

The Accuracy of Cervical Length for Prediction of Delivery in Term Pregnancy Patients Presenting with Labor Pain

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ABSTRACT

Objective: To investigate the relationship between cervical length (CL) at gestational age (GA) 37 to 41+6 weeks and delivery within 7 days in term pregnancy patients who presented with labor pain.

Methods: Term pregnancy subjects who attended antenatal clinic and delivered at Bhumibol Adulyadej Hospital, between September 2017 and June 2018 were recruited in this study. Participants who met the inclusion criteria received transvaginal ultrasound to measure CL. Clinical and delivery outcomes were followed. Sensitivity, specificity, negative predictive value (NPV) positive predictive value (PPV) and accuracy were calculated to assess the relationship between CL and delivery within 7 days.

Results: A total of 106 pregnant women were included in the analysis. The mean age was 26 years. Three-quarters of the cases were nulliparous. The average gestational age at delivery and newborn birth weight were 39 complete weeks and 3,100 grams, respectively. Seventy-six cases successfully delivered within 7 days while 30 patients had to wait for more than 7 days before delivery. The receiver operating characteristic (ROC) curve was used to assess the optimal cutoff of CL. The CL less than 25 mm. gave sensitivity and specificity at 69% and 73%, respectively and gave accuracy of 70.75% in prediction of delivery within 7 days.

Conclusion: Transvaginal CL measurement was useful to predict the time of spontaneous delivery and help clinicians to advise the patients about their delivery plans.

Keywords: Cervical length; term gestation; labor (Siriraj Med J 2019; 71: 278-283)

INTRODUCTION

Labor pain at term was one of the most reported clinical presentations that brought term pregnant women to the delivery room.¹ At our facility, if the patient was not in an active phase for delivery², she would be placed in clinical observation for 4 hours and then re-evaluated via pelvic examination. Pregnant women with no cervical

progression would then be discharged from the observation. However, such a procedure did not allow the attending physician to estimate time to delivery.

Cervical length (CL) is an ultrasonographic assessment of the cervix. It has been used widely in contemporary obstetrics. It was used to predict the risk of preterm delivery^{3,4} and in women before induction of labor to

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predict induction outcome.^{5,6} Few studies have examined cervical length at term and attempted to correlate a related cervical length with duration of spontaneous labor.⁷

The aim of the present study was to assess the relationship between cervical length measurement by transvaginal ultrasonography and time to delivery within 7 days in term pregnancy with presenting labor pain.

MATERIALS AND METHODS

Term pregnant women who had labor pain and visited labor rooms at Bhumibol Adulyadej Hospital from September 2017 to June 2018 were recruited. The ethics of the study were approved by the Hospital Ethics Committee, Bhumibol Adulyadej Hospital (IRB 52/60). Informed consent was obtained prior to transvaginal ultrasonographic examination. Labor pain was defined as regular uterine contraction (≥ 4 times/20 min).

Inclusion criteria were defined as: singleton pregnancy, term pregnant women with gestational age (GA) ranging from 37 to 41+6 weeks, cephalic presentation, intact membranes and certain estimated delivery dates.⁸ Transvaginal ultrasonographic (TVUS) cervical length measurements and pelvic examinations were performed by obstetrics and gynecology residents who trained on proper CL measurement technique at time of labor room visit. CL measurements performing the TVUS, using a LOGIQ V3 (General electric company, USA) machine equipped with a 8 MHz transvaginal probe.

The participant was placed in the dorsal lithotomy position. A vaginal probe at 8 MHz was used to perform an ultrasonic reading after the participant's bladder was emptied. Endocervical canal length was measured as the distance from the internal and external os in a straight line. If funneling was presented, the cervical length was measured as the distance between the apex of funneling and the external os parallel to the cervical canal. Three images were collected in each patient and the image with the shortest CL was chosen for analysis. All recruited patients were monitored until delivery.

Demographics and obstetrics variable data was collected including patient's age, race, height, body mass index (BMI), CL, gravidity, parity, onset of labor pain, GA at CL measurement, date and time of CL measurement, GA at birth, date and time of birth, time from CL measurement to delivery, fetal weight and route of delivery.

The data was processed using SPSS statistical software version 18 (IBM, Armonk, NY, USA). for analysis. Continuous variables were presented as mean and standard deviation (SD). The *p*-value of less than or equal 0.05 was used for statistical significance. Curves of cervical length

for predication of delivery within 7 days were generated using receiver operating characteristic (ROC) curves. Diagnostic accuracy of CL was subcategorized and used for analysis of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likely hood ratio (LR+), negative likelihood ratio (LR-) and accuracy.

RESULTS

A total of 120 pregnant women were enrolled. Fourteen cases were excluded due to patients choosing to deliver at other facilities. One hundred and six cases were interviewed and followed up until delivery. All cases that met inclusion criteria were included in the study.

Of the remaining participants, 76 successfully delivered within 7 days, whilst the remaining 30 cases, delivered outside the 7 days window. There were no statistically significant differences between groups in age, BMI and parity as represented in [Table 1](#).

The participants who delivered at more than 7 days had longer CL, longer time to delivery after visit and higher fetal birth weight than women who delivered within 7 days with ratios of: 29/21.8 mm, 272/54 hours and 3,202/3,061 grams.

ROC curve of cervical length for predicting delivery within 7 days was presented in [Fig 1](#). The appropriate cut off point was chosen from ROC curves that gave a suitable value. CLs less than 25 mm gave the sensitivity and specificity in prediction delivery within one week at a percentage of 69 and 73, respectively. The other cut-off points are also represented in [Table 2](#).

DISCUSSION

The main outcome of this study was the correlation between CL and delivery date within 7 days prediction of term pregnancy cases that presented at the hospital with labor pain. Optimal CL cut-off was suggested at less than 25 mm which gave appropriate sensitivity and specificity (69% and 73%, respectively). All cases with CL less than 15 mm had delivered their newborns within 7 days.

Bayramoglu et al¹² reported from France that sensitivity and PPV of spontaneous labor within 7 days by using CL cut off point at 24.5-29.5 mm were 75-82.9 and 54.8-95.5%, respectively. His work was conducted in vertex and singleton term pregnancy. Half of participants were nulliparous and CL cut off point decreased with the higher GA (29.5 mm at GA 37 weeks, 27.5 mm at GA 38 weeks, 25.5 mm at GA 39 weeks and 24.5 mm at GA 40 weeks). Comparison to the present study at cut off point

TABLE 1. Demographic data of the study population.

	Within	More	P-value
Age (years)	26.43±6.29	25.60±6.16	0.538
BMI (kg/m ²)	26.39±4.63	27.00±3.44	0.510
CL (mm)	21.8±7.4	29.0±6.3	<0.01
Time (hours)	53.92±42.26	271.99±91.49	<0.01
GA (days)			
Visit	274.08±6.35	268.93±6.82	<0.01
Delivery	276.42±6.26	280.40±6.43	0.04
FBW (gm)	3061.84±393.22	3202.23±249.56	0.03
Nulliparous	51(76.1%)	16(23.9%)	0.18
Multiparous	25(64.1%)	14(35.9%)	

Data were shown as mean ± SD (standard deviation), Within: delivery within 7 days from pelvic examination, More: delivery more than 7 days from pelvic examination

Abbreviations: BMI: body mass index, CL: cervical length, Time: time from examination to delivery, GA: gestational age, Visit: gestational age at examination, Delivery: gestational age at delivery, FBW: fetal birth weight.

TABLE 2. Diagnostic accuracy of CL to predict delivery within 7 days.

	CL (mm)			
	< 15	< 20	< 25	< 30
Sensitivity	19.7	40.7	69.7	85.5
Specificity	100	96.6	73.3	36.6
PPV	100	96.8	86.8	77.3
NPV	32.9	39.1	48.8	50.0
LR+		12.2	2.6	1.3
LR-	0.8	0.6	0.4	0.4
Accuracy	42.45	56.60	70.75	71.7

Data were shown as %,

Abbreviations: CL: cervical length, PPV: positive predictive value, NPV: negative predictive value, LR+: positive likelihood ratio, LR-: negative likelihood ratio

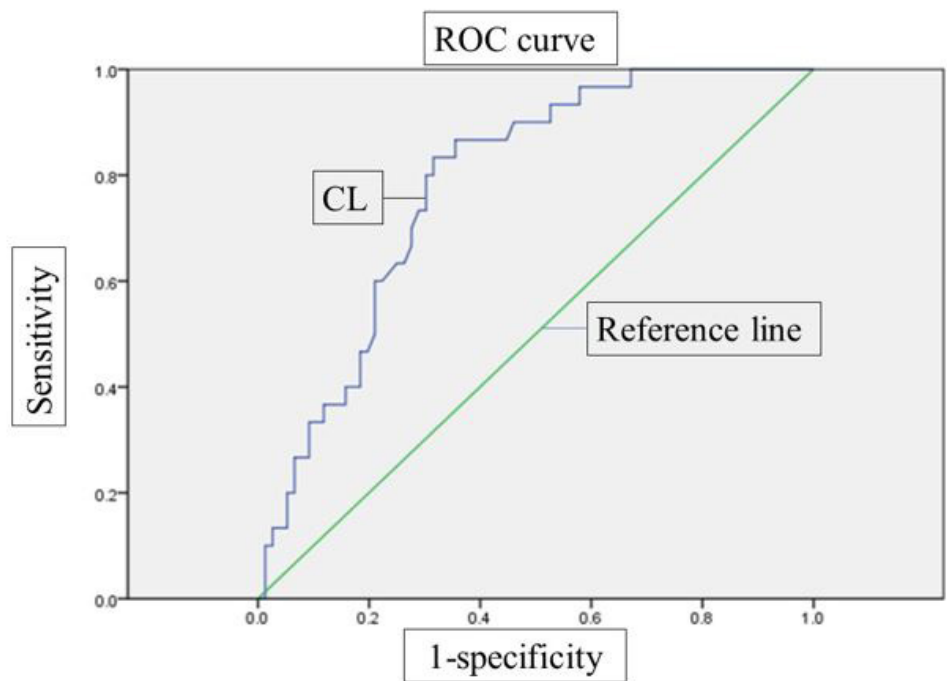


Fig 1. ROC curve of CL to predict delivery within 7 days.

Abbreviations: ROC = receiver operating characteristic, CL= cervical length (mm)

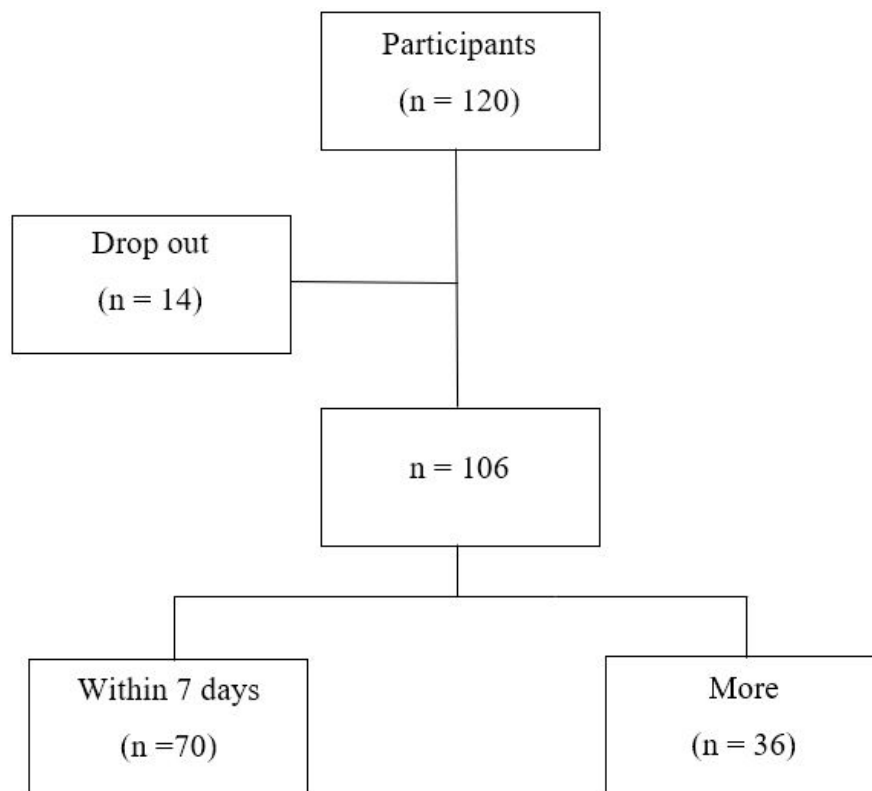


Fig 2. Subject selection and exclusion.

Participants: Term pregnancy who had labor pain, within 7 days: delivery within 7 days from pelvic examination, More: delivery more than 7 days from pelvic examination, Drop out: Term pregnancy who had delivery at other hospitals.

at 25 mm, sensitivity and PPV of Bayramoglu were higher than the present study (75.5/69.5, 90.9/73%, respectively). The discrepancy may be due to differences in patient population. The population in Bayramoglu's study was majority French, whilst this study was conducted on a majority Thai population (with 63% nulliparous cases).

Tolaymat et al.⁹ performed transvaginal ultrasonography to measure CL in 120 pregnant women with singleton and gestations at 37 to 40 weeks to assess the relationship between CL and spontaneous labor within 7 days. Tolaymat suggested CL less than 25 mm that gave sensitivity and PPV of 77.5 and 50.8%, respectively. Our study suggested a cut-off point at the same value as Tolaymat's work (less than 25 mm). The present study had less sensitivity than the Tolaymat's work at of 69.7/77.5 %, while PPV of the present study was higher than Tolaymat's work at of 86.8/50, respectively. The difference was due to differences in patients between the two studies. Three quarters of subjects in Tolaymat's study were of Hispanic race and half of cases were nulliparous women. While this study was conducted in Thai women and all participants had labor pain that increased chances of imminent delivery, compared to pregnant women who had not yet presented with labor pain. The overall prevalence of spontaneous labor within 7 days in Tolaymat's work was low (32.8%) while the present study was 71.6% due to subjects enrolled in this study having presented labor pain prior to the research registration.

In the year 2010, Miura et al reported the CL prediction of labor in Japanese pregnant women. Parity and gestational age of Miura's work were similar to the present study. His work recruited the cases who had no labor pain like Bayramoglu's and Tolaymat's work.^{9,12} Miura's work concluded that CL measurement could predict the spontaneous labor within 7 days. His work supported our study.

Systematic review study by Saccon et al.⁷ assessing the accuracy of TVU CL in the prediction of spontaneous onset of labor in singleton gestations revealed the accuracy of CL for prediction of spontaneous labor within 7 days. Pooled sensitivities and specificities yielded the conclusion that the higher CL had better sensitivity; the lower CL had better specificity. Saccon's work consisted of European cases (90%) who had the same inclusion criteria with this study. All cases in his work had no clinical presentation of labor pain. The present study recruited pregnant women with the same criteria who had clinical labor pain. However, the Saccon's work still supported the present study that CL was an

important factor to predict spontaneous delivery.

Mukherji et al.¹³ conducted the serial ultrasound for CL measurement in pregnant women at GA 36-40 weeks. Mukherji's population consisted of Indian nulliparous pregnant women. His literature concluded that a single CL could not predict spontaneous labor. CL cut of point at GA 38 weeks from transabdominal and transvaginal ultrasonography in Mukherji's study were 35 mm and 31 mm, respectively can predict post-dated pregnancy. Mukherji conducted his investigation in pregnant women who had no labor pain. In the present study, we studied women who had labor pain. Our study showed that single CL measurement in any gestational age of term pregnancy can predict delivery.

Most CL studied in prediction of spontaneous onset of labor were done in term pregnancy with no labor pain.⁹⁻¹² This study was the study that evaluated term pregnancy with labor pain and a wide range of gestational age (37-41+6 weeks). This study suggested a CL value that predicted delivery within 7 days for patients 37+ week gestation with acceptable robustness.

Pregnant population using obstetric service at Bhumibol Adulyadej hospital could be divided into two subgroups, normally local residents and people who work in the area but originated upcountry. The results from our investigation can be used to advise patients for their delivery plan. Those who are discharged from labor rooms were normally concerned about how long would it be before their time to deliver. Women with short CL should be advised to prepare to stay near the hospital or notify their care givers to stand by for future visit to a labor room. A long CL can be advised that the labor might take longer than one week.

Expecting mothers sometimes choose to deliver their offspring in their hometown so as to benefit from family care and support. A few patients had left our unit after their initial reports of labor pain to deliver elsewhere. Our CL cut-off allowed a good prediction of if the baby would be due within 7 days or not. Armed with this certainly, patients can choose if they would stay in Bangkok to deliver or allow them enough time to travel to their hometown destination for the birth.

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