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Original Research Article

Correlation of mid-trimester cervical length in primigravida with preterm labour

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ABSTRACT

Background: Preterm birth is the leading cause of neonatal morbidity and mortality that is not linked to congenital anomalies or chromosomal disorders. Studies have shown that a short cervix is a significant predictor of preterm birth in both singleton and twin pregnancies, with the risk of spontaneous preterm birth rising as cervical length decreases.
Methods: It is a prospective, observational, cross-sectional study conducted over a period of 18 months. The sample size was 500. The cervical length was measured using transvaginal ultrasound between 16 to 24 weeks period of gestation. These participants were followed up till delivery and the correlation of mid-trimester cervical length was done with preterm labour.
Results: The mean age of patients was 23.8±3.6 (range, 17-37 years). The mean body mass index (BMI) of patients was 22.6±2.7 (range, 17-33). The mean period of gestation at which trans-vaginal ultrasound was done was 19.6±8.34 weeks. The mean cervical length in patients with pre-term deliveries was 2.7±0.54 and in term deliveries was 3.2±0.43 cm, respectively. The difference in cervical length between the two groups was statistically significant (independent t-test, $p<0.001$).
Conclusions: There is an inverse relationship between cervical length measured by transvaginal ultrasound at 16 to 24 weeks of gestation and risk of preterm delivery.

Keywords: Cervical length, Preterm labour, Primigravida

INTRODUCTION

Preterm labor, defined as the onset of labor before 37 completed weeks of gestation, remains a critical challenge in modern obstetrics, contributing significantly to neonatal morbidity, mortality and long-term health complications. According to a report published by WHO in 2012 under the title 'Born too soon- the global action report on preterm birth, citing Lancet, our country shared the highest burden of preterm births of around 23%.[1]

Globally, preterm birth affects approximately 15 million neonates annually, with preterm-related conditions accounting for more than one million deaths per year.[2] Survivors are at increased risk of lifelong issues, including neurodevelopmental impairments, chronic respiratory problems and sensory deficits, placing a substantial emotional and financial burden on families and healthcare systems.[3] Despite advancements in perinatal care, identifying women at risk for preterm delivery remains a priority for optimizing pregnancy outcomes.

Preterm birth can occur spontaneously or be medically induced, with approximately 75% happening spontaneously.[4] Spontaneous preterm labor, with or without premature rupture of membranes (PROM), accounts for about two-thirds of all preterm births. Among these, roughly 40% result from preterm labor and 35% are due to pre-labor premature rupture of membranes (PPROM). The remaining 25% arise from medical or

obstetric complications. Common causes of preterm labor include placenta previa, placental abruption, chorioamnionitis, immune-related factors, cervical insufficiency, uterine abnormalities, maternal illnesses, trauma, fetal anomalies or unknown reasons. Additional risk factors include a history of preterm birth, black ethnicity, substance use, smoking, periodontal disease, socioeconomic disadvantage, multiple pregnancies and deliveries prompted by maternal or fetal indications.

The predictive value of cervical length measurement holds unique significance for primigravida women. Unlike multiparous women, primigravida women lack a prior obstetric history that could serve as a basis for assessing their risk of preterm labor.[5] Identifying risk in this group solely relies on clinical evaluation and biomarkers such as cervical length.

This study aims to investigate the correlation between mid-trimester cervical length and the occurrence of preterm labor in primigravida women. By exploring this relationship, we seeks to reinforce the importance of cervical length screening as a standard of care in antenatal management and expected to contribute to improving pregnancy outcomes by identifying at-risk women early and guiding appropriate preventive strategies.

METHODS

It is a Prospective, Observational, Cross-Sectional Study conducted in the Department of Obstetrics and Gynaecology at Swami Dayanand Hospital, Delhi over 1.5 years. Ethical clearance for the study was taken from the institutional ethical committee. Inclusion criteria for the study include primigravida having singleton pregnancy at 16-24 weeks period of gestation.

Pregnancy with a history of first trimester bleeding, hydramnios, fetal malformations, cervical length<1.5 cm, presence of uterine malformation and fibroid, chorioamnionitis, history of any surgery over uterus or cervix and presence of obstetric or medical disorders complicating the pregnancy such as severe PIH (pregnancy-induced hypertension), Severe anemia (Hb<7g/dl), diabetes mellitus (Type 1 and 2) were excluded from the study.

Sample size

Sample size was determined based on the evidence that in women with singleton gestations and no prior preterm birth, the sensitivity of short cervix for subsequent preterm birth has been reported to be as high as 35 to 45 percent in the absence of intervention.[6]

Considering the sensitivity of cervical length for prediction of preterm birth to be around 40% and prevalence of preterm birth in our hospital around 10%. To estimate an absolute difference of 10% on either side at α=5%, a sample of 590 was required. Considering the time constrains and a drop out of 5% a sample size of 500 was considered for the study.

Methodology

All primigravida attending the antenatal clinic at swami Dayanand Hospital between 16-24 weeks period of gestation were enrolled in the study after obtaining informed consent. The sample size was 500. At the time of enrolment detailed history, including demographic data like age, education level, socioeconomic status, weight and height (Body mass index) was noted on a structured proforma. Their cervical length was measured using transvaginal ultrasound between 16 to 24 weeks period of gestation. These participants were followed up till delivery and the correlation of mid-trimester cervical length was done with preterm labour.

Primary outcome measures were assessed regarding the correlation of preterm birth with mid-trimester cervical length in primigravida. Secondary outcomes measures were evaluated in terms of incidence of cervical length≥2.5 cm and 1.5-2.4 cm among primigravida and its correlation with preterm birth and correlation of preterm birth with other demographic factors like Maternal Age, Body mass index and Socio-economic status.

Statistical analysis

Statistical analysis was performed using IBM, SPSS Statistics version 25 (IBM Corp., New York, NY). Data are mean±standard deviation unless otherwise stated. Pearson's correlation analysis determined the strength and direction of a linear relationship between cervix length and pre-term delivery.

An Independent t-test was done to compare the mean difference in cervical length between pre-term (<37 weeks of gestation) and normal deliveries. A p value less than 0.05 was considered statistically significant. A binomial logistic regression model was constructed to study the effect of independent variables like age, BMI, socioeconomic status, birth weight and cervix length on the likelihood of having a pre-term delivery (dependent variable).

RESULTS

In this study, 466 (93.2%) delivered after 37 weeks period of gestation (term) and 34 participants delivered before 37 completed weeks of gestation (preterm), making the incidence of pre-term delivery (<37 weeks of gestation) in the present study as 6.8%.

The total number of study participants was 500. The maximum number of subjects was of younger age group i.e. 20-25 (table 1). The mean age was 23.8±3.6 (range, 17-37 years). The mean BMI of study participants was 22.6±2.7 (range, 17-33). Most of the cases belong to lower socio-economic status (Table 1).

Out of 26 women with a cervical length of≤2.5 cm, 10 (38.46%) delivered at term (≥37 weeks), while 16 (61.5%) delivered preterm (<37 weeks). This suggests that a short cervical length (≤2.5 cm) is associated with a higher likelihood of preterm delivery.

Out of 474 women with a cervical length of >2.5 cm, 456 (96.2%) delivered at term, while only 18 (3.79%) delivered preterm. A longer cervical length (>2.5 cm) is strongly associated with term delivery, showing a much lower risk of preterm birth compared to women with a shorter cervix (Table 2). In the present study, 53 (10.6%) cases underwent lower segment cesarean section (LSCS) for obstetric indications while 89.4% delivered vaginally (Table 3).

Of the newborns, 18% weighed less than 2.5 kg (low birth weight, LBW). Neonatal outcomes included 5 (1%) requiring NICU admission, 1 (0.2%) developing neonatal sepsis, 2 (0.4%) experiencing respiratory distress syndrome. One neonate succumbed to septicemia in the NICU (Table 4).

Binomial logistic regression evaluated the effects of age, BMI, socioeconomic status, birth weight and cervical length on the likelihood of preterm birth.

The regression model was statistically significant ($\chi^2(6)=143.74$, $P<0.0001$), explaining 63.8% of the variance in preterm birth (Nagelkerke R^2) and achieving an overall classification accuracy of 98.6%. Sensitivity, specificity, positive predictive value and negative predictive value were 82.4%, 99.8%, 96.5% and 98.7%, respectively.

Among the five predictor variables, socioeconomic status, birth weight and cervical length were statistically significant. Cervical length<2.4 cm was associated with 139 times higher odds of preterm delivery compared to greater cervical lengths. Lower socioeconomic status increased the likelihood of preterm birth, while age and BMI showed no significant association with preterm birth risk (Table 5).

Table 1: Demographic profile.

Demographic parameter		Frequency	%
Age (in years)	<20	72	14.4
	20.1-25	278	55.6
	25.1-30	119	23.8
	>30.1	31	6.2
BMI	<22	271	54.2
	22.1-26	158	31.6
	>26.1	71	14.2
Socio-economic status	Upper class	2	0.4
	Middle class	168	33.6
	Lower class	330	66.0

Table 2: Relation between cervical length and preterm delivery.

Cervical length	Term (%)	Preterm (%)	Total	P value
≤2.5	10 (38.46)	16 (61.5)	26	<0.001
>2.5	456 (96.2)	18 (3.79)	474	
	466 (93)	34 (7)	500	

Table 3: Mode of Delivery.

Mode	Frequency	%
Normal vaginal delivery	447	89.4
Lower segment cesarean section	53	10.6

Table 4: Neonatal outcome.

Neonatal outcomes	Frequency	%
Birth weight less than 2.5 kg	90	18
NICU admission	5	1
Respiratory distress	2	0.4
Neonatal sepsis	1	o.2
Neonatal death	1	o.2

Table 5: logistic regression coefficients.

		B	S. E.	Sig.	Odds ratio	95% C.I. for OR	
						Lower	Upper
Step 1[a]	Age	0.062	0.108	0.562	1.064	0.862	1.314
	BMI	0.051	0.142	0.721	1.052	0.796	1.390
	SES			0.183			
	SES (1)	-14.785	28254.477	1.000	0.000	0.000	.
	SES (2)	-2.960	1.606	0.065	0.052	0.002	1.206
	BW (1)	-4.307	1.234	0.000	0.013	0.001	0.151
	CL			0.000			
	CL (1)	6.547	1.314	0.000	139.084	10.105	1830.275
	CL (2)	-0.583	1.164	0.617	0.558	0.057	5.471
	Constant	-4.651	3.646	0.202	0.010		

a. Variable(s) entered on step 1: Age, BMI, Socioeconomic status (SES), Birth weight (BW), Cervical length (CL).

DISCUSSION

The incidence of pre-term delivery in our set up was found to be 6.8%. The incidence of preterm delivery ranges from 5 to 11% world-wide. Hassan et al, found an incidence of 10% pre-term delivery, whereas Dilek et al, found an incidence of 7.4%, respectively.[7,8] The incidence in the present study was comparable to these studies, a small difference can be explained by the fact that we have included only primigravida in our study and have excluded many high-risk factors leading to preterm birth.

The assessment of cervical length by transvaginal ultrasonography was first described by Andersen et al.[9] The reliability of ultrasonography performed before 16 weeks of gestation as a predictor of pre-term birth has shown contradictory results. Studies conducted by Naim et al, Berghella et al and Andrews et al, showed that early detection of reduced cervical length was positively associated with subsequent pre-term birth.[10-12]

In the present study, a shorter cervical length (≤2.5 cm) is associated with a higher likelihood of preterm delivery while a longer cervical length (>2.5 cm) is strongly associated with term delivery (p value<0.001). In a study conducted by Tanvir et al, they concluded that authors concluded that risk of preterm delivery is increased in women who have a short cervix as assessed by transvaginal ultrasound during pregnancy.[13]

In present study, the mean cervical length was 2.7±0.54 cm in preterm deliveries compared to 3.2±0.43 cm in term deliveries and this difference was statistically significant (independent t-test, p<0.001).

In the present study, cervical length less than 2.7 cm at 19.6 weeks had 139 times higher odds (Odds ratio=139. 95% CI, 10.1-1830) for pre-term delivery than those with higher cervical length. In a study conducted by, Priyadarshani et al, they found that cervical length of< 25 mm at the initial ultra-sonographic examination was associated with a relative risk (RR) of 15 for spontaneous preterm birth before 34 weeks and 3.75 for spontaneous preterm birth before 37 weeks.[14] Our study found that shortened cervical length detected at 18-22 weeks of gestation in women with singleton pregnancy was an invaluable observation in predicting pregnancies with an increased likelihood of having pre-term labor/delivery. The mean cervical (cut-off value) at 19.6 weeks of gestation was 2.7 cm. Cervical length and demographic variables like age, BMI and socioeconomic status in a logistic regression model show increased likelihood (OR=139) of predicting pre-term delivery.

In a developing country like India with a large magnitude of pre-term births and lack of availability of intensive care facilities to masses in rural areas, morbidity and mortality associated with it is significantly higher. With limited availability and costs associated with objective diagnostic tests like cervicovaginal fibronectin and amniotic cytokines, transvaginal ultrasonographic assessment of the cervix has remains a safe and cost-effective alternative to objectively assess cervical length and morphology for prediction of preterm labour.

The present study is a single-centre study with less number of subjects which is a limitation of this study. More randomised and larger multicentric trials are needed for better results.

CONCLUSION

Our study concludes, that a definite correlation exists between cervical length measured during mid-trimester and the period of gestation at delivery. There is an inverse relationship between cervical length measured by transvaginal ultrasound at 16 to 24 weeks of gestation and risk of preterm delivery. Thereby, routine ultrasonic assessment of cervical length in mid trimester, when done in conjunction with fetal anatomical survey can be an invaluable and cost-effective tool to predict pre-term birth. However, the risk factors can combine and not all preterm deliveries are the result of the same causes. Therefore, future studies still need to combine the risk factors together to investigate the effect on preterm birth.

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