

doi: 10.5455/aim.2014.22.306-308

ACTA INFORM MED. 2014 OCT 22(5): 306-308

Received: 11 August 2014 • Accepted: 12 September 2014

© AVICENA 2014

Published online: 29/10/2014

Published print: 10/2014

ORIGINAL PAPER

Ultrasound Measurement of Cervical Length as Predictor of Threatened Preterm Birth: a Predictive Model

Mohammad Abou El-Ardat¹, Fatima Gavrankapetanovic¹, Khalil A. Abou El-Ardat², Sanjin Dekovic¹, Senad Murtezic¹, Eldar Mehmedbasic¹, Nadja Hiros¹

Department of Obstetrics and Gynecology, Clinical Center University of Sarajevo, Bosnia and Herzegovina¹

Institut fuer Klinische Genetik, Medizinische Fakultät Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany²

Corresponding author: Mohammad Abou El-Ardat, MD. Department of Obstetrics and Gynecology, Clinical Center University of Sarajevo, Bosnia and Herzegovina. Tel.: +387 33 250 262. E-mail: ardat@gmail.com

ABSTRACT

Introduction: The incidence of preterm delivery has been increasing even in developed countries and remains a serious problem for fetuses and neonates. Although many predictors for preterm delivery have been proposed, complete prediction and prevention have not yet been established. **Aims:** To examine the potential association between sonographic measurement of cervical length and threatened preterm birth (TPTB) in pregnant woman at 24-36 weeks of gestation. **Materials and methods:** A cross-sectional study included a total of 360 pregnant woman at 24-36 weeks of gestation categorized in two groups: TPTB group ($n=160$) and non TPTB group ($n=200$). The study was carried out at the Department of Obstetrics and Gynecology of the Clinical Center University of Sarajevo (KCUS). Sociodemographic and clinical characteristics of patients were obtained from medical records and physical examination by gynecologist. Transvaginal sonography was carried out by GE Voluson 730. **Results:** There was a significant association between TPTB and sonographic measurement of cervical length <25 mm ($P<0.001$). The logistic regression model was statistically significant, $\chi^2(7) = 281.530$, $P < .001$. The model explained 72.6% of the variance in TPTB and correctly classified 88.1% of cases. Sensitivity was 83.8%, specificity was 91.5%, positive predictive value was 88.7% and negative predictive value was 87.6%. Out of the 7 predictor variables only 5 were statistically significant: cervical length, cervical consistency, rupture of membranes, uterine contractions and amine odor test. **Conclusion:** The findings of this study suggest association between sonographic measurement of cervical length and TPTB.

Key words: cervical length, threatened preterm birth.

1. INTRODUCTION

Preterm delivery is the leading cause of neonatal mortality and morbidity (1). The incidence of preterm delivery has been increasing even in developed countries and remains a serious problem for fetuses and neonates (2). Although many predictors for preterm delivery have been proposed, complete prediction and prevention have not yet been established (3). Cervical length appears to be an efficient test for predicting preterm birth; it has been found to be the best single predictor of preterm birth <34 weeks in asymptomatic women, with the risk of preterm delivery increasing dramatically for lengths <15 mm (4, 5). Several reviews show that transvaginal cervical sonography identifies women at increased risk of spontaneous preterm birth, although there is usually a wide variation amongst studies in gestational age at testing, definition of threshold of abnormality, and definition of reference standard (6,7,8). Cochrane's review emphasizes that there is a non-significant association between cervical length results with transvaginal ultrasound and prevention of preterm delivery at less than 37 weeks in symptomatic women and suggests that future studies should include a clear protocol for management of women based on measurement of cervical length by transvaginal ultrasound, so that it can be easily evaluated

and replicated (9).

The aim of this study was to examine the potential association between sonographic measurement of cervical length and threatened preterm birth (TPTB) in pregnant woman at 24-36 weeks of gestation.

2. MATERIALS AND METHODS

A cross-sectional study included a total of 360 pregnant woman at 24-36 weeks of gestation categorized in two groups: TPTB group ($n=160$) and non TPTB group ($n=200$). The study was carried out at the Department of Obstetrics and Gynecology of the Clinical Center University of Sarajevo (KCUS). A written informed consent was obtained from those women who agreed to take part in the study, which was approved by the research ethic committee of KCUS. Sociodemographic and clinical characteristics of patients were obtained from medical records and physical examination by gynecologist. In all cases gestation was calculated from the menstrual history. Transvaginal sonography was carried out by GE Voluson 730. Three measurements were obtained and the shortest, technically the best measurement in the absence of uterine contractions was recorded. The Kolmogorov-Smirnov statistic Test with a Lilliefors significance level was

used for testing normality. Results are expressed as median and interquartile range (25th to 75th percentiles) in case of non-normal distributed continuous variables. In case of categorical variables, counts and percentages were reported. A P-value <0.05 was considered as significant. Statistical analysis was performed with Mann-Whitney Test and comparison of groups by Chi-Squared test. The effect of age (years), cervical length (<25 mm or >25 mm), cervical consistency (soft or firm), uterine contractions (absence or presence), openness of the cervix (closed or opened >10 mm), rupture of membranes (no or yes), and amine odor test (negative or positive) were analyzed using logistic regression analysis. A P-value <0.05 was considered as significant. Statistical analysis was performed by using the Statistical Package for the Social Sciences (SPSS Release 19.0; SPSS Inc., Chicago, Illinois, United States of America) software.

3. RESULTS

There was a significant difference between two groups regarding age (P<0.01), number of births (P<0.001) and previous examination (P<0.001) (Table 1).

There was a significant association between TPTB and: sonographic measurement of cervical length <25 mm (P<0.001), soft cervical consistency (P<0.001), opened cervix >10 mm (P<0.01), rupture of membranes (P<0.001), presence of uterine contractions (P<0.001), positive amine odor test (P<0.001) and previous treatment of vaginal infection (P<0.05). Cervical length was significantly correlated with cervical consistency, $r_s=0.23$, uterine contractions, $r_s=-0.21$, and amine odor test, $r_s=-0.27$ (all $P_s<0.001$). Amine odor test was significantly correlated with cervical consistency, $r_s=-0.36$, rupture of membranes, $r_s=-0.38$, and uterine contractions, $r_s=-0.40$, (all $P_s<0.001$). A logistic regression was performed to ascertain the effects of age, cervical length, cervical consistency, openness of the cervix, rupture of membranes (ROM), cardiotocography (CTG) monitoring uterine activity and amine odor test on the likelihood that participants have TPTB. The logistic regression model was statistically significant, $\chi^2(7) = 281.530$, $P < .001$. The model explained 72.6% (Nagelkerke R^2) of the variance in TPTB and correctly classified 88.1% of cases. Sensitivity was 83.8%, specificity was 91.5%, positive predictive value was 88.7% and negative predictive value was 87.6%. Out of the 7 predictor variables only 5 were statistically significant: cervical length, cervical consistency, ROM, uterine contractions and amine odor test (as shown in Table 2).

Pregnant woman with cervical length <25 mm were 4.16 times more likely to exhibit TPTB than pregnant woman with cervical length >25 mm. Pregnant woman with soft cervical consistency were 4.89 times more likely to TPTB than pregnant woman with firm cervical consistency. Pregnant woman with ROM were 52.37 times more likely to exhibit TPTB than pregnant woman with non ROM. Absence of uterine contractions and negative amine odor test were as-

Variable	TPTB (n=160)	non TPTB (n=200)	P-value
Age (yrs)	27.0 (22.0 to 29.0)	25.0 (21.0 to 28.0)	0.002
Level of education			
Elementary school	14.4	12.0	0.124
High school	58.8	51.0	
Higher education	26.9	37.0	
Weeks of gestation			
26-29	31.3	27.5	0.187
30-33	37.5	47.0	
34-36	31.3	25.5	
Number of births			
0	33.8	17.0	<0.001
1	41.3	43.5	
≥2	25.0	39.5	
Number of spontaneous abortion			
0	76.3	73.0	0.544
1	15.6	20.0	
≥2	8.1	7.0	
Number of artificial abortion			
0	73.1	63.5	0.064
1	16.3	26.5	
≥2	10.6	10.0	
Numbers of previous examination			
0	4.4	1.5	<0.001
1	11.9	4.5	
2	29.4	12.0	
≥3	54.4	82.0	
Clinical characteristics			
Cervical length <25 mm (%)	57.5	20.5	<0.001
Soft cervical consistency (%)	48.8	9.0	<0.001
Opened cervix > 10 mm (%)	32.5	19.0	0.003
ROM (%)	30.0	0.5	<0.001
Presence of uterine contractions (%)	57.5	18.0	<0.001
Positive Amine Odor Test (%)	75.0	7.0	<0.001
Treatment of vaginal infection (%)	21.9	13.5	0.037

Table 1. Characteristics of study population based on the TPTB. Note: Continuous variables are expressed as median with interquartile range (IQR, 25th to 75th percentiles), statistics by Mann-Whitney Test. Comparison of groups by Chi-Squared test. Definition of abbreviations TPTB = threatened preterm birth; ROM = rupture of membranes

Variables	B	S.E.	OR	P-value
Cervical length < 25 mm	1.46	0.37	4.16	<0.001
Soft cervical consistency	1.59	0.41	4.89	<0.001
Openness of the cervix	-0.78	0.43	0.46	0.066
Rupture of membranes (ROM)	3.96	1.12	52.37	<0.001
Absence of uterine contractions	-0.89	0.38	0.41	0.018
Negative amine odor test	-3.19	0.40	0.04	<0.001
Age	-0.04	0.04	0.96	0.294
Constant	-2.88	1.56	0.06	0.066

Table 2. Logistic regression predicting of TPTB. Note: $R^2=0.726$ (Nagelkerke), 0.543 (Cox & Snell). $P=0.513$ (Hosmer & Lemeshow). Model $\chi^2(7) = 281.530$, $P < .001$.

sociated with a reduction in the likelihood of TPTB. Pregnant woman with absence of uterine contractions were 2.44 times less likely to exhibit TPTB than pregnant woman with uterine contractions. Pregnant woman with negative amine

odor test were 24.38 times less likely to exhibit TPTB than pregnant woman with positive amine odor test.

4. DISCUSSION

In this cross-sectional study, we found significant association between TPTB and sonographic measurement of cervical length <25 mm and that is compatible with results of other studies. A systematic review which involved 2 258 woman, showed that cervical length measured by transvaginal ultrasonography predicted spontaneous preterm birth. The most common cervical length cut-off was < 25 mm (10). Transvaginal ultrasonography is the preferred route for cervical assessment to identify women at increased risk of spontaneous preterm birth and may be offered to women at increased risk of preterm birth. Also, it can be used to assess the risk of preterm birth in women with a history of spontaneous preterm birth and to differentiate those at higher and lower risk of preterm delivery (11). Cervical length is an independent predictor of preterm delivery in women with preterm labor (12). Beside the cervical length, we found significant association between TPTB and: soft cervical consistency, opened cervix >10 mm, rupture of membranes, presence of uterine contractions, positive amine odor test and previous treatment of vaginal infection. In the study of Abou El-Ardat et al., prevalence of bacterial vaginosis in women with threatened preterm birth was higher than in women without threatened preterm birth (28.9% vs. 6.3%) (13). In our study pregnant woman with TPTB were older compared to non TPTB pregnant woman. Woman who did not give birth were significantly more frequent in TPTB group compared to non TPTB group (33.8% vs. 17.0%). Also, woman with ≥ 3 previous examinations were less frequent in TPTB group compared to non TPTB group (54.4% vs. 82.0%). The logistic regression model, which included: cervical length, cervical consistency, ROM, uterine contractions and amine odor test, was statistically significant and explained 72.6% of the variance in TPTB and correctly classified 88.1% of cases. In the study of Takagi et al., factors that increased the risk of preterm birth were premature rupture of the membranes, intrauterine infection, dilatation of the cervix and uterine bleeding and the predictive accuracy of the function was 75.4% in the 236 patients analyzed (14).

5. CONCLUSION

The findings of this study suggest association between sonographic measurement of cervical length and TPTB. A predictive model which included: cervical length, cervical consistency, ROM, uterine contractions and amine odor test, explained 72.6% of the variance in TPTB and correctly classified 88.1% of cases.

CONFLICT OF INTEREST: NONE DECLARED.

REFERENCES

1. Tsoi E, Akmal S, Rane S, Otigbah C, Nicolaides KH. Ultrasound assessment of cervical length in threatened preterm labor. *Ultrasound Obstet Gynecol.* 2003; 21: 552-555.
2. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *Lancet.* 2008; 371: 75-84.
3. Kurpa FG, Faltin D, Cecatti JG, Surita FGC, Souza JP. Predictors of preterm birth. *Int J Gynecol Obstet.* 2006; 94: 5-11.
4. Yoshizato T, Obama H, Nojiri T, Miyake Y, Miyamoto S, Kawarabayashi T. Clinical significance of cervical length shortening before 31 weeks' gestation assessed by longitudinal observation using transvaginal ultrasonography. *J Obstet Gynaecol. Res.* 2008; 34: 805-811.
5. Masamoto H, Nagai Y, Inamine M. et al. Outcome of pregnancy after laser conization: implications for infection as a causal link with preterm birth. *J Obstet Gynaecol Res.* 2008; 34: 838-842.
6. Conde-Agudelo A, Romero R, Hassan SS, Yeo L. Transvaginal sonographic cervical length for the prediction of spontaneous preterm birth in twin pregnancies: a systematic review and metaanalysis. *Am J Obstet Gynecol.* 2010 Aug; 203(2): 128. e1-12
7. Lim AC, Hegeman MA, Huis In 'T Veld MA, Opmeer BC, Bruinse HW, Mol BW. Cervical length measurement for the prediction of preterm birth in multiple pregnancies: a systematic review and bivariate meta-analysis. *Ultrasound Obstet Gynecol.* 2011 Jul; 38(1): 10-17.
8. Crane JM, Hutchens D. Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review. *Ultrasound Obstet Gynecol.* 2008 May; 31(5): 579-587.
9. Berghella V, Baxter JK, Hendrix NW. Cervical assessment by ultrasound for preventing preterm delivery. *Cochrane Database Syst Rev.* 2009; 8: CD007235.
10. Crane JM, Hutchens D. Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review. *Ultrasound Obstet Gynecol.* 2008 May; 31(5): 579-587.
11. Lim K, Butt K, Crane JM. Ultrasonographic cervical length assessment in predicting preterm birth in singleton pregnancies. *J Obstet Gynaecol Can.* 2011 May; 33(5): 486-499.
12. Melamed N, Hirsch L, Domniz N, Maresky A, Bardin R, Yoge Y. Predictive value of cervical length in women with threatened preterm labor. *Obstet Gynecol.* 2013 Dec; 122(6): 1279-1287.
13. Abou-El-Ardat M, Godinjak Z, Deković S, Lačević L, Mehmedbašić E, Rovčanin A. The prevalence of bacterial vaginosis in pregnant women with threatened preterm birth. *Medical Journal.* 2013; 19(4): 308-312.
14. Takagi K, et al. A mathematical model for predicting outcome in preterm labour. *J Int Med Res.* 2012; 40(4): 1459-1466.