

# Cervical Length Measurement at Term Pregnancy as a Predictor of Time of Onset of Labour and Mode of Delivery: A Longitudinal Study

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## ABSTRACT

**Introduction:** Cervical assessment has moved from digital examination to sonographic evaluation in recent years. Predicting the time of onset of labour and mode of delivery at term is a great concern for both the pregnant woman and her relatives.

**Aim:** To predict the time of onset of labour and mode of delivery by Transvaginal sonographic measurement of cervical length at term.

**Materials and Methods:** This longitudinal study was conducted in the Department of Obstetrics and Gynaecology, SRM Medical College Hospital and Research Centre, Kattankalathur, Tamil Nadu, India, from March 2021 to August 2021. All low-risk singleton pregnancies between 38-40 weeks of gestation were included. Cervical length (in mm) was measured transvaginally by the principal investigator between 38 and 40 weeks. When the labour sets in the duration between cervical length measurement and the onset of labour, duration of labour and mode of delivery were noted. Pearson correlation coefficient was used to quantify the association between cervical length and time of onset of labour and duration of labour.

**Results:** In the study, 164 low-risk patients (143 primigravida patients+21 multigravida patients) between 38-40 weeks were

included. In patients with spontaneous onset of labour, 45 (70.3%) had labour onset within 120 hours (five days) when cervical length was  $\leq 30$  mm, when compared with 7 (22.58%) when cervical length was  $>30$  mm ( $p=0.001$ ). In patients with cervical length  $\leq 30$  mm, vaginal delivery occurred in 47 (73.43%) ( $p=0.019$ ). In women with induced labour with cervical length  $\leq 30$  mm, 13 (61.9%) had labour onset within 120 hours when compared to 15 (30.6%) in women with cervical length  $>30$  mm ( $p=0.02$ ). Vaginal delivery occurred in 5 (29.41%) of women when cervical length was  $\leq 30$  mm compared to 32 (65.30) in women when cervical length  $>30$  mm which may be attributed to other causes. There was a significant positive correlation between cervical length and time of onset of labour (correlation coefficient=0.221,  $p$ -value=0.004). There was a negative correlation between cervical length and duration of labour which was not statistically significant (correlation coefficient=-0.108,  $p=0.25$ ). There was no significant difference in mean cervical length measurement between vaginal delivery and caesarean section.

**Conclusion:** Transvaginal cervical length measurement at term positively correlates with time of onset of labour but not with duration of labour and mode of delivery.

**Keywords:** Cervical assessment, Low risk pregnancies, Spontaneous labour, Transvaginal ultrasound, Vaginal delivery

## INTRODUCTION

Determination of time of onset of labour is a very crucial aspect of antenatal care. Pregnant women especially, those coming from remote areas could plan and get themselves equipped for delivery. During pandemics, this could avoid unnecessary visits of pregnant women to the hospital and prevent unnecessary hospital stays. In addition, obstetricians may be able to manage and make themselves available for delivery. The usual practice for estimating gestational age and expected date of delivery is the combination of the last menstrual period and early ultrasound, but this method is accurate in only 5% [1].

The uterine cervix is a complex heterogeneous organ which undergoes extensive changes throughout pregnancy and labour. Cervical softening and dilatation result from changes in extracellular matrix composition like increased vascularity and stromal and glandular hypertrophy [2]. Both cervical and myometrial preparedness is needed before the onset of spontaneous labour. Usually, cervical ripening occurs prior to myometrial preparation of labour. The most commonly used subjective method for evaluation of the cervix is the Bishop score obtained by digital examination. The components of the scoring system are cervical dilatation, position, effacement, consistency of the cervix, and the station of the foetal head [3]. Though digital examination gives a comprehensive evaluation of

the cervix, it fails in its ability to accurately measure the cervical length. Further, it is more subjective.

Recently, ultrasonography has become an intrinsic part of antenatal care, performing an important role in dating pregnancy and screening for foetal anomalies, diagnosing placenta previa and multiple pregnancies. Transvaginal ultrasound by its proximity to the cervix aids in better assessment of cervical length and makes it an ideal non-invasive modality. Mid-trimester Transvaginal ultrasound measurement of cervical length was also used to predict pregnancies at risk of preterm delivery [4-7].

Cervical assessment has moved from digital examination to sonographic evaluation. Not only for predicting preterm labour but cervical length has also been used to predict the onset of labour in spontaneous labour and labour outcome in induced labour. Tolaymat LL et al., and Giyahi H et al., have shown cervical length measurement at term can predict the spontaneous onset of labour [8,9]. Taha OT et al., in their study found antenatal cervical length measurement predicted both the mode of delivery and gestational age of delivery [10]. Tan PC et al., have shown that both cervical length and Bishop score are predictors of Caesarean delivery following labour induction but tolerability is better with transvaginal ultrasound [11]. There are very few studies evaluating transvaginal ultrasonographic cervical length measurement for predicting the onset of labour in India [12,13]. Among the Indian studies, one

was done in the mid-trimester and the other showed a lot of inter-individual variations in cervical length measurement. The objective of this study was to measure the cervical length by transvaginal sonography at term in low-risk pregnancies in a tertiary care hospital to predict the time of onset of labour, duration of labour and mode of delivery.

## MATERIALS AND METHODS

This longitudinal study was conducted in the Department of Obstetrics and Gynaecology, SRM Medical College Hospital and Research Centre, Kattankalathur, Tamil Nadu, India, from March 2021 to August 2021. The study was approved by the Institutional Ethical Committee and the procedures were followed in accordance with the institutional ethical standards (SRM IEC: 2182/2020).

**Inclusion criteria:** All low-risk singleton pregnancies with cephalic presentation between 38-40 weeks of gestation, who were willing to participate in the study were included after informed consent.

**Exclusion criteria:** Antenatal women with foetal growth restriction, medical disorders complicating pregnancy like hypertension, gestational diabetes mellitus on insulin, and pre-gestational diabetes were excluded. Patients with previous surgical procedures on the cervix, patients with contraindications for vaginal birth like malpresentation and placenta previa, post-caesarean pregnancy and patients in active labour were also excluded.

**Sample size calculation:** Sample size was calculated using this formula:

$$n = (Z_{1-\alpha/2})^2 \sigma^2 / d^2$$

$$Z_{1-\alpha/2} = 1.96 \text{ at a 95\% confidence level}$$

Estimated standard deviation  $\sigma=8$ ,  $d=1.25$  acceptable margin of error [10]:

$$n=158$$

## Study Procedure

Patients were recruited by convenient sampling. At the time of recruitment, demographic data including age, parity, and gestational age at recruitment were noted. Cervical length (in mm) was measured transvaginally in an empty bladder in a dorsal lithotomy position using a transvaginal probe (7-9 megahertz) by the principal investigator between 38 and 40 weeks. The ultrasound probe was positioned in the anterior fornix of the vagina and withdrawn till an appropriate sagittal view of the cervix was attained. An image for the measurement of cervical length was considered acceptable if visualisation of the internal os, external os and endocervical canal was noted. An average of three values was taken for analysis.

After measuring cervical length by ultrasound, patient was followed-up as per standard protocol every week. In case of labour pains, antenatal women were asked to attend the labour casualty ward. At the time of admission, the gestational age at the onset of labour and the time of onset of labour from cervical length measurement were noted in hours. Duration of labour and mode of delivery were noted. The above parameters were also noted for patients who required induction of labour. The latent phase of labour was taken from the onset of labour pains to 4 cm dilatation and the active phase from 4 cm to full dilatation of the cervix. Second stage of labour was from full dilatation of the cervix to delivery of the foetus. The total duration of labour from the onset of labour pains to full dilatation of the cervix was also noted.

## STATISTICAL ANALYSIS

Data were analysed and statistically evaluated using Statistical Package for Social Sciences (SPSS) version 20.0. Categorical variables was analysed by Chi-square test while student t-test was applied to the continuous variable. The p-value of  $\leq 0.05$  was considered as significant. Pearson correlation coefficient was used

to quantify the association between cervical length and time of onset of labour and duration of labour.

## RESULTS

In the study, 164 low-risk patients between 38-40 weeks were included. Among them 143 (87.1%) were primigravida. There was no significant difference in cervical length between primigravida and multigravida. A total of 74 patients amongst 143 Primigravida (51.74%) had spontaneous onset of labour and 19 patients amongst 21 multigravida (90.47%) had spontaneous onset of labour [Table/Fig-1].

Parameters	Primigravida (143)	Multigravida (21)	p-value
Age (years) (mean $\pm$ SD)	27.19 $\pm$ 3.326	25.20 $\pm$ 3.172	<b>0.016</b>
Period of gestation at recruitment (days) (mean $\pm$ SD)	270.92 $\pm$ 3.72	267.67 $\pm$ 1.983	<b>0.004</b>
Mean cervical length (mm)	28.83 $\pm$ 10.053	27.76 $\pm$ 8.258	0.645
<b>Labour onset</b>			
Spontaneous labour	74 (51.7%)	19 (90.47%)	<b>0.001<sup>y</sup></b>
Induced labour	69 (48.3%)	02 (9.53%)	
Time of onset of labour from cervical length measurement (hours, mean $\pm$ SD)	147.44 $\pm$ 104.716	105.14 $\pm$ 67.233	0.120
Total duration of labour (minutes, mean $\pm$ SD)	722.27 $\pm$ 277.404	503.16 $\pm$ 249.478	<b>0.002</b>
Duration of labour (minutes, mean $\pm$ SD)-Active phase	135.62 $\pm$ 115.115	131.43 $\pm$ 111.973	0.772
<b>Mode of labour</b>			
Vaginal delivery	92 (64.33%)	19 (90.47%)	<b>0.022<sup>y</sup></b>
Caesarean section	51 (35.66%)	2 (9.53%)	

**[Table/Fig-1]:** Comparison of labour characteristics between primigravida and multigravida.  
<sup>y</sup>Chi-square test was used. Student t-test was used

Among 86 patients with cervical length  $\leq 30$  mm, 64 (68.8%) had spontaneous labour and 22 (30.9%) had induced labour [Table/Fig-2].

In patients with spontaneous onset of labour, when the cervical length was  $\leq 30$  mm, 45 (70.3%) had labour onset within 120 hours (five days) in contrast to 7 (22.58%) of women with cervical length  $>30$  mm ( $p=0.001$ ). Vaginal delivery occurred in 47 (73.43%) of pregnant women with cervical length  $\leq 30$  mm and 27 (93.10%) in women with cervical length  $>30$  mm [Table/Fig-3].

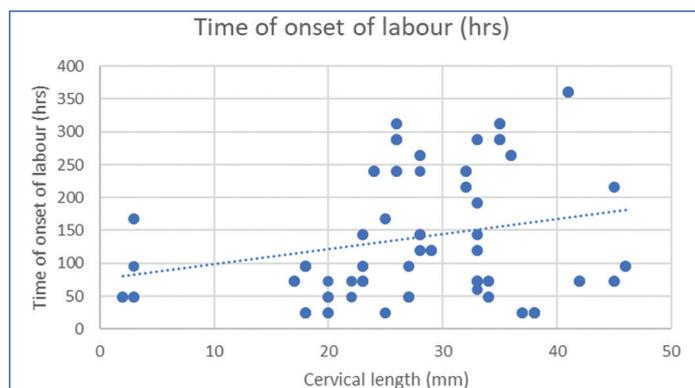
Cervical length (mm)	Spontaneous labour (N=93)	Induced labour (N=71)
$\leq 30$ mm (N=86)	64 (68.8%)	22 (30.9%)
$>30$ mm (N=78)	29 (31.2%)	49 (69.1%)

**[Table/Fig-2]:** Comparison of cervical length between spontaneous and induced labour.

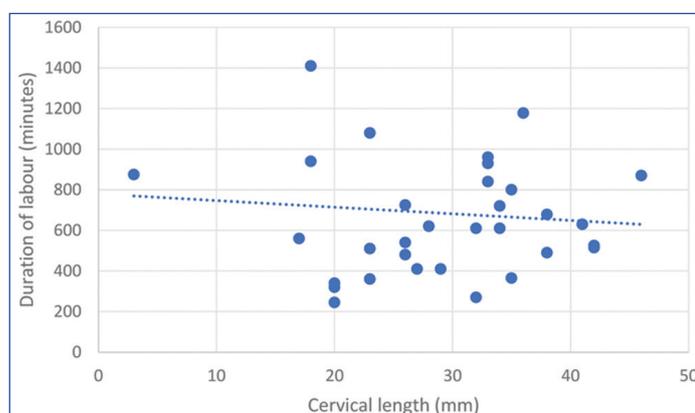
Cervical length (mm)	Onset of labour (<120 hours)	Onset of labour (>120 hours)	p-value
<b>Spontaneous labour (n=93)</b>			
$\leq 30$ mm (N=64)	45 (70.3%)	19 (29.7%)	<b>0.001</b>
$> 30$ mm (N=29)	7 (24.13%)	22 (75.86%)	
<b>Induced labour (n=71)</b>			
$\leq 30$ mm (N=22)	13 (61.9%)	9 (38.1%)	<b>0.02</b>
$> 30$ mm (N=49)	15 (30.61%)	34 (69.39%)	
Cervical length (mm)	Vaginal delivery	Caesarean delivery	p-value
<b>Spontaneous labour (n=93)</b>			
$\leq 30$ mm (64)	47(73.4%)	17 (26.6%)	<b>0.019</b>
$> 30$ mm (29)	27 (93.1%)	2 (6.9%)	
<b>Induced labour (n=71)</b>			
$\leq 30$ mm (22)	5 (29.41%)	17 (77.27%)	<b>0.001</b>
$> 30$ mm (49)	32 (65.3%)	17 (34.7%)	

**[Table/Fig-3]:** Comparison of cervical length with time of onset of labour and mode of delivery in spontaneous and induced labour.  
 Chi-square test was used

Positive correlation was observed between cervical length and time of onset of labour. Correlation coefficient=0.221, 95% CI 0.0704-0.362, p-value=0.004 [Table/Fig-4]. Negative correlation was observed between cervical length and total duration of labour. Correlation coefficient=-0.108, 95% CI -0.289-0.0797, p-value=0.258 [Table/Fig-5].

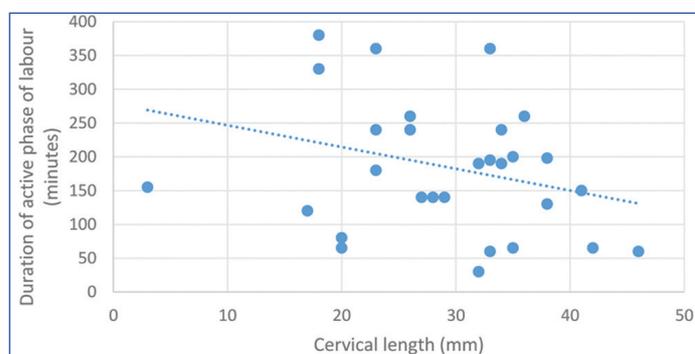


**[Table/Fig-4]:** Correlation between cervical length and time of onset of labour in spontaneous labour.



**[Table/Fig-5]:** Correlation between cervical length and duration of labour in vaginal delivery patients.

The duration of active phase of labour was also found to be negatively correlated with cervical length measured between 38-40 weeks significantly. Correlation coefficient=-0.312, 95% CI -0.471-0.133, p-value=0.0008 [Table/Fig-6]. In spontaneous labour, mean cervical length measurement was 27.06±7.19 mm in vaginal delivery compared to 27.21±7.64 mm in caesarean section. In induced labour, mean cervical length measurement was 36.06±5.63 mm in vaginal delivery compared to 30.79±7.22 mm in caesarean section. There was no significant difference in mean cervical length measurement between vaginal and caesarean delivery.



**[Table/Fig-6]:** Correlation between cervical length and duration of active phase of labour in vaginal delivery patients.

## DISCUSSION

In the present study, 164 low-risk patients between 38-40 weeks were included. Among them 87.1% were primigravida and 12.9% were multigravida. There was no significant difference in cervical length measurement at term between primigravida and multigravida.

In a study by Taha OT et al., induction of labour was required for about one-third of patients (45.45% nulliparous and 31.25% multiparous women) [10]. In this study among primigravida, 51.74% had spontaneous onset of labour and 90.4% of multigravida had spontaneous onset of labour. Giyahi H et al., have shown a statistically significant linear relationship between cervical length measurement by ultrasound and the onset of spontaneous labour (r=0.333, p<0.001) [9]. In the present study, there was a significant positive correlation between cervical length and time of onset of labour.

Bayramoglu O et al., by weekly serial measurement of cervical length reported that cervical length could predict the spontaneous onset of labour within seven days. The optimum cut-off values for expecting the onset of spontaneous labour within seven days in their study were 29.5 mm at 37 weeks, 27.5 mm at 38 weeks, 25.5 mm at 39 weeks and 24.5 mm at 40 weeks of gestation [14]. In this study, 70.3% of patients with cervical length ≤30 mm went into spontaneous labour within 120 hours (five days) and only 22.58% of patients with cervical length >30 mm went into spontaneous labour within 120 hours.

A study by Lehner G et al., showed no correlation between the cervical length and the duration of labour [15]. In the present study, there was a negative correlation between cervical length and total duration of labour which was not found significant. Probably, this may be due to other factors influencing duration of labour such as parity, the position of the foetal head, size of the baby and strength of uterine contractions. Further cervical length may not influence cervical dilatation.

In the study by Taha OT et al, in patients with shorter cervical length (CL <28 mm), 85.3% delivered vaginally (p=0.03) [10]. Various other studies have also shown that the cervical length measurement at term was highly predictive of vaginal birth [16,17]. But, Giyahi H et al., has reported that cervical length could not predict the mode of delivery both in univariate or multivariate analysis [9]. A study by de Vries B et al., have shown that cervical length measurement by ultrasound at 37 weeks of gestation was associated with subsequent caesarean section after adjusting for maternal age, height, pre-pregnancy Body Mass Index (BMI), parity, neonatal sex and birthweight centile [18].

In the present study, also in women with spontaneous labour onset, when the cervical length was ≤30 mm, vaginal delivery occurred in 73.43% and caesarean delivery in 26.6%. In women with cervical length >30 mm, 93.10% delivered vaginally and 6.9% delivered by caesarean section. Vaginal delivery is more in women with cervical length >30 mm probably due to cervical changes which would have occurred after a period of recruitment. In patients with induced labour, when the cervical length was ≤30 mm, vaginal delivery occurred in 29.41% and caesarean delivery in 70.59%. When the cervical length was >30 mm, 65.30% were delivered by vaginal delivery and 34.7% were delivered by caesarean section. In induced labour there was no association between cervical length and mode of delivery. Probably the mode of delivery in induced labour depends upon other factors other than cervical length such as indications for induction, the number of doses of inducing agent, pre-pregnancy BMI, parity, foetal position and foetal wellbeing. Beloosesky R et al., have shown a significant correlation between the mode of delivery and cervical length, Bishop score and previous obstetrical history [Table/Fig-7] [9,10,12,14-16,19-21].

Author	Inference
Giyahi H et al., [9]	Measurement of cervical length at 37 weeks could predict the onset of spontaneous labour, but it failed to predict the mode of delivery.
Taha OT et al., [10]	In patients with shorter cervical length (CL <28 mm), 85.3% delivered vaginally (p=0.03).
Mukherji J et al., [12]	Poor correlation between gestational age at delivery and the last measured CL, either by TVS or TAS.

Bayramoglu O et al., [14]	Weekly serial measurement of cervical length could predict spontaneous onset of labour within 7 days.
Lehner G et al., [15]	No correlation between the cervical length and the duration of labour.
Beloosesky R et al., [16]	CL measurement after 36 weeks has a high predictive accuracy for a successful vaginal birth after cesarean.
Anikwe CC et al., [19]	Transvaginal sonographic measurement of cervical length provides a useful prediction of the likelihood of duration of labour following the induction of labour.
Parmar SK et al., [20]	Measurement of CL at term can be used to determine the likelihood of prolonged pregnancy and the risk of emergency CS for failure to progress or failed induction of labour.
Li PC et al., [21]	Shorter cervical length ( $\leq 3.415$ cm) was associated with a higher chance of successful labour induction (76.8%).
Present study	Transvaginal Cervical length measurement at term positively correlates with time of onset of labour but not with duration of labour. In women with spontaneous labour onset with cervical length $\leq 30$ mm 73.43% delivered vaginally. In induced labour in women with cervical length $\leq 30$ mm 29.41% delivered vaginally.

**[Table/Fig-7]:** Comparison with other studies [9,10,12,14-16,19-21].

TAS: Trans-abdominal sonography; TVS: Trans-vaginal sonography

The strengths of this study are that the same machine was used and the same obstetrician trained in obstetric scan measured the cervical length for all patients eliminating inter-examiner variability.

### Limitation(s)

Single measurement of cervical length and failure to include pre-pregnancy BMI, indication of induction, method of induction and foetal position which will influence the outcome in induced patients.

### CONCLUSION(S)

Transvaginal cervical length measurement at term positively correlates with the time of onset of labour but not with duration of labour and mode of delivery. Cervical length measurement by ultrasound at term can be incorporated in routine practice so that, the authors can counsel the patients about appropriate time of admission especially for low-risk patients coming from faraway place.

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