



ASSOCIATION BETWEEN CERVICAL LENGTH AND GESTATIONAL AGE AT BIRTH IN SINGLETON PREGNANCIES

Obstetrics & Gynaecology

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ABSTRACT

Background: Cervical length is a critical predictor of preterm birth, with shorter lengths indicating higher risks. This study aims to explore the association between cervical length (CL) measured in the second trimester of pregnancy and the gestational age at birth in Indian women with singleton pregnancies. Utilizing a sample size of 300 antenatal patients attending the outpatient department (OPD) of GCS Hospital, Ahmedabad Materials and Methods: A cohort of 300 singleton pregnant women in their second trimester was recruited from GCS Hospital's OPD from 01/05/23 to 30/04/24. CL was measured using transvaginal ultrasound (TVU), with a cutoff point of ≤ 25 mm used to identify women at risk of preterm birth (PTB). The study observes the outcomes of gestational age at birth, comparing them with the mid-pregnancy cervical length (CL) measurements. **Results: Conclusion:** The study reaffirms the importance of CL measurement in the second trimester for predicting gestational age at birth. It also highlights the need for tailored interventions in the Indian healthcare setting to prevent preterm birth (PTB).

KEYWORDS

Cervical Length, Gestational Age, Singleton Pregnancy, Second Trimester, Preterm Birth, Indian Women

Introduction

Prematurity, defined as birth before 37 weeks of gestation, is a leading cause of neonatal morbidity and mortality worldwide, presenting significant emotional and economic challenges. [1] The World Health Organization reports a global preterm birth (PTB) rate of 10.6%, with some regions experiencing higher rates. [2] In India, for instance, the PTB rate is 13%, surpassing global averages. [3]

Cervical length (CL), as measured during the second trimester of pregnancy, has emerged as a crucial predictor of preterm birth (PTB). A short CL is particularly associated with an increased risk of PTB. [1] This association has been substantiated by various studies, which have demonstrated an inverse relationship between mid-gestation sonographically measured CL and gestational age at birth in singleton pregnancies. [4]

A multicentric prospective cohort study conducted in the Brazilian population aimed to further elucidate this relationship. The study involved 3139 singleton pregnant women who underwent transvaginal ultrasound to measure CL between 18 to 22 weeks of gestation. The findings revealed a negative association between CL and PTB, with CL ≤ 25 mm being associated with PTB < 28 , < 34 , and < 37 weeks. Conversely, a CL of 25–30 mm was directly associated with late PTB. [1] The study's results underscore the prognostic effectiveness of CL measurement, with an area under the receiver operating characteristic curve (AUC) of 0.82 for predicting severe PTB < 28 weeks and 0.67 for PTB < 34 weeks. [1]

These findings have significant clinical implications, suggesting that CL measured by transvaginal ultrasound should be utilized to predict PTB < 34 weeks. Women with a CL ≤ 30 mm are at an increased risk for late PTB, highlighting the potential benefits of targeted interventions such as progesterone prophylaxis. [1]

This introduction provides a concise overview of the topic, emphasizing the significance of the study and its potential impact on clinical practices. The references cited offer a foundation for further exploration of the subject matter.

MATERIALS AND METHODS

Study Design and Setting This observational cohort study was conducted at the GCS Hospital, Ahmedabad. The study period spanned from May 2023 to April 2024.

Participants The study included pregnant women with singleton gestations who presented for routine antenatal care between 18 to 22 weeks of gestation.

INCLUSION CRITERIA:

- age 18-40 years
- singleton pregnancy
- gestational age confirmed by first-trimester ultrasound.

EXCLUSION CRITERIA:

- known fetal anomalies
- history of cervical surgery
- comorbidities
- history of previous preterm birth
- multiple gestations.

Ethical approval was obtained from the institutional review board, and informed consent was obtained from all participants.

Sample Size Calculation The sample size was calculated based on the preterm birth rate in India, aiming for a confidence level of 95% and a margin of error of 5%. [3]

$$n = [Z^2 * p(1-p)] / e^2$$

Where:

- n is the sample size
- Z is the Z-score corresponding to the desired confidence level (for 95%, $Z \approx 1.96$)
- p is the estimated prevalence (proportion) of the condition (in this case, 50% or 0.5) Here I took p as 13%
- E is the margin of error (in this case, 5% or 0.05)

So, $n = 173.79 \approx 174$. I took almost double of this 300 as my sample size.

Cervical Length Measurement Briefly, after consent, with the woman in dorsal lithotomy position and empty bladder, a TVU probe was introduced inside the vagina until the anterior fornix avoiding pressure. A sagittal view of the cervix, including the edge, identified the internal and external os. Calipers were used to measure the linear distance (in mm) between the external and internal os.

DATA COLLECTION

Data were collected prospectively, including maternal age, parity and cervical length measurements. Gestational age at birth was recorded, and preterm birth was defined as delivery before 37 completed weeks of gestation.

We excluded women who were in exclusion criteria and those with incomplete gestational outcome data. The outcomes were term baby at ≥ 37 weeks' gestation, preterm birth at < 37 and severe preterm birth at < 34 weeks' gestation.

STATISTICAL ANALYSIS

Statistical analysis was performed using MsExcel version 2019. Descriptive statistical analysis was performed for demographic characteristics, expressed as numbers and percentages. Statistical analysis was done using Pearson chi square test and p value less than 0.05 was considered as significant.

ETHICAL CONSIDERATIONS

This study adhered to ethical standards, ensuring the confidentiality and privacy of participants. Informed consent was obtained, and participants were provided with the option to withdraw from the study at any point without consequences. All collected data was anonymized and stored securely to protect participant identity.

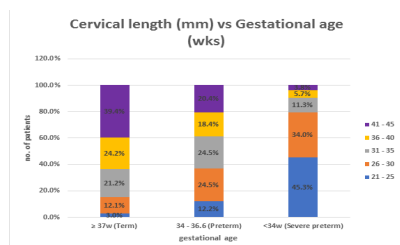
RESULTS

During study period After excluding patients with comorbidity and insufficient CL data we took 300 patients as our sample size.

Table 1: Cervical Length at 18 - 22 weeks vs Gestational Age at Birth (n=300)

Cervical length at 18 - 22 weeks (mm)	≥ 37w (Term)		34 - 36.6 (Preterm)		<34w (Severe preterm)		p Value
	No	%	No	%	No	%	
21 - 25	6	3.0%	6	12.2%	24	45.3%	<0.0001
26 - 30	24	12.1%	12	24.5%	18	34.0%	
31 - 35	42	21.2%	12	24.5%	6	11.3%	
36 - 40	48	24.2%	9	18.4%	3	5.7%	
41 - 45	78	39.4%	10	20.4%	2	3.8%	
Total	198	100.0%	49	100.0%	53	100.0%	

Fig. 1: Cervical Length at 18 - 22 weeks vs Gestational Age at Birth (n=300)



Majority of the term deliveries 39.4% (78) are having CL of 41-45 mm, followed by 24.2% (48) with CL of 36-40 mm. we found preterm birth of patients with CL 21-25 are 12.2% (6) and with CL 26-30 are 24.5% (12) whereas severe preterm birth with CL of 21-25 are 45.3% (24) and with CL of 26-30 are 34% (18) the difference is statistically significant with $p < 0.0001$.

With the data we have collected and shown above we can say that majority of severe pre term birth occur with CL of 21-25 f/b 26-30 and majority of term delivery occur with CL of 41-45 f/b 36-40. so we can say that as CL decrease chances of pre term birth increase and as CL increase chances of term birth increase. So we have taken CL 25mm as a cut off for our study is correct.

Table 2: Cervical Length at 18 - 22 weeks vs Delivery Type

Cervical length at 18 - 22 weeks (mm)	Vaginal Delivery		CS		p Value
	No	%	No	%	
21 - 25	21	9.2%	3	4.2%	0.371
26 - 30	47	20.6%	18	25.0%	
31 - 35	58	25.4%	15	20.8%	
36 - 40	67	29.4%	20	27.8%	
41 - 45	35	15.4%	16	22.2%	
Total	228	100.0%	72	100.0%	

Among the sample, the majority (76%) of vaginal deliveries occurred in women with varying CL measurements, with the highest percentage (29.4%) in the 36-40 mm CL group, though this was not statistically significant ($p = 0.371$).

Fig. 2: Cervical Length at 18 - 22 weeks vs Delivery Type

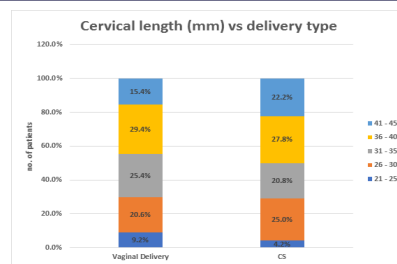
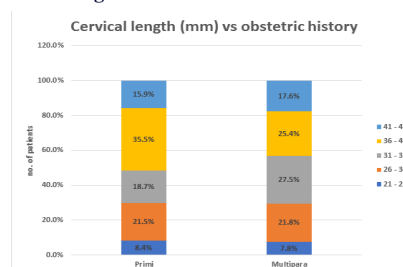


Table 3: Cervical Length at 18 - 22 weeks vs Obstetric History

Cervical length at 18 - 22 weeks (mm)	Primi		Multipara		p Value
	No	%	No	%	
21 - 25	9	8.4%	15	7.8%	0.312
26 - 30	23	21.5%	42	21.8%	
31 - 35	20	18.7%	53	27.5%	
36 - 40	38	35.5%	49	25.4%	
41 - 45	17	15.9%	34	17.6%	
Total	107	100.0%	193	100.0%	

Fig. 3: Cervical Length at 18 - 22 weeks vs Obstetric History



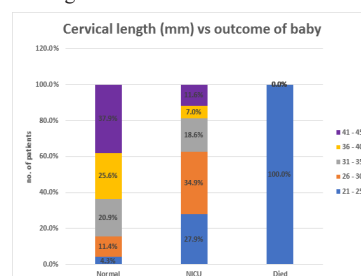
Regarding obstetric history, 35.7% (107) of our sample were primi and 64.3% (193) of our sample were multi and the difference was statistically not significant.

Table 4: Cervical Length at 18 - 22 weeks vs Outcome of Baby

Cervical length at 18 - 22 weeks (mm)	Normal		NICU		Died		p Value
	No	%	No	%	No	%	
21 - 25	9	4.3%	24	27.9%	3	100.0%	<0.0001
26 - 30	24	11.4%	30	34.9%	0	0.0%	
31 - 35	44	20.9%	16	18.6%	0	0.0%	
36 - 40	54	25.6%	6	7.0%	0	0.0%	
41 - 45	80	37.9%	10	11.6%	0	0.0%	
Total	211	100.0%	86	100.0%	3	100.0%	

Outcomes for babies showed that preterm and severe preterm births were significantly associated with shorter CLs ($p < 0.0001$), with 27.9% of babies requiring NICU admission when the CL was 21-25 and 34.9% of babies requiring NICU admission when the CL was 26-30 mm. So by above data we can say that as CL length decrease pre term birth increases and NICU admission is more in preterm babies.

Fig. 4: Cervical Length at 18 - 22 weeks vs Outcome of Baby



DISCUSSION

The association between cervical length (CL) measured in the second trimester and gestational age at birth in singleton pregnancies has been extensively studied, with numerous findings reinforcing its significance as a predictor of preterm birth (PTB). Our study, which recruited 300 antenatal patients from GCS Hospital Ahmedabad, aligns with these findings and adds to the growing body of evidence emphasizing the importance of CL measurement in predicting gestational outcomes.

Our results demonstrate a clear inverse relationship between mid-pregnancy cervical length and the risk of preterm birth. Specifically, we observed that women with shorter cervical lengths (≤ 25 mm) had significantly higher rates of severe preterm birth (< 34 weeks) compared to those with longer cervical lengths. This observation is consistent with previous studies, such as the multicentric prospective cohort study conducted by Silva et al. [1], which found a similar inverse relationship between CL and gestational age at birth in a Brazilian population.

The data from our study showed that majority of severe pre term birth occur with CL of 21-25 f/b 26-30 and majority of term delivery occur with CL of 41-45 f/b 36-40. so we can say that as CL decrease chances of pre term birth increase and as CL increase chances of term birth increase. These findings underscore the critical role of cervical length as a predictor of preterm birth and highlight the need for close monitoring and potential interventions in women identified with a short cervix during the second trimester.

Several studies support our findings, indicating that short cervical length in mid-pregnancy is a robust predictor of preterm birth. For instance, a study by Kindinger et al. [5] conducted a meta-analysis on twin pregnancies and found that cervical length measurement is a valuable tool for predicting preterm birth, even in multifetal gestations. Another study by Fox et al. [6] emphasized the prognostic effectiveness of CL measurement, with an area under the receiver operating characteristic curve (AUC) of 0.82 for predicting preterm birth < 28 weeks and 0.67 for preterm birth < 34 weeks.

Moreover, a large-scale study by Iams et al. [7] involving over 29,000 women found that the risk of preterm delivery increased significantly as cervical length decreased below 25 mm at 24 weeks of gestation. This study further solidifies the predictive value of cervical length measurement and its application in clinical practice to identify high-risk pregnancies early.

CLINICAL IMPLICATIONS

The clinical implications of these findings are substantial. Early identification of women at risk of preterm birth through cervical length measurement allows for timely and targeted interventions. Progesterone therapy, cervical cerclage, and the use of pessaries have been shown to be effective in reducing the risk of preterm birth in women with a short cervix. Our study supports the implementation of such interventions in the Indian healthcare setting to improve pregnancy outcomes and reduce the burden of preterm birth.

In addition, the results from our study suggest that regular screening of cervical length during routine antenatal visits should be considered a standard practice. This approach can facilitate the early detection of women at high risk and ensure that they receive appropriate and timely care.

LIMITATIONS

While our study provides valuable insights, it is not without limitations. The sample size, though adequate, may not fully capture the diversity of the Indian population. Additionally, the study was conducted in a single center, which may limit the generalizability of the findings. Future research involving larger, multi-center studies would help to confirm these results and provide more comprehensive guidelines for clinical practice.

CONCLUSION

In conclusion, our study reaffirms the importance of second-trimester cervical length measurement as a predictor of preterm birth in singleton pregnancies. The findings highlight the need for incorporating routine CL screening into antenatal care protocols and implementing appropriate interventions for women identified with short cervical lengths. These measures can significantly improve

gestational outcomes and reduce the incidence of preterm births, ultimately benefiting both mothers and infants.

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CONFLICT OF INTEREST: None declared

ETHICAL APPROVAL: The study was approved by the Institutional Review Board

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