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

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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, $x^2(7) = 281.530, P < .001$. 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 least at 36 weeks in asymptomatic 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=-0.23, uterine contractions, r=-0.21, and amine odor test, r=-0.27 (all P<0.001).

Amine odor test was significantly correlated with cervical consistency, r=-0.27, soft cervical consistency, r=-0.36, rupture of membranes, r=-0.38, and uterine contractions, r=-0.40, (all P<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, χ²(7) = 281.530, P < .001. The model explained 72.6% (Nagelkerke R²) 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 exhibit 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 associated 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 women 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. 6.3%) (13). In our study pregnant woman with 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 were 24.38 times less likely to exhibit TPTB than pregnant woman with positive amine odor test.

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