

MEDICAL SCIENCES

UDC 618.39-021.3-036.3:618.14-07-092

DETERMINATION OF THE UTEROCERVICAL ANGLE AS A MARKER OF SPONTANEOUS PRETERM LABOR

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Annotation: The ability to identify women at risk of spontaneous preterm birth (sPTB) is limited and includes a detailed history, transvaginal ultrasound, or symptoms such as preterm contractions. Clinical cervical function can be described through cervical structure integrity as is displayed through ultrasonographic cervical length (CL) and uterocervical angle (UCA) [1, p. 376.e1]. The role of universal cervical length screening to predict preterm birth in general obstetric population is contentious; those guidelines that are in favor, recommend screening in the mid-trimester between 18 and 24 weeks gestation. Where cervical length is measured, however, a cervical length of <25 mm is universally agreed upon as the threshold for intervention, with less than 24 weeks gestation suggested most commonly as the gestational limit where this measurement should be considered abnormal. There is strong agreement that pregnancies at increased risk of preterm birth should undergo cervical length measurement preferably with transvaginal ultrasound [2, p. 934]. The 3D geometry of the cervix and the UCA has an important effect on the load distribution and stretch pattern within the internal os. Large anatomical changes occur

with fetal growth and these changes are associated with changes in CL, cervical volume, and UCA. A better understanding of relationships between anatomical geometry and cervical loading has direct clinical relevance. Modification of the UCA was postulated to be the mechanism of preterm birth prevention for the Arabin pessary in clinical trials [3, p. 1514] A wide, or obtuse, UCA lends a more direct, linear outlet of uterine contents onto the cervix. A narrower, or acute, UCA supports an anatomical geometry that would exert less direct force on the internal os, which may be protective from cervical deformation [1, p. 376.e1].

Key words: spontaneous preterm birth, transvaginal ultrasound, cervical length, uterocervical angle, predictive markers.

Aim: to evaluate the prognostic potential of ultrasound parameters (cervical length and uterocervical angle) measured in the second trimester as predictors of spontaneous preterm birth in singleton pregnancies.

Materials and methods. The main study group included 22 women aged 16 to 43 years (mean age (M $\pm$ SD) – 32.5 $\pm$ 6.9 years) who had a singleton pregnancy that ended in preterm birth at 24-36 weeks of gestation (median – 32 (30; 35) weeks). Women were excluded from analysis if they experienced medically indicated preterm birth. The control group consisted of 24 patients aged 18 to 38 years (mean age 30.4 $\pm$ 5.8 years) who had full-term deliveries (median 39 (38.5; 40) weeks). Both study groups were statistically comparable in terms of patient age, with the majority being women aged 35 years and older – 45.5% in the main group and 33.3% in the control group ($p>0.05$).

Transvaginal ultrasound for cervicometry and determination of the UCA was performed on several devices: GemisLogiQ-5 PRO, General Electric, USA; Philips Hd-11 XE, Netherlands; Philips EPIQ 7, Netherlands, using intracavitary transducers with a frequency of 3-13 MHz at 18-22 weeks of pregnancy.

Statistical processing of research data was performed using the licensed software package Statistica version 6.1 (Statsoft Inc., USA, No. AGAR909E415822FA) and a trial version of MedCalc Software, trial v. 23.2.6

(MedCalc Software Ltd, Ostend, Belgium, <https://www.medcalc.org>, 2025). The Shapiro-Wilk test was used to verify the distribution of quantitative variables. To describe and compare normally distributed data between groups, the arithmetic mean and standard deviation ($M \pm SD$) and Student's t-test were used; for abnormally distributed data, the median (Me), lower and upper quartiles (LQ; HQ) and Mann-Whitney U test were used. Comparisons of categorical variables were performed using Pearson's chi-square test (χ^2) and Fisher's exact test (FET). Correlations between characteristics were assessed using Spearman's rank correlation coefficients (r_s). To assess the prognostic potential of indicators that have predictive value for the risk of sPTB, ROC analysis was performed with the calculation of the area under the ROC curve (AUC) with a 95% confidence interval (95% CI), the discriminatory criterion and operational characteristics (sensitivity (Se), specificity – Specificity (Sp)). A level of $p \leq 0.05$ was considered statistically significant in all tests, with a trend noted at $0.05 < p < 0.1$.

Informed consent was obtained from the patients for the study.

Results of the study and their discussion. It was found that the CL in the main group ranged from 31.2 mm to 34.9 mm and averaged 32.8 ± 1.1 mm. In women in the control group, CL ranged from 32.5 to 36.2 mm, averaging 34.4 ± 1.2 mm, which was 4.9% higher than in the main group ($p_t < 0.001$). At the same time, no significant differences were found between the CL in the main group at 32 weeks (32.6 ± 1.0 mm) and 37 weeks (32.9 ± 1.2 mm) at $p_t = 0.588$, which allows this marker to be considered a predictor of sPTB at < 37 weeks.

The results of UCA measurements at 18-22 weeks of gestation showed significant differences in the mean UCA values between the study groups. Thus, in women in the main group, UCA values ranged from 86.9 to 128.8 degrees and averaged 107.2 ± 13.3 degrees, which was 15.1% higher than the corresponding values in women in the control group (93.1 ± 11.7 degrees) at $p_t < 0.001$. At the same time, in women in the main group at 32 weeks, the average UCA was 99.8 ± 9.6 degrees, while with the development of sPTB at 32 to 37 weeks, it increased to 113.4 ± 13.1 degrees ($p_t = 0.013$). This coincides with the data of the authors [1, p. 376.e3–376.e4], that in

women with singleton pregnancies between 16+0 and 23+6 weeks, UCA ≥ 95 degrees was significantly associated with sPTB <37 weeks with a sensitivity of 80% ($P < 0.001$; CI 0.70–0.81; specificity 53%; positive predictive value 14%; negative predictive value 95%), and UCA ≥ 105 degrees predicted sPTB <34 weeks with a sensitivity of 81% ($P < 0.001$; CI 0.72–0.86; specificity, 65%; positive predictive value 10%; negative predictive value 99%).

Thus, both indicators of transvaginal ultrasonography performed in the second trimester of pregnancy are significantly associated with sPTB at gestational ages up to 37 weeks: correlation coefficients are $r_s = -0.57$, $p < 0.001$ for CL and $r_s = 0.48$, $p < 0.001$ for UCA. This indicates the need to consider both indicators for predicting sPTB.

Conclusions. The risk of sPTB was directly associated with a shortening of the cervix and an increase of UCA according to transvaginal ultrasound data at 18-22 weeks of pregnancy. This allows these indicators to be considered as possible markers for predicting preterm birth.

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