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ASSESSMENT OF CERVICAL LENGTH, SHAPE AND CONSISTENCY BETWEEN 18-24 WEEKS GESTATIONAL AGE BY TRANSVAGINAL ULTRASOUND FOR PREDICTION OF PRETERM LABOR

By

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ABSTRACT

Background: Preterm labor is the presence of uterine contractions of sufficient frequency and intensity to affect progressive effacement and dilation of the cervix prior to term gestation. Shortening and funneling of the cervix was first described to be associated with the diagnosis of cervical incompetence, Transvaginal sonographic measurement of cervical length could be used to predict a risk for preterm delivery for a significant proportion of preterm births. Cervical length is measured by transvaginal ultrasound from internal os to external os while the urinary bladder is empty.

Objective: To determine the value of measurement of cervical parameters by transvaginal ultrasound between 18 and 24 weeks' gestation in the prediction of spontaneous preterm delivery.

Patients and Methods: The study was carried out at Bab EL-Sha'aria University Hospital between 1/10/2018 and 31/12/2019 on 200 primigravida women with single pregnancy and intact membranes. Women with scarred uterus, women with chronic medical diseases or obstetric problems, women who underwent cerclage and fetal anomalies were excluded from the study. For all participants, transvaginal ultrasound was done between 18 and 24 weeks' gestation for measurement of cervical length, shape and consistency.

Results: Infant means weight at delivery was 1589 g with SD 215 in preterm delivery, while Infant mean weight at delivery was 3024 g with SD 200 which was significant. 33.3% of preterm birth delivered vaginally, while 66.7% delivered by C.S. 62.6% of full term delivery delivered vaginally, while 37.4% delivered by C.S. No statistically significant difference was found regarding mode of delivery. Cervical length was significant in prediction of preterm labor with sensitivity 88.9%, specificity 91.2%, PPV 50.0% and NPV 98.8 %. Cervical consistency index was significant in prediction of preterm labor with sensitivity 88.9%, Specificity 93.4%, PPV 57.1% and NPV 98.8 %. Funneling was present in 33.3% of preterm delivery, and 4.4% of full term delivery which was significant. Measurement of cervical length, shape and consistency was a reliable method for prediction of preterm labor.

Conclusion: Measurement of cervical length, shape and consistency by transvaginal ultrasound between 18 and 24 weeks' gestation was a reliable method for prediction of preterm labor.

Keywords: Cervical length, cervical consistency index, preterm birth.

INTRODUCTION

Preterm labor incidence is increasing in many countries, including developing countries, despite extensive research efforts. Spontaneous preterm labor in pregnancies with intact fetal membranes represents the largest cause of preterm delivery accounting for about half of preterm births *(Simmons et al., 2010)*.

Shortening and funneling of the cervix was first described to be associated with the diagnosis of cervical incompetence *(Richard et al., 2019)*.

The use of transvaginal ultrasound examination of the cervix is now widely recommended as a part of the surveillance of women at high risk of preterm delivery. Its use as a screening tool in a low risk population is more debatable.

Romero et al. (2012) concluded that the shorter the cervical length, the higher is the risk of spontaneous preterm labor.

Finding of a funnel at the internal os is a poor independent predictor of preterm labor once the effect of short cervix is considered. The shape of the funnel (U, Y or V), percent funneling, and the depth and width of the funnel have all been described as methods of assessing cervical funneling *(Lee et al., 2016)*.

Cervical consistency index (CCI) represents the ratio of cervical width after compression by transvaginal probe (AP'') to the width before compression (AP). The cervical width is always measured perpendicular to the longitudinal cervical axis. Thus, the equation is: CCI = (AP" / AP) × 100. The lower cervical consistency index indicates weakness of the cervix and is directly related to preterm birth *(Parra-Saavedra et al., 2011)*.

The present work aimed to determine the value of measurement of cervical parameters by transvaginal ultrasound between 18 and 24 weeks' gestation in the prediction of spontaneous preterm delivery.

PATIENTS AND METHODS

Study area: Bab-Elsha'aria university hospital.

Study population: Pregnant women 18-24 weeks who attended outpatient clinic at Bab-Elsha'aria University Hospital from 1-10- 2018 to 31-12-2019.

Sample size: 200 primigravida women with no risk of preterm labor were screened by transvaginal ultrasound between 18-24 wks. gestational age for cervical length, shape and consistency.

Inclusion criteria: Singleton pregnancy, primigravida, intact membranes and 18-24 weeks gestational age.

Exclusion criteria: A scarred uterus (e.g. myomectomy or uterine perforation), women with chronic medical or obstetric problems that might result in an indicated preterm birth (eg, hypertension, red blood cell isoimmunization), women who underwent a cerclage for recurrent abortion because of a clinical history of cervical incompetence, fetal anomalies and rupture of membrane.

Measurement of cervical length and shape: The patient has an empty bladder. A transducer was inserted in anterior fornix until cervix was visualized. Excessive pressure was avoided. Cervix occupied 50% of the screen with equal

thickness of anterior and posterior aspects of the cervix. Image of the cervix included V-shaped notch at internal os, triangular area of echodensity at the external os and endocervical canal. When endocervical canal curved, we used 2 straight lines rather than tracing the canal. Abdominal pressure was applied for 15 seconds and allowed for a few minutes. If cervical funneling was observed, it usually associated with a cervical length < 25 mm. Record cervical length but measurements of the depth and width of funnel is not needed. Funneling present was reported.

Once traced the cervical length, the screen was divided into two: leaving fixed on the left side the cervical length taken previously, and on the right side in real time, A pressure was made softly and progressively on the cervix until there was no visual observation of a greater shortening in the anteroposterior diameter (AP) or the cervix moves due to the pressure. To determine accurately the point of greatest shortening of the cervix anteroposterior diameter, the cineloop was used in the equipment.

A half point of the cervical length transported to the center line of the longitudinal axis of the cervix was calculated (C/2) in both sides of the screen.

In the half point, the cervical length transported to the center line of the longitudinal axis of the cervix (C/2) was built. A perpendicular with an angle of 90º (to measure accurately this angle was used the option angle between 2 lines). This perpendicular measured the distance of the most anterior lip point placed anterior to the cervix, until the most posterior point of the lip, posterior of the cervix (AP). The same procedure was applied on the right side of the screen, obtaining the distance AP.

Finally, the AP´ distance was divided by the AP distance, and it was multiplied by 100, obtaining this way the CCI, by the equation: CCI = AP´/AP × 100 *(Parra-Saavedra et al., 2011)*.

Every patient eligible for the study was submitted for fully informed verbal and written consent, completely detailed medical and obstetric history record as a standard paper form including patient age, height, parity, date of last menstrual period, medical disorders and surgical interventions, routine general and obstetric medical examination, detailed ultrasound examination using transabdominal fetal gestational age at time of examination by measuring BPD, FL and abdominal circumference and placental topography, amniotic fluid and fetal anomaly survey.

Patients were followed up till delivery by transabdominal ultrasound for BPD, FL, AFI and FHR.

Outcome data:

Primary outcome: Gestational age at time of delivery categorized as either. Term delivery: Delivery at or after completed 37 weeks gestational age. Preterm delivery: Delivery before completed 37 weeks gestational age.

Secondary outcomes: Mode of delivery. Neonatal weight at time of delivery.

Data analysis:

Data were statistically described in terms of range, mean, standard deviation, frequencies (number of cases) and percentage when appropriate. Comparison

of quantitative variables between the study groups was done using student t test for independent samples. For comparing categorical data, chi square (x^2) test was performed. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Office 2010 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Sciences, SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

RESULTS

No statistically significant difference was found regarding baseline characteristics (p=0.022 for age, p=0.675 for height, p= 0.719 for weight and p= 1.00 for B.M.I.) Mean cervical length was 23.11mm with SD 4.73 in preterm, while mean cervical length was 34.01mm with SD 4.59 in full term which was significant (p value 0.001). Funneling was present in 33.3% of preterm delivery, and 4.4% of full term delivery which was significant. (p value 0.001). Mean cervical consistency index is 48.48 with SD 5.54 in preterm, while mean cervical consistency was 69.97with SD 7.33 in full term which was significant (p value 0.001). Six cases (33.3%) of preterm birth delivered vaginally, while 12 cases (66.7%) delivered by C.S. 114 cases (62.6%) of full term delivery delivered vaginally, while 68 cases (37.4%) delivered by C.S. No statistically significant difference was found regarding mode of delivery (p=0.155). Infant mean weight at delivery was 1589g with SD 215in preterm delivery, while Infant mean weight at delivery was 3024 g with SD 200 which was highly significant (p=0.001, **Table 1**).

Table (1): Correlation between demographic data, cervical parameters, mode of delivery and infant weight at delivery and maturity

		Pre term (No. = 18)	**Full term (No. = 182)**	**P-value**	**Sig.**
Age (years)	Mean ± SD	20.22 ± 4.06	22.33 ± 3.66	0.022	S
	Range	17 – 30	16 – 32		
Height (cm)	Mean ± SD	167.22± 7.07	166.54± 6.51	0.675	NS
	Range	154 – 176	152 – 182		
Weight (kg)	Mean ± SD	80.44± 15.54	79.40± 11.23	0.719	NS
	Range	60 – 115	55 – 110		
BMI	Mean ± SD	28.65± 4.37	28.62± 3.65	1.00	NS
	Range	25.21 – 37.13	19.96 – 36.36		
		Pre term (No. = 18)	**Full term (No. = 182)**	**P-value**	**Sig.**
Length (mm)	Mean ± SD	23.11± 4.73	34.01± 4.59	0.001	HS
	Range	17 – 31	21 –47		
		Pre term (No. = 18)	**Full term (No. = 182)**	**P-value**	**Sig.**
Funneling	No	12 (66.7%)	174 (95.6%)	0.001	HS
	Yes	6(33.3%)	8 (4.4%)		
		Pre term (No. = 18)	**Full term (No. = 182)**	**P-value**	**Sig.**
Consistency%	Mean ± SD	48.84± 5.54	69.97± 7.33	0.001	HS
	Range	38.5 – 56.3	41.2 – 90.5		
		Pre term (No. = 18)	**Full term (No. = 182)**	**P-value**	**Sig.**
Mode of delivery	CS	12 (66.7%)	68 (37.4%)	0.155	NS
	VD	6 (33.3%)	114 (62.6%)		
		Pre term (No. = 18)	**Full term (No. = 182)**	**P-value**	**Sig.**
Infant weight at delivery (g)	Mean ± SD	1588.89± 214.74	3024.18± 199.63	0.001	HS
	Range	1300 – 1900	2500 – 3700		

*:Chi-square test; •: Independent t-test

Cervical consistency index at 54.95% was significant in prediction of preterm labor with sensitivity 88.9%, Specificity 93.4%, PPV 57.1% and NPV 98.8 %. Cervical length of 30mm is highly significant in prediction of preterm labor with sensitivity 88.9%, Specificity 91.2%, PPV 50.0% and NPV 98.8 % **(Table 2)**.

Table (2): Roc Curve between Maturity group regarding Consistency and Cervical Length (mm)

Parameter	AUC	Cut of Point	Sensitivity	Specificity	PPV	NPV
Consistency (%)	0.968	>54.95	88.9	93.4	57.1	98.8
Length (mm)	0.962	>30	88.9	91.2	50.0	98.8

DISCUSSION

In the present study, there was a correlation between cervical length and maturity. The combined presence of a shorter cervical length and funneling was found to be a better predictor of preterm birth than short cervix alone.

A prospective cohort study by *Sandeep et al. (2017),* on asymptomatic low risk antenatal women with gestational age of 20 to 24 weeks, showed that cervical assessment with transvaginal sonography for the measurement of cervical length, seven percent of women delivered preterm. The incidence of short cervix in low risk women was only 0.56%. 100% women with short cervix delivered preterm and only 6.9% patients who had cervical length more than 25 mm delivered preterm. The results of this study correlated with the present study as transvaginal ultrasound measurement of cervical length is reliable method for prediction of preterm labor.

In the present study, funneling was present in 33.3% of preterm delivery and 4.4% of full term delivery which was significant. *Reddy and Mudanur (2018)* for the role of cervical length evaluation with transvaginal ultrasound for prediction of preterm delivery in low risk pregnancy. correlates with the present study that 50% of short cervical length had delivered preterm ,while all women had funneling delivered preterm. This difference probably due to different size of the sample.

In the present study, mean cervical consistency index was 48.48 with SD 5.54 in preterm, while mean cervical consistency was 69.97with SD 7.33 in full term which was significant. In order to determine the predictive value of C.C.I. for detection of preterm labor, the cutoff value was needed. According to the present study, the best cut off value for predicting P.T.B. before 37 weeks was 54.95% with sensitivity, specificity, PPV, NPV, recorded were 88.9%, 93.4%, 57.1% and 98.8 % respectively.

Prospective cross-sectional study by *Parra-Saavedra et al. (2011)* correlated with the present study as transvaginal ultrasound measurement of cervical consistency index is a reliable method for prediction of preterm labor. However it differs in that the cervical length is not reliable in prediction of preterm labor, while it is significant in prediction of preterm labor in the present study.

Parichehr et al. (2018) for measurement of cervical consistency index as predictor of preterm birth in low-risk pregnant women, conducted on low-

risk pregnant women at 14-28 weeks of pregnancy. (C. L.) and AP cervical diameter were measured and the C.C.I. determined according to the formula AP2/AP1*100. This study correlated with the study as transvaginal ultrasound measurement of cervical consistency index and cervical length is reliable method for prediction of preterm labor.

Prospective cohort study by *Banos et al. (2018)* was measurement of mid-trimester cervical consistency index and cervical length to predict spontaneous preterm birth in high-risk singleton pregnancies between 19 and 24 weeks. Eighty-two high spontaneous preterm labor risk women were included. Cervical consistency index was significantly reduced in women who delivered <37 weeks compared with those who delivered at term, while C.L. was not. The results of this study correlates with the present study as transvaginal ultrasound measurement of cervical consistency index is more reliable than cervical length for prediction of preterm labor.

The main limitation of our study was the limited number of PTB (n=18) cases, due to the low risk population selection of the study. However, in the current study, in which only low risk people were selected, a good relation between cervical length, shape and consistency index and PTB in the low risk population has been obtained, so indicating the validity of the current study.

CONCLUSION

Measurement of cervical length, shape and consistency by transvaginal ultrasound between 18 and 24 weeks' gestation was a reliable method for prediction of preterm labor.

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تقييم طول وشكل واتساق عنق الرحم بين 18-24 أسبوعاً من عمر الحمل عن طريق الموجات فوق الصوتية عبر المهبل للتنبوء بالولادة المبكرة

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خلفية البحث: الولادة المبكرة هي وجود تقلصات الرحم ذات التردد والشدة الكافيين لحدوث توسع تدريجي لعنق الرحم قبل الاسبوع السابع والثلاثين من عمر الحمل الحمل وقصر طول عنق الرحم ووجود تقمع لأول مرة مرتبطان بتشخيص عدم كفاءة عنق الرحم، ويمكن إستخدام القياس بالموجات فوق الصوتية عبر المهبل لطول عنق الرحم للتنبوء بحدوث ولادة المبكرة ويتم قياس طول عنق الرحم عن طريق الموجات فوق الصوتية عبر المهبل من الفتحة الداخلية لعنق الرحم حتى الفتحة الخارجية لعنق الرحم مع مراعاة ان تكون المثانة البولية فارغة.

الهدف من البحث: تحديد قيمة قياس قياسات عنق الرحم بواسطة الموجات فوق الصوتية عبر المهبل بين 18 و24 أسبوعًا من الحمل في التنبؤ بالولادة المبكرة.

المريضات وطرق البحث: أجريت الدراسة في مستشفى باب الشعرية الجامعي في الفترة ما بين 2018/10/1 و 2019/12/31 على 200 امرأة بكرية ذات حمل مفرد وأغشية الجنين سليمة وتم استبعاد النساء المصابات بجرح سابق بالرحم، والنساء المصابات بأمراض طبية مزمنة، والنساء اللائي خضعن لربط عنق الرحم ووجود تشوهات بالجنين وتم إجراء الموجات فوق الصوتية عبر المهبل بين 18 و 24 أسبوعًا من الحمل لقياس طول عنق الرحم وشكله ومرونته.

نتائج البحث: كان متوسط وزن الرضيع عند الولادة 1589 جم مع انحراف معياري 215 في الولادة المبكرة، بينما كان متوسط وزن الرضيع عند الولادة 3024 جم مع انحراف معياري 200. 33.3٪ من السيدات اللاتي خضعن لولادة مبكرة تمت ولادتهن عن طريق المهبل، في حين أن 66.7٪ ولدت عن طريق ولادة قيصرية. 62,6٪ من السيدات خضعن لولادة كاملة المدة عن طريق المهبل،

بينما 37.4٪ تمت الولادة عن طريق ولادة قيصرية ولم يتم العثور على فرق معتد به إحصائيًا فيما يتعلق بطريقة الولادة و كان طول عنق الرحم مهمًا في التنبوء بالولادة قبل الأوان بحساسية 88.9٪، وخصوصية 91.2٪ وقيمة تنبؤية موجبة 50,0٪، وقيمة تنبؤية سالبة 98,8٪ وكان مؤشر ثبات عنق الرحم مهمًا في التنبوء بالولادة قبل الأوان بحساسية 88.9٪ ، خصوصية 93.4٪، وقيمة تنبؤية موجبة 57,1٪ وقيمة تنبؤية سالبة 98,8٪ وكان التقمع موجودًا في 33.3٪ من الولادة المبكرة، و 4.4٪ من الولادة كاملة المدة والتي كانت ذات دلالة إحصائية كبيرة.

الاستنتاج: كان قياس طول عنق الرحم وشكله وثباته بالموجات فوق الصوتية عبر المهبل بين الأسبوع الحملي 18 و 24 طريقة موثوقة للتنبوء بالولادة المبكرة.