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CERVICAL LENGTH IN MID PREGNANCY AND LABOUR OUTCOME IN A TERTIARY CARE CENTRE

Obstetrics & Gynaecology

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ABSTRACT

Introduction: CL has been tested for its role in predicting PTB and post- dated pregnancies for over 20 years. It is a simple, easily accessible and non-invasive tool. Since PTB, prolonged pregnancies and CDs are associated with raised perinatal mortality and morbidity, their early prediction may help in improving their management and outcome.**Aims and Objectives:** In the current hospital- based prospective observational study, the relationship between CL in mid- pregnancy and labour outcome was studied. The objective was to determine the relationship between CL at mid- pregnancy and GA at delivery, Onset of labour, Mode of delivery and Caesarean section due to failed induction. And estimate the mean CL at mid- pregnancy in the study population.**Methods:** 109 pregnant women attending antenatal checkups from 18- 24 weeks of GA were included in the final analysis of the study after exclusion. A purposive sampling technique was used to select study participants from those who fulfil the selection criteria.**Results:** Among 109 primigravidas, mean age was 24.07 ± 3.566 years and mean GA at which their CL was measured was 20.87 ± 1.454 weeks. The mean CL was 3.66 ± 0.419 cm. 8.3% subjects had preterm labour, 22% had post- dated pregnancy, 71.6% subjects had spontaneous onset of labour, 41.3% subjects underwent CD and 22% subjects had CD due to failed induction. Maternal CL was found to be statistically significantly associated with all the labour outcomes (all the p values < 0.05). Women with shorter CL in mid- pregnancy were at a higher risk of preterm labour. By using Receiver Operator Characteristic curve, CL measurement predicts preterm labour, post- dated pregnancy, failure of spontaneous onset of labour, caesarean delivery.**Conclusion:** Maternal CL measurement by TVS in mid- pregnancy can be potentially used as an easy, simple and feasible predictive tool to establish the possibility of occurrence of PTBs and other labour outcomes like GA at delivery, mode of delivery, onset of labour. Our outcome indicates that screening of antenatal women for short CL helps in recognizing asymptomatic women who are at risk of adverse labour outcome.

KEYWORDS

Cervical Length, TVS Measurement, Mid- Pregnancy, Labour Outcome

INTRODUCTION

Normal parturition at term is dependent on the programmed development of the cervix early in pregnancy. Weeks prior to the onset of labour, the cervix undergoes preparative changes. A shorter mid-trimester cervical length (CL) is associated with a higher risk of having a spontaneous preterm birth (PTB).[1] High perinatal death and morbidity rates are correlated with PTB, which by itself is a significant issue. Because of problems like necrotizing enterocolitis, intraventricular haemorrhage, respiratory distress syndrome, and neurological impairment, PTB continues to be the leading cause of infant morbidity and death.[2]

PTB can be predicted by many factors like CL, foetal fibronectin, cortisol levels, placental hormone levels, and non- invasive electromyography.[3–4] The best approach to predict spontaneous PTB is the transvaginal sonographic (TVS) evaluation of CL.[5] TVS CL measurement is an easily reproducible measurement that can objectively assess the supravaginal portion of the cervix and can be utilized even if the cervix is closed and causes less discomfort. TVS can also be used to assess cervical funneling and posterior cervical angle that can predict induction outcomes. TVS can also provide pictorial evidence of measured CL that can be documented for future reference.

An increase in the mid- trimester CL is related to a higher risk of prolonged pregnancies, failure of spontaneous onset of labour and caesarean delivery (CD) during labour.[1] Rates of CDs have increased recently worldwide. Poor labour progress plays a key factor in primary CDs at term.[6]

In post- dated pregnancies, there may be additional risks for fetal macrosomia, oligohydramnios, increased risk of meconium- stained liquor and operative intervention. Many factors that lead to poor progress in labour have been acknowledged like increasing maternal age, higher body mass index (BMI) and prolonged pregnancy. Biological mechanisms leading to poor labour progress are however to be completely understood.[7]

Predictive measures of post- dated pregnancy include CL measurement by ultrasonography and measurement of fetal fibronectin, cytokine and nitric oxide concentration in cervicovaginal secretions.[8] According to several researches TVS measurements of CL can help establish if a primigravida will have a prolonged pregnancy.[9–10] Furthermore, it was noticed that there is a correlation between CL at mid- pregnancy and CD due to non- progress of labour at term.

CL has been tested for its role in predicting PTB for over 20 years. It is a simple, easily accessible and non- invasive tool. Since PTB, prolonged pregnancies and CDs are associated with raised perinatal mortality and morbidity, their early prediction may help improve their management and outcome.[1]

AIM AND OBJECTIVES OF THE STUDY

Aim: To study the relationship between cervical length in mid-pregnancy and labour outcome.

Objectives:

1. To determine the relationship between cervical length at mid-pregnancy and
   i. Gestational age at delivery
   ii. Onset of labour
   iii. Mode of delivery
   iv. Caesarean section due to failed induction

2. To estimate the mean cervical length at mid-pregnancy in the study population

MATERIALS AND METHODS

Study Design: The current study was a hospital- based prospective observational study.

Study Setting: The current study was conducted in the Out- Patient Department of Obstetrics and Gynaecology, A.J. Institute of Medical Sciences and Research Centre (AJIMS&RC), Mangalore after obtaining ethical clearance.

Study Period: The current study was carried out for a duration of 18 months from July 2022 to December 2023

Study Population: The study population comprised of Primigravidas attending antenatal checkups from 18 - 24 weeks of GA at A.J. Institute of Medical Sciences and Research Centre (AJIMS&RC), Mangalore.

Sampling Technique: A purposive sampling technique was used to select a sample of study participants from those who fulfil the selection criteria among Primigravidas attending antenatal checkups from 18 to 24 weeks of GA.

Inclusion Criteria
- Primigravidas aged above 18 years with a singleton pregnancy between 18 and 24 weeks attending the antenatal check ups
- Low risk pregnancies with no co- morbidities
- Pregnant women with no prior history of cervical surgery

Exclusion Criteria
- Multiple pregnancy
- Polyhydramnios
- Pregnancies with Hemoglobin < 8 gm%
- Pregnancies with fetal anomalies
- short statured women or women with skeletal abnormalities
- primigravidas with wrong dates

Method of Collection of Data:
- After obtaining clearance from institutional ethics committee, informed written consent was obtained.
- Primigravidas from 18 to 24 weeks of GA who fulfilled both inclusion and exclusion criteria were recruited for the study.
- Clinical variables: A questionnaire was used to obtain information regarding the identity, hospital outpatient number, age, marital status, education, maternal weight, maternal height, maternal body mass index, and medical complications and were recorded.
- Cervical length at 18- 24 weeks was measured by transvaginal sonography.
- Patients were followed up till delivery and labour outcome was noted.
- Total 121 pregnant women were included initially but along the course of the study, 12 subjects were excluded due the co-morbidities that they developed along the course of their pregnancy and thus 109 were included in the final analysis.

Cervical Length Measurement Protocol: Standard cervical length measurement protocols were followed while measuring the cervical length.[31] The women were examined with the empty bladder in a dorsal position. The external os, internal os, cervical canal and endocervical mucosa were all identified. To define the site of internal os, endocervical mucosa was used. The image was then magnified so that the cervix occupies approximately 50-75% of the image. The distance from the internal to the external os was measured. If the cervix is curved/ angulated, the curved length of the cervix is measured to eliminate false cervical shortening. To eliminate interobserver variation while measuring the cervical length a specific radiologist was assigned for this study- i.e., all the scans in the current study were done by a single observer. 3 measurements were then taken over 3 minutes to observe any dynamic changes in the cervix and the mean of these three measurements was considered. The presence of funneling and diameter of internal os was noted.

Statistical Analysis:
The data that was collected was entered into an MS Excel sheet and analysis was done using Statistical Package for Social Sciences software version 18. Descriptive statistics were employed to summarize quantitative variables of clinical data. Standard deviation was calculated as a measure of variation. Qualitative variables were expressed as percentages with 95% CI. Independent t test was used to compare the mean values between two groups The chi- square test was used to compare and test the significant difference in labour outcomes such as cesarean section, preterm delivery, post- term delivery etc. with the cervical length. The level of significance [P- Value] was set at $P < 0.05$

RESULTS
The study included 109 participants after fulfilling inclusion and exclusion criteria. The participants were in the age range of 19-35 years with mean age of 24.07 ± 3.566 years. The majority were aged between 20 - 24 years (55%). In majority of the study participants i.e, 55 participants cervical length was measured at 20-21 weeks of gestation, in 25 participants cervical length was measured at 18-19 weeks of gestation, and in the rest 29 participants cervical length was measured at 22-24 weeks of gestation. The mean gestational age of the pregnant women at which their cervical length was measured was 20.87 ± 1.454 weeks. Majority of participants i.e, 63.3% had a BMI of ≤ 22.9 kg/m². The mean BMI of the pregnant women was 22.60 ± 2.699 kg/m².

Table 1 shows the baseline characteristics of the study participants. The least and maximum cervical length in the study population was noted to be 2.6cm and 4.3cm respectively. The mean cervical length in the study population was 3.66 ± 0.419 cm. Majority of the subjects had cervical length between 3.1 and 4 cm (69 subjects). 30 subjects had cervical length >4 cm and the rest 10 subjects had cervical length ≤ 3 cm.

Table 1: Baseline characteristics of study participants (N=109)

Characteristic	Value
Mean age (years)	24.07 ± 3.566
Age groups, n (%)	
≤ 19 years	2 (1.8%)
20 – 24 years	60 (55%)
25 – 29 years	39 (35.8%)
≥ 30 years	8 (7.4%)
Mean GA at CL measurement (weeks)	20.87 ± 1.454
Mean BMI (kg/m²)	22.60 ± 2.699
Mean cervical length (cm)	3.66 ± 0.419
Cervical length groups, n (%)	
≤ 3 cm	10 (9.2%)
3.1 – 4 cm	69 (63.3%)
> 4 cm	30 (27.5%)

Table 2 presents the distribution of labour outcomes among the study subjects. 9 subjects (8.3%) had preterm labour, 24 subjects (22%) had post-dated pregnancy, 78 subjects (71.6%) had spontaneous onset of labour, 64 subjects (41.3%) had caesarean section and 24 subjects (22%) had caesarean section due to failed induction. Among the 31 induced patients, 7 had vaginal delivery and 24 had caesarean section. Among the 64 caesarean deliveries, the majority were due to failed induction of labour (24 subjects, 37.5%), followed by fetal distress (15 subjects, 23.4%), CPD (11 subjects, 17.2%), meconium stained liquor (10 subjects, 15.6%) and breech presentation (4 subjects, 6.3%).

Table 2: Labour outcomes of study participants (N=109)

Labour outcome	n (%)
Gestational age at delivery	
< 37 weeks (preterm)	9 (8.3%)
37 – 40 weeks	76 (69.7%)
> 40 weeks (post-dated)	24 (22%)
Onset of labour	
Spontaneous	78 (71.6%)
Induced	31 (28.4%)
Mode of delivery	
Vaginal delivery	45 (58.7%)
Caesarean delivery	64 (41.3%)
Caesarean section due to failed induction	24 (22%)

Maternal age was not found to be associated with any of the labour outcomes (all p values >0.05). Maternal BMI was not associated with any of the labour outcomes (all p values >0.05).

Association of cervical length with labour outcomes
Maternal cervical length was found to be statistically significantly associated with all of the labour outcomes (all p values < 0.05). Table 3 shows the comparison of mean cervical length between groups for each labour outcome.

The mean cervical length in mid-pregnancy among those who had preterm labour (3.27 ± 0.500 cm) was found to be statistically significantly lesser than the mean cervical length among the women who did not have preterm labour (3.69 ± 0.395 cm) (p = 0.003). The mean cervical length among women who had post-dated pregnancy (3.88 ± 0.314 cm) was significantly higher than among women who had term pregnancy (3.60 ± 0.426 cm) (p = 0.004). The mean cervical length among women who had spontaneous onset of labour (3.51 ± 0.374 cm) was significantly lesser than among women who had induced labour (4.03 ± 0.269 cm) (p = 0.028). The mean cervical length among women who had a caesarean delivery (3.74 ± 0.293 cm) was significantly higher than among women who had a vaginal delivery (3.54 ± 0.531 cm) (p < 0.001). The mean cervical length among those who had caesarean delivery due to failed induction (3.82 ± 0.305 cm) was significantly higher than among those who did not (3.61 ± 0.436

cm) (p = 0.012).

Table 3: Association of maternal cervical length in mid-pregnancy with labour outcomes (Independent samples t-test)

Labour outcome	Mean CL in "Yes" group (cm)	Mean CL in "No" group (cm)	p-value
Preterm labour	3.27 ± 0.500	3.69 ± 0.395	0.003
Post-dated pregnancy	3.88 ± 0.314	3.60 ± 0.426	0.004
Spontaneous onset of labour	3.51 ± 0.374	4.03 ± 0.269	0.028
Caesarean delivery	3.74 ± 0.293	3.54 ± 0.531	< 0.001
Caesarean section due to failed induction	3.82 ± 0.305	3.61 ± 0.436	0.012

Table 4 demonstrates the association of cervical length categories with preterm labour. In the study participants with cervical length ≤ 3 cm, 30% had preterm labour; in those with cervical length 3.1-4 cm, 8.6% had preterm labour; and none of those with cervical length >4 cm had preterm labour. Maternal cervical length was found to be statistically significantly associated with preterm labour (p = 0.011).

Table 4: Association of maternal cervical length with preterm labour (Chi-square test)

Cervical length	Preterm labour (Yes) n (%)	Preterm labour (No) n (%)	p- value
≤ 3 cm	3 (33.3%)	7 (7%)	0.011
3.1 – 4 cm	6 (66.7%)	63 (63%)	
> 4 cm	0 (0%)	30 (30%)	

Regarding post-dated pregnancy, none of the study participants with cervical length ≤ 3 cm had post-dated pregnancy; in those with CL between 3.1-4 cm, 17% had post-dated pregnancy; and 40% with CL >4 cm had post-dated pregnancy. This association was statistically significant (p = 0.009).

All the study participants (100%) with cervical length ≤ 3 cm went into labour spontaneously; in those with CL 3.1-4 cm, 87% had spontaneous onset; and only 27% with CL >4 cm had spontaneous onset of labour. The association was statistically significant (p < 0.001).

None of the study participants with cervical length ≤ 3 cm underwent caesarean delivery; in those with CL 3.1-4 cm, 67% underwent caesarean delivery; and 60% with CL >4 cm underwent caesarean delivery. This association was statistically significant (p < 0.001). For caesarean section due to failed induction, none with CL ≤ 3 cm underwent the procedure; 22% with CL 3.1-4 cm and 30% with CL >4 cm underwent caesarean due to failed induction (p = 0.039).

Predictive ability of cervical length

Figure 1 shows the Receiver Operator Characteristic (ROC) curves for predicting various labour outcomes using mid-pregnancy cervical length measurement. For preterm labour, the Area under the ROC curve (AUC) was 0.267. Using the ROC curve, cervical length < 3.2 cm (optimum cut-off criterion) predicts preterm labour with a sensitivity of 66.7% and specificity of 87.0%. For post-dated pregnancy, the AUC was 0.754, and cervical length > 3.8 cm predicts post-dated pregnancy with a sensitivity of 50.0% and specificity of 31.8%. For onset of labour, the AUC was 0.121, and cervical length > 3.5 cm predicts failure of spontaneous onset of labour with a sensitivity of 71.8% and specificity of 100%. For mode of delivery, the AUC was 0.423, and cervical length > 3.7 cm predicts caesarean delivery with a sensitivity of 40.0% and specificity of 42.2%.

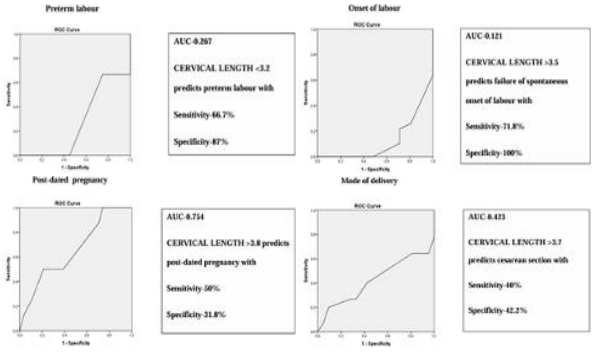

Figure 1: Receiver Operator Characteristic curves showing diagnostic ability of maternal cervical length in mid-pregnancy for predicting labour outcomes

DISCUSSION

Assessment of mid- pregnancy maternal cervical length has been evaluated broadly in the past decade.[34–35] The association between maternal cervical length and labour or obstetric outcome was evaluated by the measurement of the CL of different maternal groups using diverse techniques and methodologies. Maternal cervical length measurement can be applied in early trimesters for prevention of PTBs, and also in mid and late trimesters in predicting the PTBs and other labour outcomes like gestational age at delivery, mode of delivery, onset of labour and caesarean section due to failed induction.[36]

The findings of the current study are similar to those of Usha Rani et al.,[1] who demonstrated that the lower the CL, the higher is risk of PTB, and an increase in CL at mid-trimester is associated with increase in the incidence of post-term pregnancy, failure of spontaneous onset of labour and CD due to failed induction. Jabacsnick Sharmila et al.[7] also reported that a short cervix between 2.1 and 3.0 cm measured at 20 - 24 weeks GA is significantly associated with PTB and a long CL of >4.0 cm is significantly associated with post- dated delivery. Gordon C.S. Smith et al.[30] concluded that the cervical length at mid-pregnancy is a self-determining predictor of the risk of CD at term in primiparous women.

In the present study, the mean cervical length was 3.66 ± 0.419 cm, which is comparable to Usha Rani et al.[1] (mean 3.632 cm) and Jabacsnick sharmila et al.[7] (majority 3.1-4.0 cm). The rates of preterm labour (8.3%), post-dated pregnancy (22%), spontaneous onset of labour (71.6%), and CD (41.3%) in this study align closely with the findings of Usha Rani et al.[1] (6%, 20.8%, 69.2%, and 55% respectively).

The Receiver Operator Characteristic curve analysis in our study showed that a cervical length < 3.2 cm predicts preterm labour with 66.7% sensitivity and 87.0% specificity, which is consistent with Usha Rani et al.[1] who reported 56.7% sensitivity and 78.9% specificity for the same cutoff. The predictive value of CL for post-dated pregnancy and CD due to failed induction in our study further supports the use of mid-pregnancy CL measurement as a routine screening tool.

CONCLUSION

Maternal cervical length measurement by transvaginal ultrasonography at mid- pregnancy can be potentially used as an easy, simple and feasible predictive tool to establish the possibility of occurrence of PTBs and other labour outcomes like gestational age at delivery, mode of delivery, the onset of labour and caesarean section due to failed induction. Our outcome indicates that screening antenatal women for short cervical length helps in recognizing asymptomatic women who are at risk of adverse labour outcomes. Hence, identification of pregnant women with a high risk of adverse labour outcomes can be made more practical and easy by transvaginal measurement of cervical length in mid- pregnancy. As ultrasound machines are extensively available in almost every antenatal clinic, Transvaginal ultrasonography can be easily implemented in clinical obstetric practice.

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