Accuracy of the Anterior Uterocervical Angle in Predicting the Transvaginal Cerclage Failure to Prevent Spontaneous Preterm Birth Relative to the Cervical Length in Sonography

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Article Info

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ABSTRACT

Background & Objective: Spontaneous preterm birth (SPB) occurs in about 10 to 12 percentage of pregnancies and causes many complications and mortality during pregnancy periods (1). The aim of this study was to determine the evaluation of uterocervical angle compared to cervical length as a sonographic method in predicting preterm delivery for patients who were undergoing the transvaginal cerclage.

Materials & Methods: The present study was performed on 91 pregnant women who were candidates for cerclage in Zabol, Iran, 2019-2020. In this study, about 16.48 percentage of births were preterm and 27.47 percentage were post-term. During the study, routine cervical evaluation was performed by post-cerclage ultrasound and transvaginal ultrasound was performed in all patients one week after cerclage. Additional evaluation with transvaginal ultrasound was performed at intervals determined by the treating physicians with final ultrasound evaluation of the cervix up to 28 weeks of gestation. Finally, the obtained data were entered into SPSS 22 and statistically analyzed using t-test, Chi-square and Fisher's exact test.

Results: The results of the present study showed that considering the existing thresholds (95 and 105) for the anterior uterosacral angle and the threshold 25 for the cervical length index, all these indices were included 100% sensitive.

Conclusion: This sensitivity in the case of UCA higher than 95°C was about 80%, but the disadvantage of these indicators was their low specificity, so that these indicators were different ranging from 30% in the case of (UCA 105) to 7.15% in the case of (UCA 95).

Keywords: Anterior uterocervical angle, Cerclage, Cervical Length, Spontaneous preterm birth

Introduction

The childbirth is a process with coordinated uterine contractions that leads to progressive dilation of the cervix by which the fetus and placenta are removed. Preterm birth means a birth that occurs after 20 but before 37 weeks of pregnancy. Cervical failure may require to put cerclage, and premature uterine contractions without cervical dislocation are generally a self-limitation phenomenon that resolves spontaneously and does not require any intervention (7). Preterm delivery is said to be the occurrence of labor after fetal resuscitation (20-28 weeks) and before the age of 37 weeks (1, 8). Spontaneous preterm birth (SPB) occurs in about 10 to 12 percentage of pregnancies and causes many complications and mortality during pregnancy (2).

Many of the patients are faced with vaginal bloody discharge or "Bloody discharge." More significant vaginal bleeding should be evaluated for placental abruption or placenta previa. In addition, patients may report increased vaginal discharge or their mucosal plug-in passage (9). The main complication of preterm

delivery is premature birth. Its treatment is to reduce the probable risk of preterm birth and reduce the risk of premature complications in the infant, such as respiratory distress syndrome and nerve damage **(10)**. Antibiotic therapy has been studied as a treatment for preterm delivery and a means for prolonging pregnancy and so far, no effect has been reported on delayed preterm birth in this population of patients. If the patient's GBS status is positive or unknown, patients with preterm delivery should use antibiotics to prevent neonatal GBS infection **(11)**. Preterm delivery has many complications such as hypoglycemia-hypocalcemia-respiratory distress syndrome and neonatal death **(12)**. Accordingly, attention to prenatal risk factors, including cervical length and the use of contraceptive strategies such as progesterone supplementation and transvaginal cerclage, has increased.

Cervical length measurement is the only predictive morphological measurement method.

Short uterus is an etiological factor that is associated with an increased risk of sPTB **(13)**.

Transvaginal cerclage is a potential intervention procedure that helps pregnant women with a uterine length less than 25 mm who have had a previous preterm delivery to extend their gestational period. However, despite putting the cerclage, about 21 to 53% of treated women give birth earlier than 36 weeks **(14)**.

Failure in transvaginal cerclage can cause iatrogenic pre-morbidities to increase mortality and neonatal morbidity. Accurate identification of women at risk of cerclage may provide an opportunity for additional interventions and supportive care **(2)**.

The limited tools which are available to identify patients at risk for cerclage failure and subsequent preterm delivery include the anterior uterine angle UCA1 which is defined as the angle between the anterior wall of the uterus and the cervical canal, and is associated with gestational age **(6)**.

Unfortunately, few interventions to prevent preterm delivery have been known. For women who have a history of previous SPB, there is evidence that progestin reduces preterm birth by approximately up to 30% through progesterone vaginal suppository or weekly intramuscular injection of 17-α hydroxy progesterone from 16-20 weeks to 36-37 weeks. In addition, vaginal progesterone may also reduce the risk of preterm delivery in women with transvaginal ultrasound in a short cervical pregnancy. However, apart from these specific interventions, there are little works to be done to prevent preterm delivery **(7)**.

Severe cases of premature pregnancy cause certain problems. In general, very early pregnancy fetuses (20-23 weeks; EGA or estimated fetal weight (EFW) less than 550 g) are not acceptable. If these pregnancies can continue for a few more weeks, the fetus will survive, but if it is born in this cumulative period and survives, there will be a significant risk. When pregnancy lasts longer than EGA at 37-34 weeks or more than 2500 g, fetal complications have less severity and rarely cause long-term complications. In addition, it has not been proven that corticosteroids are useful in fetuses of this age or size. Therefore, expectation management is usually a suggested course of action. When deciding between intervention and pregnancy management, several factors must be considered, including certainty of gestational age, EFW, and maternal problems that can delay fetal lung maturation, such as diabetes mellitus and a family history of respiratory distress syndrome **(15)**.

Materials and Methods

Pregnant women referring to the clinic and obstetrics department of Amir Al-Momenin (AS) Hospital in Zabol from the beginning of 2017 to the end of 2019 who were candidates for cerclage, were randomly selected. During the study period, routine cervical evaluation was performed as a standard method using ultrasound after cerclage. Transvaginal ultrasound was implemented in every pregnant woman one week after cerclage. Extra assessment was performed by transvaginal ultrasound about spaces determined by the treating physicians with terminal ultrasound evaluation of the cervix up to 28 weeks conception.

The indication for cerclage was determined based on history, physical examination, and ultrasound. The previous recording was defined as cervical failure in the case of documentary in previous pregnancies with preterm delivery before 34 weeks. The cerclage ultrasound indication was defined as Premature birth before thirty-four weeks and ultrasound serial examination in the second trimester with cervical length less than 25 mm (CL <25 mm).

The physical examination-indicated cerclage determined if patients show a cervical dilatation of 2 cm before 24 weeks of gestation using a digital examination. Records were revised to get maternal demographic data and maternal diseases.

Gestational age was defined by menstrual history and confirmed with given first trimester ultrasound. Midwifery records contained the use of 17-hydroxy perfuseable progesterone or vaginal progesterone. Cerclage failure was defined as preterm delivery less than 36 weeks. People with significant fetal abnormalities, multiple pregnancies, ventral cerclage, more than one cerclage stitch, disability to accurate determination of gestational age by first trimester ultrasound, patients whose their iatrogenic preterm delivery was documented, and had out-of-hospital delivery (inaccessibility childbirth entry) were excluded from the study.

Data Analysis and Description Method

Statistical analysis of demographic and medical particulars of women via cerclage failure were contrasted with women without cerclage failure using x2 and t-tests. Binary logistic regression was applied to define the risk of preterm delivery based on the sensitivity threshold and optimal specialty and predictive values in the receiver operating characteristic (ROC) curve. Significance of statistical analysis is performed using Statistics IBM SPSS version 23.0 (SPSS Inc., Chicago, IL., USA). The significant value was considered to be less than 0.05.

Results

In this study, 91 pregnant women were examined from the beginning of pregnancy. Their age mean was 30.1 years with a standard deviation of 5.5. The youngest and oldest women studied were 18 and 43 years old, respectively. Most of the studied women (57.15) had 1 Gravid. Other types of gravid in the studied women have been listed in Table 1.

The results of the present study indicated that 18% of pregnant women participating in the study had a history of previous cerclage.

Most of the studied women, i.e. 67% of them, had no history of abortion of which 17% had a history of one miscarriage and the rest had more cases of miscarriages.

The gestational age mean of the studied women was 9, 36 weeks with a standard deviation of 2.4. This time was varied from 27 to 40 weeks in different women.

Table 1. Frequency distribution of gravid types in the case-study women

Types of Gravid	Frequency	Percentage
1	52	57.14
2	21	23.08
3	9	9.89
4	7	7.69
5	2	2.2
Total	91	100

Twenty-five of the cases eventually were involved in early preterm labor) and 15 women were involved in late preterm labor.

The cervical length mean in the studied women was 21.36 mm with a standard deviation of 3.03. The UCA angle mean in the studied women was 31.18 degree with a standard deviation of 20.45.

The frequency of different values of uterocervical angle and cervical length in the cases has been expressed in Table 2.

Table 2. Abundance of cervical measurement indices types in the case-study women

Types of index	Cutting point	Frequency	Percentage
UCA (105)	<105	26	28.57
	> 105	65	71.43
UCA (95)	<95	12	13.19
	>95	79	86.81
CL	mm> 25	15	16.48
	<25	76	83.52

Table 3 illustrates that women with and without early preterm, in terms of uterocervical angle larger than 95 and larger than 105 and cervical length less than 25 mm had no significant difference.

However, the cervical length mean and cervical angle were statistically had significantly different in the two groups, so that women with early preterm delivery had significantly larger cervical angle and shorter cervical length than women with natural childbirth.

Table 4 demonstrates the area under the ROC curve for predicting preterm delivery for each of the cervical indices.

Table 3. Cervical indices in women with and without preterm labor

Cervical indices			Early preterm labor		P-value	Late preterm labor		P-value
			term	preterm		term	preterm	
UCA (95)	<95	no	12	0	0.205	11	1	0.111
		%	15.79	0		16.67	4	
	>95	no	64	15		55	24	
		%	84.21	100		83.33	96	
UCA (105)	<105	no	23	3	0.541	21	5	0.265
		%	30.26	20		31.82	20	
	>105	no	53	12		45	20	
		%	69.74	80		68.18	80	
UCA	Mean (SD)		116(19.40)	129(22.96)	0.024	115(18.81)	127(22.46)	0.012
CL	>25	no	15	0	0.067	14	1	0.048
		%	19.74	0		21.21	4	
	<25	no	61	15		52	24	
		%	80.26	100		78.79	96	
CL	Mean (SD)		22.20(2.30)	17.13(2.80)	0.0001	22.41(2.27)	18.60(3.11)	0.0001

Table 4. The area down the ROC curve to determine the accuracy of prediction of cervical indices types

Type of premature delivery	Cervical indices	Area under AUC curve	P-value	Confidence interval 95%
Early preterm labor	CL	0.90	<0.001	0.81- 0.99
	UCA	0.66	0.057	0.49- 0.82
Late preterm labor	CL	0.84	<0.001	0.74- 0.94
	UCA	0.65	0.026	0.52- 0.78

Discussion

The present study aimed to investigate the accuracy of the anterior uterocacral angle in predicting the transvaginal cerclage failure to prevent SPB relative to the cervical length in sonography in 2019-2020.

The findings of the present study showed that having an anterior uterocervical angle increases and a lower cervical length increases the chances of premature and late delivery.

In other words, high UCA is a risk factor for preterm delivery, while high CL is a protective factor for preterm delivery. In general, with thresholds 95 and 105 related to UCA and threshold 25 related to CL, the lowest sensitivity and highest specificity for predicting delivery status was related to UCA 95.

Accordingly, we were to determine the optimal points of these cervical indices that have both high sensitivity and high specificity, and finally the best threshold of cervical length index for predicting preterm early and preterm late delivery was obtained as 5.19 and 50.21 mm, respectively. Also, the best threshold of uterocervical angle index for predicting preterm early and late preterm delivery was obtained to be 5.131 and

5.120 degrees, respectively. In general, the use of cervical examination by transvaginal ultrasound is widely used as a part of monitoring and managing on women at risk for early preterm delivery. However, its use as a screening tool in a low-risk population is more controversial (16). Generally, a lot of evidence has shown that CL less than 25 mm before the 28th week of pregnancy is associated with a higher incidence of preterm labor (17, 18).

In their study, Plis et al. showed that CL measurement during 3 to 6 days after putting the cerclage, provides the best information in the field of risk of delivery > 35 weeks (19).

Another study has also reported that CL serial measurements in the late second trimester or early third trimester can serve as a warning tool, however they have not found any relationship between CL imbalance before and after cerclage and pregnancy outcome (2). These findings are consistent with the present study.

In the study by Mirteymori et al., among 25 patients (17.7%) with successful natural childbirth after cesarean section, there was vaginal bleeding more than 500 cc.

One of the important factors that have been mentioned in studies with uterine rupture in people seeking natural childbirth is undesirable cervix and the use of prostaglandins for induction of labor (20).

Nikolova *et al.* also in their study, have expressed the amount of sensitivity, specificity, positive and negative CL <25mm value in predicting early preterm delivery is 83%, 59%, 22% and 96%, respectively (21).

Agudelo *et al.* in their study have reported that CL on transvaginal ultrasound at 20-24 weeks of gestation was a good predictor for SPB in asymptomatic women with twin pregnancy (22).

However, Dziadosz *et al.* showed that UCA above ≥ 95 and ≥051 detected in the second trimester with an increased risk of SPB, was associated with > 37 and > 34 weeks, respectively. The results of this study indicated that UCA in predicting preterm delivery is performed better than CL and has recommended to use of UCA as a useful screening tool for SPB (23). These findings are consistent with the results of the present study; the comparison of ROC curves in this study showed that cervical length index is a more accurate indicator both for predicting early preterm delivery and for predicting preterm late delivery.

In 2010, Swanson *et al.* in a study entitled of" Whether uterocervical angle has a role in delayed pregnancy in patients with cerclage indication?" stated that there is no significant relationship between uterocervical angle and delayed pregnancy. Also, when you use it, it is divided into two categories based on the uterocervical angle, which is equal to 95, and the uterocervical angle is greater than and equal to 105. Again, there was no significant relationship between pregnancy delay mean and uterocervical angle (24).

However, in general, many studies have suggested the suitability and usefulness of UCA as a predictor of the risk of SPB in people with vaginal cerclage. Therefore, in order to strengthen the prediction of cerclage failure in this population, CL should be used as a supplement (25).

Conclusion

The best cervical length index threshold for predicting preterm early and preterm late delivery was obtained 19.5 and 21.50 mm, respectively. Also, the best utroscervical angle index threshold for predicting preterm early and preterm late delivery was obtained 131.5 and 120.5 degrees, respectively. The results of the present study showed that the above indices had high sensitivity in predicting preterm early delivery, however, the disadvantage of these indices was their low specificity. In this study, the cervical length was predicted preterm delivery more accurately than uterocervical angle. In this study, the length of the cervix relative to the uterocervical angle was accurately predicted in preterm delivery.

Acknowledgments

Conflict of Interest

The authors declared no conflict of interest.

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How to Cite This Article:

Rezaie keikhaie K, Rezaie Kahkha L, Shahraki Z, Esbati S, Afshari M, Kamali A, et al . Accuracy of the Anterior Uterocervical Angle in Predicting the Transvaginal Cerclage Failure to Prevent Spontaneous Preterm Birth Relative to the Cervical Length in Sonography. J Obstet Gynecol Cancer Res. 2021; 6 (4) :181-187

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