterm labor and women with term labor ($p<0.05$). The mean UCA in the second trimester was found to be wider in the preterm group than in the control group, and UCA was considered to be an important discriminator in preterm labor. At a threshold value of ≥ 105, the sensitivity for discrimination between preterm and term deliveries was 0.600 and specificity was 0.952.

In another study, in line with our findings, the ability of UCA to predict spontaneous preterm delivery before 34 and 37 weeks of gestation was evaluated (26). This study was a prospective cohort study of singleton pregnancies between 19.0 and 22.6 weeks of gestation. The mean UCA in the second trimester was found to be larger in the preterm group than in the control group. Similarly, in another study, they aimed to determine whether there was an association between UCA and preterm births under 37 weeks. A retrospective cohort study of pregnancies that underwent cervical length (CL) screening between 15 and 24 weeks from 2014 to 2017 was conducted. Mean UCA was significantly lower for ≥37 weeks of gestation compared with <37 weeks of gestation (27).

In another research, a prospective observational study was performed to assess the UCA of the uterus by transvaginal sonography and determine its feasibility to predict spontaneous preterm labor. One hundred asymptomatic pregnant women with singleton pregnancies were included. In the 1st trimester, mean cervical angles were 114.2° in preterm group vs 93.0° in term group ($p<0.001$). In the 2nd trimester, the mean cervical angle was 127.66° in the preterm group and 103.65° in the term group and was found to be significant ($P<0.001$). In the 1st trimester, a UCA of 114.2° was associated with a risk of spontaneous preterm delivery (P value 0.0065, sensitivity 90% and specificity 80%) (28).

In one study, the ability of UCA compared with cervical length to predict the risk of spontaneous preterm delivery was evaluated. The authors conducted a retrospective cohort study of twin pregnancies undergoing transvaginal ultrasound between 19-21 weeks. A total of 177 women were included in the study. ROC curves showed a better area under the curve (AUC) for UCA compared with cervical length at all gestational ages (29). Another study aimed to determine whether UCA was associated with the risk of spontaneous preterm labor and to evaluate its inter-observer variability. A case-control study was conducted in 275 women, including 34 women who started spontaneous labor and gave birth before 34 weeks of gestation (preterm group) and 241 women who gave birth at term (control group). The mean UCA in the second trimester was wider in the preterm group (105.16°) than in the control group (94.53°) and was found to be significant ($p<0.01$) (30).

In contrast, in another study, the test characteristics of CL and UCA were compared in patients at risk of preterm labor. 109 patients with at least one of the signs of preterm labor between 20 and 31 weeks were included in a prospective cohort analysis. The mean UCA was 103°, and the mean UCA did not differ significantly between preterm and term groups ($P = .924$). UCA has not been found to be predictive of preterm delivery, even when only singleton deliveries are considered (31).

Similarly, another study aimed to determine whether the change in UCA was associated with an increased preterm birth rate (less than 37 weeks) for women with a short cervix. This study was a retrospective study of singleton pregnancies undergoing cervical length screening. A total of 176 women met the inclusion criteria. There was no difference in the rate of preterm birth <34 weeks or <37 weeks based on a change in UCA (i.e., decreased/no change or increased UCA). However, women with a final UCA >105 degrees had an increased risk of preterm delivery in pregnancies <34 weeks (32).

The exact reasons for such differences between our findings and those of the studies mentioned above are not clear, but may be attributed to several factors. First, the patient type was heterogeneously selected in the studies mentioned above. There are large differences between the sample size and the studies mentioned above, which may be attributed to such heterogeneity. The apparently different characteristics of the women included could be considered as another factor. We acknowledge that this study has a number of limitations. The sample size of patients included is relatively small and this may affect the generalizability of our findings.

CONCLUSION

In conclusion, wider UCA and shorter cervical length in the second trimester are associated with spontaneous preterm delivery. UCA measurement is a reproducible technique and the UCA value increases from the first trimester to the second trimester. We suggest incorporating UCA into current clinical practice in addition to cervical length measurement as a predictive factor for decision-making regarding the management of women at risk of preterm labor. Future studies are needed to evaluate the diagnostic accuracy of this index, and these studies should particularly consider the use of thresholds and related outcomes (premature birth rates based on specific weeks of gestation).

REFERENCES

1. J. A. Martin, M. J. Osterman, S. E. Kirmeyer, and E. C. Gregory, "Measuring Gestational Age in Vital Statistics Data: Transitioning to the Obstetric Estimate," in National Vital Statistics Reports, vol. 64, pp. 1–20, 2015.
2. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. Lancet 2012;379:2162–72. DOI: 10.1016/S0140-6736(12)60820-4
3. Farr`as Llobet A, Reginc´os Mart´ı L, Higueras T, et al. The uterocervical angle and its relationship with pretermbirth. Journal of Maternal-Fetal & Neonatal Medicine 2017; 31(14): 1881-1884. DOI: 10.1080/14767058.2017.1331427
4. Amon E. Preterm labor. In : Reece EA, Hobbins JC, editors. Medicine of the fetus and mothers. Philadelphia, PA: Lippincott-Raven; 1999. p. 1529–79.
5. Lynch TA, Szlachetka K and Seligman NS. "Ultrasonographic Change in Uterocervical Angle is not a Risk Factor for Preterm Birth in Women with a Short Cervix," American Journal of Perinatology, 2017; 34(11): 1058-1064. DOI: 10.1055/s-0037-1603653
6. Liu L, Oza S, Hogan D, Perin J, Rudan I, Lawn JE, et al. Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis. Lancet 2015 Jan 31;385:430-40. DOI: 10.1016/S0140-6736(14)61698-6
7. Ercan F, Yenigul NN, Baser E. Measurement of the Uterocervical Angle for Predicting the Latent Period in Pregnancy Exhibiting Premature Membrane Rupture. Gynecol Obstet Invest 2021;86:200-8. DOI: 10.1159/000515224
8. Yenigul NN, Ercan F. The Efficacy and Efficiency of Uterocervical Angle Measurements to Predict Preterm Labor in Idiopathic Polyhydramnios Patients: A Prospective Cohort Study. Z Geburtshilfe Neonatol 2021;225:129-33. DOI: 10.1055/a-1176-2390
9. Khamees RE, Khattab BM, Elshahat AM, Taha OT, Aboelroose AA. Uterocervical angle versus cervical length in the prediction of spontaneous preterm birth in singleton pregnancy. Int J Gynaecol Obstet 2022;156:304-8. DOI: 10.1002/ijgo.13629
10. Dagdeviren E, Aslan Çetin B, Aydogan Mathyk B, Koroglu N, Topcu EG, Yuksel MA. Can uterocervical angles successfully predict induction of labor in nulliparous women? Eur J Obstet Gynecol Reprod Biol 2018;228:87-91. DOI: 10.1016/j.ejogrb.2018.06.014
11. Eser A, Ozkaya E. Uterocervical angle: an ultrasound screening tool to predict satisfactory response to labor induction. J Matern Fetal Neonatal Med 2020;33:1295-301. DOI: 10.1080/14767058.2018.1517324
12. Z. Alfrevic, J. Owen, E. Carreras Moratonas, A. N. Sharp, J. M.Szychowski, and M. Goya, "Vaginal progesterone, cerclage or cervical pessary for preventing preterm birth in asymptomatic singleton pregnant women with a history of preterm birth and a sonographic short cervix," in Ultrasound in Obstetrics & Gynecology, vol. 41, pp. 146–151, 2013. DOI: 10.1002/uog.12300
13. Sepúlveda-Martínez A, Díaz F, Muñoz H, et al. Second-Trimester Anterior Cervical Angle in a Low-Risk Population as a Marker for Spontaneous Preterm Delivery. Fetal. Diagn. Ther., 2016. DOI: 10.1159/000447588

14. Cannie MM, Dobrescu O, Gucciardo L, et al., Arabin cervical pessary in women at high risk of preterm birth: amagnetic resonance imaging observational follow-up study. Ultrasound Obstet.Gynecol 2013; 42: 426–433. DOI: 10.1002/uog.12507
15. F. Dos Santos and J. Daru, "Accuracy of fetal fbronectin for assessing preterm birth risk in asymptomatic pregnant women: a systematic review and meta-analysis, 2018". DOI: 10.1111/aogs.13299
16. A. C. Lim, M. A. Hegeman, M. A. Huis In 'T Veld, B. C. Opmeer, H. W. Bruinse, and B. W. J. Mol, "Cervical length measurement for the prediction of preterm birth in multiple pregnancies: A systematic review and bivariate meta-analysis," Ultrasound in Obstetrics & Gynecology, vol. 38, no. 1, pp. 10–17, 2011. DOI: 10.1002/uog.9013
17. J. M. G. Crane and D. Hutchens, "Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review,"Ultrasound in Obstetrics & Gynecology, vol. 31, no. 5, pp. 579–587, 2008 DOI: 10.1002/uog.6143
18. Cobo T, Kacerovsky M, Jacobsson B. Risk factors for spontaneous preterm delivery. Int J Gynecol Obstet 2020; 150:17–23. DOI: 10.1002/ijgo.13184
19. Daskalakis G, Theodora M, Antsaklis P, Sindos M, Grigoriadis T, Antsaklis A, Papantoniou N, Loutradis D, Pergialiotis V. Assessment of Uterocervical Angle Width as a Predictive Factor of Preterm Birth: A Systematic Review of the Literature. Biomed Res Int 2018; 2018. DOI: 10.1155/2018/1837478
20. Sawaddisan R, Kor-anantakul O, Pruksanusak N, Geater A. Uterocervical angle measurement for preterm birth prediction in singleton pregnant women with no history of preterm birth and normal cervical length: A prospective cohort study. Eur J Obstet Gynecol Reprod Biol 2020; 252:30–5. DOI: 10.1016/j.ejogrb.2020.06.020
21. Butali A, Ezeaka C, Ekhaguere O, Weathers N, Ladd J, Fajolu I, Esezobor C, Makwe C, Odusanya B, Anorlu R, Adeyemo W. Characteristics and risk factors of preterm births in a tertiary center in Lagos, Nigeria. Pan Afr Med J 2016;24 DOİ: 10.11604/pamj.2016.24.1.8382
22. Iyoke CA, Lawani LO, Ezugwu EC. Maternal risk factors for singleton preterm births and survival at the University of Nigeria Teaching Hospital, Enugu, Nigeria. Niger J Clin Pract 2015; 18:744-50. DOI: 10.4103/1119-3077.158141
23. Romero R, Dey SK, Fisher SJ. Preterm labor: One syndrome, many causes. Science (80) 2014; 345:760–5. DOI: 10.1126/science.1251816
24. D'Onofrio BM, Class QA, Rickert ME, Larsson H, Långström N, Lichtenstein P. Preterm birth and mortality and morbidity: A population-based quasi-experimental study. JAMA Psychiatry 2013; 70:1231–40. DOI: 10.1001/jamapsychiatry.2013.2107
25. Cupen K, Barran A, Singh V, Dialsingh I. Risk Factors Associated with Preterm Neonatal Mortality: A Case Study Using Data from Mt. Hope Women's Hospital in Trinidad and Tobago. Children 2017;4:108. doi: 10.3390/children4120108
26. Llobet FA, Higueras T, Calero IZ, et al. Prospective evaluation of the uterocervical angle as a predictor of spontaneous preterm birth. Acta Obstet Gynecol Scand 2020; 99(11): 1511-8. DOI: 10.1111/aogs.13879
27. Lynch TA, Szlachetka K and Seligman NS. Second trimester uterocervical angle and spontaneous preterm birth in twins. J Matern Neonatal Med 2020;33:3125–31 DOI: 10.1080/14767058.2019.1569615
28. Sur B, Misra S and Dash S. Evaluation of the anterior cervical angle of the uterus to predict spontaneous preterm birth. Int J Reprod Contraception, Obstet Gynecol 2017; 6:2323. DOI:10.18203/2320-1770.IJRCOG20172114
29. Vielba BM, De Bonrostro Torralba C, Espiau RA. Uterocervical angle as a predictor of spontaneous preterm birth in twin pregnancies. J Matern Neonatal Med 2020; 1-8. DOI: 10.1080/14767058.2020.1771553
30. Llobet FA, Regincós Martí L, Higueras T, et al. The uterocervical angle and its relationship with preterm birth. J Matern Neonatal Med 2018; 31:1881–4. DOI: 10.1080/14767058.2017.1331427
31. Gründler K, Gerber B and Stubert J. Uterocervical angle as a predictor of preterm birth on a high-risk collective between 20 and 31 weeks of gestation: A cohort analysis. Acta Obstet Gynecol Scand 2020; 99(11): 1527-33. DOI: 10.1111/aogs.13955
32. Lynch TA, Szlachetka K and Seligman NS. Ultrasonographic Change in Uterocervical Angle is not a Risk Factor for Preterm Birth in Women with a Short Cervix. Am J Perinatol 2017; 34:1058–64. DOI: 10.1055/s-0037-1603653

back