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Anterior uterocervical angle: is it an ultrasonographic screening tool that estimates the latent phase duration in post term pregnancies?

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ABSTRACT

Objectives: In recent years, in addition to cervical length measurement, a new ultrasonographic parameter has been defined as uterocervical angle (UCA), which can be used in the prediction of preterm labor. In this study,we evaluated the place of uterocervical angle in predicting the latent phase duration in postterm pregnancies.

Material and methods: This prospective study consists of 90 pregnant women aged between 18 to 40 years who were hospitalized with a diagnose of late term pregnancy. Pregnant women with a latent phase duration of 1200 minutes or less were defined as Group 1. Patients with latent phase duration over 1200 minutes were defined as Group 2. All patients' age, BMI, smoke, cervical length measurements, uterocervical angle, latent and active phase of labor durations, length of the third stage and delivery types were compared.

Results: The UCA median value of group 1 was 120 (94–147), and group 2 was 99 (94–105) ($p < 0.001$). CL medians of Groups 1 and 2 were 29 (17–43) and 28 (27–41) respectively (p: 0.871). UCA (AUC: 0.917, $p < 0.0001$) significantly predicted prolonged latent phase duration. Optimal cut off value was obtained at the value of 105 degree (100% sensitivity, 75% specificity) for UCA. Kaplan-Meier survival analysis showed that duration of labor was significantly higher in a group with low UCA (p: 0.013).

Conclusions: UCA can be a successful tool that can be used to predict duration of labor in cases of postterm pregnancies with medical induction.

Keywords: uterocervical angle; postterm; cervical length

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INTRODUCTION

Late term pregnancy (LTP) is defined as 294 days after the last menstrual period and increases fetal morbidity and mortality [1]. For this reason, labor induction is applied for postterm pregnancies. The evaluation of these patients for delivery is conventionally performed by digital examination of the cervix. The useful Bishop score assesment has been used for a long time to predict successful labor induction [2]. However, this score is often not suitable for postterm pregnancies. Being able to predict the duration of the latent phase will be useful for predicting the likely time of delivery [2]. There are some measurement studies as an alternative to the Bishop score, which was created in the 1960's and is still actively used in delivery rooms today [3, 4]. Because the Bishop score calculated by digital examination, it is a subjective evaluation form and it can give different results even in the same person according to the experience of the practitioner. In addition, the length of the cervix is excluded from this scoring.

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Figure 1. The ultrasound image of the uterocervical angle

Objectives

In recent years, in addition to cervical length measurement, a new ultrasonographic parameter has been defined as uterocervical angle (UCA), which can be used in the prediction of preterm labor [5, 6]. UCA is the angle between the lower uterine segment and the cervical canal, and measurements above 105 degree in singleton pregnancies have been shown to correlate with the increased risk of spontaneous preterm labor [7, 8]. More publications about UCA in predicting the duration of the latent phase and active phase of labor are needed. [2, 9]. Therefore, in this study, we evaluated the place of UCA in predicting the latent phase duration in postterm pregnancies.

MATERIAL AND METHODS

This prospective study was performed in our obstetric clinic between June 1, 2020 and October 30, 2020. The study cohort consists of 108 pregnant women aged between 18 to 40 years who hospitalized with a diagnose of late term pregnancy. All participants were nulliparous. The study protocol was approved by the hospital's Ethics Committee and was registered with clinicaltrials.gov (NCT04848701). Signed informed consent was obtained from all participants prior to the start of the study.

Postterm pregnancy is defined as 287 days (41 weeks) after the last menstrual period. It was calculated according to the last menstrual period and the patients' first trimester ultrasounds (especially at 8–12 weeks). Patients who delivered before the 41st week were not recruited to the study. Patients with singleton pregnancies, vertex presentation, intact membranes no uterine contractions were included. Exclusion criterias were women with BMI > 30, multipar women, multiple pregnancies, macrosomia (> 4500 g), major fetal congenital abnormality or fetal death and any contraindications to vaginal birth (*e.g.* active genital herpes), abnormal Pap smears, patients with a history of previous cesarean section, myomectomy, hysteroscopic surgeries, dilatation and curettages, loop electrosurgical excision procedures, and cervical conization. In patients diagnosed with late term pregnancy, the UCA and CL were measured by transvaginal ultrasound (TVUS) at the time of admission to the delivery room before labor induction. Both CL and UCA measurements were obtained three times and mean values for them were included in the analysis. All measurements were made by an experienced sonographer (F.E.) on the same ultrasound (Ultrasound System HS70A with Prime; Samsung Healthcare, Seoul, South Korea). Thus, all measures were standardized, and bias was limited. CL measurement was performed according to Fetal Medicine Foundation guidelines [10]. Since the guidelines for UCA are not yet established, it was measured following Dziadosz M. protocol [5] (Fig. 1).

Ninety women with postterm pregnancy who met the inclusion criteria participated in the study. Pregnant women with a latent phase duration of 1200 minutes or less were defined as Group 1. Patients with latent phase duration over 1200 minutes were defined as Group 2 [11]. To all participants with bishop score of ≤ 6, vaginal ovule of dinoprostone was inserted into the posterior fornix. The exact time of application was recorded. The duration of administration for dinoprostone ovule was 24 hours [12]. Patients with no cervical dilatation despite dinoprostone for 24 hours, were performed cesarean section and excluded from study. While the Bishop score was > 6, the dinoprostone ovul removed and oxytocin infusion was started. It was prepared as 5 units in 500 mL salin and was started with an initial dose of 4 mU/min which was increased 2 mU/min every 20 minutes. Maximum dose was defined as 20 mU/min. All patients had continuous fetal heart monitoring once uterine contractions were formed. All patients' age, BMI, smoke, CL measurements, UCA measurements, latent and active phase of labor durations, length of the third stage (min) and delivery types were recorded.

The latent phase is defined as cervical dilatation ≤ 4 cm with regular or irregular uterine activity [13]. Active labour is defined as cervical dilatation ≥ 5 cm with regular uterine activity [14]. The time from complete dilatation and complete erasure to birth was recorded as the duration of the second phase of labor. In our unit, the third stage of labor is defined as the period of time from birth of the neonate until the delivery of the placenta. Duration of labor was defined as the time from induction to delivery.

The primary outcome was the predictive ability of UCA for prolong latent phase duration. The secondary outcome was the relative success of UCA in active phase and duration of labor prediction.

Statistical analysis

Using the G-power 3.1.9.2 program, the appropriate sample size was calculated. Based on the results of a similar study conducted in 2020 [3], a total of 64 participants were needed [effect size 89%, alpha = 0.05, power (1 beta) = 0.95]. Statistical analysis was carried out using SPSS program (ver. 20, SPSS, Chicago, IL, USA). Data was expressed as average ± SD and in percentages. Continuous variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogrov-Simirnov/Shapiro-Wilk's test) to determine whether they are normally distributed. If the numerical data was non-parametric, Student's t-test was conducted, if it was parametric, Mann-Withney U test was carried. Categorical data was compared using Chi-square test. Multivariate logistic regression analysis was used to determine independent predictors of latent phase duration. P < 0.05 were accepted as statistically significant. ROC analysis was performed in medcalc.

RESULTS

One hundred and eight women with posterm pregnancy were included in the study. In total, 90 patients deliveried vaginally and 18 patients deliveried by cesarean section (Fig. 2). The latent phase duration of 64 (71%) patients were less than 1200 minutes, and 26 (29%) of them were more than 1200 minutes.

The demographic and clinical characteristics of the two groups are presented in Table 1. Groups were similar in terms of maternal age, BMI and smoking situations. The UCA median value of group 1 was 120 (94–147), and group 2 was 99 (94–105) (p < 0.001). CL medians of Group 1 and 2 were 29 (17–43) and 28 (27–41) respectively (p: 0.871). When the active phase,second and third stages of labor were evaluated separately, there was no significant difference between the groups. However, when the whole delivery time including the latent phase was evaluated, a significant difference was observed between the groups. (1172.39 ± 289.23 min and 1758.42 ± 406.73 min respectively, p < 0.001). In multivariate regression analysis, maternal age, UCA and cervical length were added to the model, the analysis revealed significant associations between UCA (OR: –8.494, p < 0.001), and prolonged latent phase (Tab. 2).

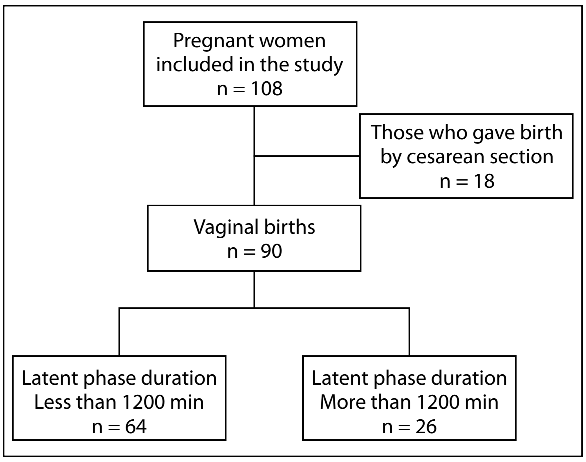

Figure 2. Study flowchart

Uterocervical angle [area under curve (AUC): 0.917, p < 0.0001] significantly predicted prolonged latent phase duration (Fig. 3). Optimal cutoff value was obtained at the value of 105° (100% sensitivity, 75% specificity) for UCA. Kaplan-Meier survival analysis showed that duration of labor was significantly higher in a group with low UCA (p = 0.013) (Fig. 4).

DISCUSSION

In pregnant women whose UCA measurement was performed before labor induction due to postterm pregnancy, UCA being below 105° has a predictive value for prolonged latent phase (> 1200 min). CL is not effective in predicting the latent phase duration. In addition, the regression analysis revealed that UCA was an independent risk factor for prolonged latent phase.

Transvaginal ultrasound's place in obstetrics practice has gradually increased in the last decade. TVUS has important role especially in studies conducted for preterm labor prediction. Different evaluation parameters such as UCA were added to the CL measurement, which was successful in preterm labor prediction [6]. In addition,the utility of ultrasound in predicting the success of labor induction is being investigated. Dağdeviren et al. [9] in their study; they subgrouped the patients and compared CL and UCA in predicting induction success. They found negative corelation in the duration of active phase with narrower UCA; however, they showed that it was not effective in predicting the success of labor induction. Differently, in this study, the relationship between UCA and induction success was evaluated in pregnant women with Bishop

Table 1. Comparison of some clinical and demographic characteristics of the cases who delivered vaginally according to the latent phase duration

	Total cohort (n = 90)	Latent phase duration less than 1200 min (n = 64)	Latent phase duration more than 1200 min (n = 26)	p
Maternal age [years]	28.17 ± 4.99	28.65 ± 5.23	27 ± 4.21	0.155
BMI [kg/m^2]	28.5 (20–34.5)	27.75 (20.7–34.5)	28.50 (20–32.5)	0.193
Smoke				0.262
Yes	3 [3.3%]	3 (4.7%)	0	
No	87 [96.7%]	61(95.3%)	26	
UCA	111° (94–147°)	120° (94–147°)	99° (94–105°)	< 0.001
CL [mm]	29 (17–43)	29 (17–43)	28 (27–41)	0.871
Duration of active phase [min]	631.92 ± 268.29	651.14 ± 266.51	584.61 ± 272.01	0.296
Duration of second stage labor [min]	50 (40–70)	55 (40–70)	50 (40–70)	0.883
Duration of thirth stage labor [min]	12 (10–20)	10 (10–20)	15 (10–20)	0.124
Duration of labor [min]	1341.68 ± 420.75	1172.39 ± 289.23	1758.42 ± 406.73	< 0.001
Birth weight [g]	3285.70 ± 238.78	3278. 76 ± 247.92	3302.76 ± 218.32	0.652

Values were presented as mean ± SD or n (%) or median (min-max); p value < 0.05 was statistically significant; BMI — body mass index; CL — cervical lenght; SD — standard deviation; UCA — uterocervical angle

Table 2. Multiple lineer regression for predicting prolonged latent phase duration in patients with vaginal delivery

	B	P	OR	95% CI
Age [years]	–7.191	0.196	–1.304	0.987–1.013
CL	5.940	0.388	0.868	0.996–1.004
UCA	–14.329	**< 0.001**	–8.494	0.992–1.008

B — Standardized regression coefficient; CI —confidence interval; CL — cervical lenght; OR — odds ratio; SE — standard error; UCA — uterocervical angle; p values with statistical significance (p < 0.05) are shown in bold.

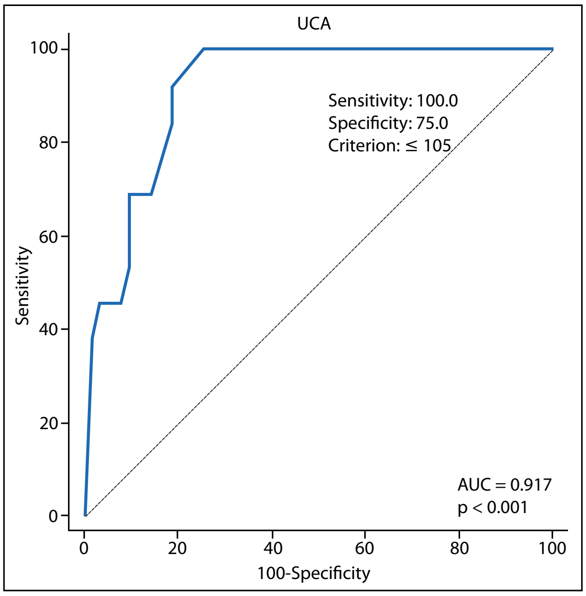

Figure 3. Receiver operating characteristic (ROC) curve of uterocervical angle (UCA) to predict prolonged latent phase duration; AUC — area under curve

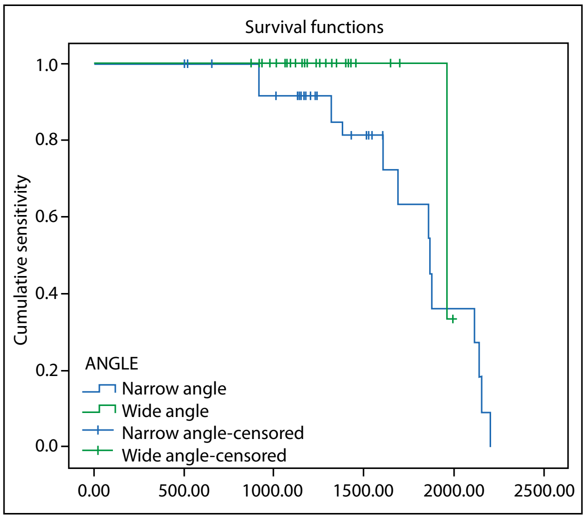

Figure 4. Survival curve showing significant association between uterocervical angle (UCA) and duration from labor

score < 6 and more than 37 weeks pregnancy with regular contractions. We think that the results were obtained in this way because they compared the patients who went to cesarean due to unsuccessful induction, who had a normal delivery with successful induction, and those who underwent cesarean for other indications although induction was successful.

In another similar study [15], the posterior uterocervical angle (PUC) and the place of CL in predicting successful induction were compared with Bishop score. It was determined as 99.5° cutoff for PUC. It has been observed that the success of labor induction increases with values above this angle. Vaginal misoprostol was used for induction in ths study to the pregnancies between 35–42 weeks. In the unsuccessful induction group, patients who did not progress to labor and had cesarean section after 24 hours were included. Patients who underwent cesarean due to other reasons were not included in the study. We think that this situations creates less bias according to the study of Dağdeviren et al. [9]. PUC values above 99.5° increased vaginal delivery significantly. Similarly, Adbelhafeez et al. [16] showed that UCA (as a cutoff value of 110.2°) and CL (as acutoff value of 32.3 mm) may be useful in predicting the success of labor induction in pregnant women over 38 weeks induced by vaginal misoprostol. In our study, we evaluated postterm pregnancies that only gave vaginal delivery by excluding the patients who had cesarean section. In addition, instead of misoprostol for induction,we used dinoprostone for pregnant women with Bishop score ≤ 6 and oxytosin for pregnant women with a Bishop score > 6. In this way,we aimed to show the effect of UCA only on the latent phase and active phase of delivery in nulliparous and postterm pregnancies. It is difficult to carify the effect of these different medical approaches on the result of the studies. The use of different birth induction methods may affect the duration of labor differently on its own. Therefore, in order to see the effect of UCA alone, we limited the pregnant women criteria to the nulliparous, postterm and a standard birth induction method.

There are other studies conducted with pregnant women who are postterm and grouped according to their latent phase durations [2, 17]. In these studies, UCA nad CL were found to be effective in predicting successful labor induction. In the study of Eser et al. [2], unlike our study, mechanical induction (balloon catheter) was used instead of medical induction agents in the latent phase. In addition, the prolonged latent phase duration in this study was defined as over 720 minutes. In this study, the treshold value for UCA was found to be 97°. The difference between UCA cutoffs may be due to the difference in time determined for the prolonged latent phase (720 min vs 1200 min). In our study, we based on the latent phase duration defined for nulliparous pregnant women as 20 hours [11]. Unlike this study, we did not observe a significant relationship between CL and the prediction of successful labor induction. This result may be due to the latent phase duration we have also defined. Nevertheless, the results of the studies are in a similar direction. In this study, we showed that UCA is significantly associated with duration of labor.

Strengths of this study; choosing pregnant women with ≤ 6 Bishop score by including isolated nulliparous pregnant women in the study and choosing the same method (dinoprostone and oxytocin) in all patients in terms of delivery induction method. In this way, we minimized the other factor that may affect delivery times and we tried to measure the effect of UCA measurement purely.

Our study has some limitations. First labor is a dynamic process and cervical changes is a result of uterine contractions. UCA measurement was performed in all patients just before the induction agent was started,and then the labor was followed by digital examination. Also multiparous pregnant women was not included in the study. Since the aim of the study was to evaluate the latent phase and active phase durations in patients who had vaginal delivery, patients who underwent cesarean section were excluded from the analysis and the relationship between UCA and delivery type was not evaluated.

CONCLUSIONS

Despite these limitations, exact cut off for UCA as a prediction of prolonged latent phase duration, is a successful ultrasonographic tool. In addition, UCA can be a successful tool which can be used to predict duration of labor in cases of postterm pregnancies with medical induction. Prospective studies with more patients are needed to determine a certain UCA value to be used in the delivery room and for more accurate data.

Article information and declarations

Conflict of interest

The authors have no conflicts of interest relevant to this article.

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