Original Research Article

Evaluation of cervical length in early and 2nd trimester of pregnancy by TVS and gestational age at delivery

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Abstract

Background: Preterm labour, leading to births before 37 weeks, poses significant health risks for newborns. Cervical length measurement via TVS is a crucial method to identify the PTL risk. This study investigates how early pregnancy cervical length measurements can predict preterm labour, aiming to enhance care for pregnant women and improve neonatal outcomes.

Materials and Methods: A prospective cohort design was employed, involving 70 asymptomatic pregnant women aged 18-35 with singleton pregnancies, cervical lengths >25 mm, and no history of cervical issues. Length of cervix was measured using TVS at 10-14 weeks and 20-24 weeks of gestation and pregnancy outcome was noted. Regression models were used to analyse the relationship between preterm labour and cervical length changes.

Results: The study found that preterm labour occurred in 30% of patients, predominantly in those with cervical lengths under 26 mm during the second measurement. Significant differences in cervical length were observed between pregnancies under and over 37 weeks. Cervical length measurement demonstrated a specificity of 90.91% and a sensitivity of 76.19% in predicting preterm labour.

Conclusion: The study highlights a strong correlation between significant cervical length changes early in pregnancy and the risk of preterm labour. The findings underscore the importance of cervical length as a predictive tool, with its high sensitivity and specificity supporting its use in managing preterm labour risks and improving maternal and neonatal outcomes.

Keywords: Preterm labour, Cervical length, Transvaginal ultrasound, Pregnancy outcome.

1. Introduction

Premature births impose a significant financial burden on healthcare systems and are a predominant cause of perinatal morbidity and mortality. Premature infants are at heightened risk for a range of severe health complications, including intraventricular haemorrhage, necrotizing enterocolitis, respiratory distress syndrome, sepsis, and long-term developmental issues. The term "preterm" specifically refers to births occurring before 37 weeks of gestation.[1] Despite advancements in medical care, the rate of preterm births has remained stable over the past four decades, with no significant decline observed.[2] The increased use of assisted reproductive technologies (ART) in industrialized countries has exacerbated this issue, contributing to the steady incidence of premature deliveries.[2] Nearly two-thirds of preterm births are spontaneous, often resulting from either the early stat of labour or preterm premature rupture of membranes (PPROM). The remaining one-third of preterm births are induced due to maternal or foetal complications.[1]

Preterm labour can occur at various gestational ages and through different mechanisms. While term labour is initiated by physiological activation of the labour pathways, preterm labour is often triggered by pathological factors that activate one or more components of the same pathway. The pathway, which involves uterine contractions, cervical dilation, and membrane activation, is consistent across both term and preterm labour.[3]

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Identifying women at risk for preterm labour early is very crucial, particularly due to the recent increase in preterm births. While advancements in neonatal care have improved survival rates for very premature infants, early detection of preterm birth risk remains essential. Therefore, developing a very sensitive approach to diagnose women at high risk and implementing effective prevention strategies for preterm labour is of paramount importance.

Cervical length measurement is considered the gold standard for detecting preterm birth risk. Since eighties (1980), transvaginal ultrasonography (TVU) has been used to measure length of cervix, offering a simple, non-invasive, and accessible tool for identifying pregnant women at high risk for PTD. TVU can be integrated with routine nuchal translucency (NT) and anomaly scans to enhance early detection. In some cases, early recognition of a shortened cervical length can lead to interventions (under quotation) that may reduce the likelihood of PTB.[4,5]

Research has shown that using 17α-hydroxyprogesterone caproate, micronized progesterone, and cervical cerclage can help prevent preterm birth. Measuring cervical length during the first trimester NT scan (10 to 14 weeks) and repeating the measurement during the second trimester anomaly scan (20 to 24 weeks) while monitoring the rate of shortening is a valuable indicator for predicting PTL. Although no statistically significant difference in cervical lengths between term and non-term pregnancies has been observed during TVS at 10 to 14 weeks, this method provides a useful baseline for monitoring.

The predictive accuracy for spontaneous preterm delivery varies based on factors such as the number of foetuses, gestational age during testing, cervical length, and the presence of preterm birth risk factors.[6] While a short cervical length is associated with preterm delivery, it remains unclear whether this condition is a cause or a consequence of pathophysiological processes.[7]

In women with singleton pregnancies presenting with symptoms of preterm labour, transvaginal cervical length measurement has been shown to significantly reduce the risk of spontaneous preterm birth by guiding timely interventions.[8]

In cases of a short cervix, there is a higher prevalence of infection or inflammation. Studies have found that in instances where cervical dilation exceeds 1.5 cm without active labour, 80% of these cases involve infection or inflammation, as indicated by positive amniotic fluid cultures or elevated levels of inflammatory cytokines. In preterm labour patients with cervical lengths shorter than 15 mm, microbial invasion was significantly higher (26.3%) compared to those with cervical lengths between 15 and 25 mm (3.8%). This suggests that intraamniotic infection and inflammation are extremely common in cases of very short cervixes.

2. Materials and Methods

After ethical committee approval, this observational prospective study was carried out in the Department of Obstetrics and Gynaecology at Shri Sathya Sai Medical College and Research Institute, Ammapettai (under quotation), over 18 months. The sample size was 70. The study population included were antenatal patients aged 20-35 years with singleton pregnancies between 10-14 weeks of gestation, attending the OBG Out-Patient Clinic. Exclusion criteria included women with complicating factors like preeclampsia, severe IUGR, GDM, low-lying placenta, first-trimester bleeding, multiple gestations, and uterine anomalies.

After obtaining the informed & written consent, comprehensive history and examination were done as per Performa. After explaining the procedure, Transvaginal ultrasound (TVS) was utilized to measure cervical length at 10-14 weeks and 20-24 weeks of gestation. Patients were instructed to empty their bladders before the procedure, and the scans were performed with a 7.5 MHz Mindray 2D ultrasound using a transvaginal probe. The shortest of three cervical length measurements, taken from the internal os to the external os, was recorded. The study aimed to assess cervical shortening and its correlation with preterm labour. Consistency in measurements was ensured by having a single operator perform all scans. Research data was analysed using SPSS-23, with statistical significance set at 5%. The study's primary focus was on the relationship between shortening of cervical length and the risk of preterm labour.

3. Results

Table 1: Age distribution of the patients and their percentages

Age Distribution	Number	Percentage
21-25 Years	12	17.14
26-30 Years	37	52.86
31-35 Years	21	30
Mean	28.37±2.91 Years	

In (**Table 1** lists of patient age groupings and percentages are given. Patients were most numerous in the 26-30 age group. Patients in the 21-25 age group were rare, with an average age of 28.37±2.91 years.

Table 2: Parity distribution

Parity	Number	Percentage
PRIMI	36	51.43
MULTI	34	48.57
Total	70	100

Parity and percentages of patients are shown in **Table 2**. There were 36 Primi and 34 Multi patients out of 70.

Table 3: Gestational age I (when cervical length measured at first trimester)

Gestational age I	Number	Percentage
10 weeks	19	27.14
11 weeks	7	10
12 weeks	16	22.86
13 weeks	12	17.14
14 weeks	16	22.86
Total	70	100

In gestational age I patients, the higher number of patients were observed in 10 weeks and 12 weeks given in **Table 3**. In 11 weeks, patients were few.

Table 4: Gestational age II (when cervical length measured at second trimester

Gestational age II	Number	Percentage
20 weeks	23	32.86
21 weeks	13	18.57
22 weeks	12	17.14
23 weeks	12	17.14
24 weeks	10	14.29
Total	70	100

Table 4 showed that the highest number of patients in gestational age II were recorded at 20 weeks, followed by 23 weeks. After 24 weeks, the number of patients was significantly decreased.

Table 5: Patients developing preterm labour

Preterm Labour	Number	Percentage
Yes	21	30
No	49	70
Total	70	100

This study showed that 21 out of 70 patients experienced premature labor. The number of patients undergoing term labour was found to be greater.

Table 6: Mode of delivery and their percentages

Mode of delivery	Number	Percentage
Vaginal	44	62.86
Instrumental	10	14.29
LSCS	16	22.86
Total	70	100

Out of 70 patients, 44 patients had vaginal delivery, and 10 patients had instrumental delivery and the remaining 16 patients had LSCS, a higher no. of vaginal delivery was observed.

Table 7: Cervical length and preterm

Cervical Length	Preterm Labour	
	Yes	No
>26 mm	5	44
<26 mm	16	5
Total	21	49

In cervical length II > 26 mm, 5 patients only preterm labour and remaining 44 patients term labour was observed and given in **Table 7**. In 16 patients with cervical length < 26 mm, preterm labour and in the remaining 5 patients, term labour was observed; in the < 26mm patients, higher rates of preterm labour were observed.

Table 8: Shows specificity, sensitivity, negative likelihood ratio, positive likelihood ratio, prevalence, positive predictive value, negative predictive value, accuracy

Statistic	Value	95% CI
Sensitivity	76.19%	52.83% to 91.78%
Specificity	90.91%	77.77% to 96.60%
Positive Likelihood Ratio	7.47	3.15 to 17.72
Negative Likelihood Ratio	0.27	0.04 to 0.53
Prevalence	30.00%	17.86% to 44.61%
Positive Predictive Value	81.25%	59.06% to 92.87%
Negative Predictive Value	89.80%	81.43% to 98.32%
Accuracy	86.00%	78.19% to 96.67%

Table 8, the study showed a specificity of 90.91% (95% CI: 77.77% to 96.60%) sensitivity of 76.19% (95% CI: 52.83% to 91.78%). The positive predictive value was 81.25% (95% CI: 59.06% to 92.87%), and the negative predictive value was 89.80% (95% CI: 81.43% to 98.32%). The overall accuracy was 86.00% (95% CI: 78.19% to 96.67%), with a positive likelihood ratio of 7.47 and a negative likelihood ratio of 0.27.

4. Discussion

Preterm delivery, occurring in approximately 5-15% of all births, is a significant contributor to perinatal fatalities, particularly post-birth. Infant mortality and morbidity risk is mostly determined by the gestational age at birth. Developing countries frequently lack adequate critical care facilities, which contributes to greater mortality rates for shorter gestation durations. Therefore, it is crucial to increase the gestation length in order to improve survival rates.

4.1. Demographic insights

In this study, 52.86% of participants were aged 26-30 years, 30% were 31-35 years, and 17.14% were 21-25 years. The mean age was 28.37±2.91 years. In the study by Verma et al.[9]

86.8% of participants were within this age range, indicating that age was a statistically matched criterion with no significant distribution differences between groups.

4.2. Gravidity and delivery outcomes

In our study, out of 70 patients, 51.43% were primigravida and 48.57% were multigravida, with 30% experiencing preterm delivery. Begum J et al. found 43.20% primigravida and 56.80% multigravida in their study.[10] Berghella S et al. reported 38.75% primigravida and 61.25% multigravida.[8] In terms of delivery modes, 62.86% had vaginal deliveries, 14.29% had instrumental deliveries, and 22.86% underwent LSCS.

4.3. Gestational age and cervical changes

1. First trimester cervical length measurements:

   a. In this study, cervical length measurements were most frequently conducted at 10 and 12 weeks, with a smaller proportion of patients measured at 11 weeks. This distribution is consistent with studies that have emphasized the importance of early cervical length assessment as a baseline for predicting PTL risk.
   b. A study done by Greco et al. found that length of cervix measured at 11-13 weeks of gestation could predict spontaneous preterm delivery, with a shorter cervix at this stage correlating with a higher risk of PTL.[11] However, they also noted that the predictive value increased when measurements were taken closer to the second trimester, highlighting the importance of serial measurements, as done in the present study.

2. Second trimester cervical length measurements

   a. The maximal no. of patients in this study were measured at 20 and 23 weeks, with a significant drop-off by 24 weeks. This trend aligns with the clinical practice of conducting mid-trimester cervical length assessments to identify those at high risk for PTL.
   b. A study by Iams et al. demonstrated that cervical length measurement at 24 weeks was a strong predictor of preterm birth, particularly when the length was below 25 mm.[12] The present study's focus on 20-24 weeks is supported by this evidence, as it represents a critical period for identifying women who may benefit from interventions such as progesterone therapy or cervical cerclage.
   c. Additionally, the findings align with those of a meta-analysis by Conde-Agudelo et al., which showed that cervical length measured between 20 and 24 weeks is a reliable predictor of spontaneous preterm birth in asymptomatic women with singleton pregnancies.[6] The current study's emphasis on measurements at 20 weeks is consistent

with this evidence, suggesting that early detection at this stage is crucial for implementing preventive measures.

3. Cervical length and preterm delivery

   a. In our study, at 10-14 weeks gestation, the mean cervical length for those delivering before 37 weeks was 42.06±1.42 mm, compared to 41.78±0.96 mm for those delivering after 37 weeks. Among women who gave birth before 37 weeks, the average cervical length at 20-24 weeks was 26.17±2.68 mm, but the average for those who gave birth after 37 weeks was 34.84±3.28 mm. Verma et al. found a mean cervical length of 28.1±3.9 mm at 30 weeks,[9] and Wadhawan UT et al. reported an average cervical length of 33.7 mm.[13]

4.4. Predictive value of cervical length measurement

Cervical length yielded a 76.19% sensitivity, 90.91% specificity, 81.25% positive predictive value, 89.80% negative predictive value, and 86.00% accuracy in predicting early delivery. Transvaginal sonography (TVS) is more sensitive and accurate than abdominal sonography when evaluating the cervical region. TVS also shows a clear link between cervical funnelling and preterm birth.[14] Tsoi E. et al. found TVS to have excellent negative predictive value, indicating its efficacy in high-risk preterm labour cases and asymptomatic patients.[15]

This study's results highlight the significance of measuring cervical length as a predictor of premature labour. The statistics showed that most patients were between the ages of 26 and 30, which is a crucial reproductive period. The even distribution between first-time mothers (PRIMI) and those with previous pregnancies (MULTI) suggests that parity alone is not a significant predictor of preterm labour within this sample.

The gestational age measurements at 10 and 20 weeks provide key insights into common periods for evaluating cervical length changes. Notably, preterm labour was significantly associated with shorter cervical lengths, particularly those less than 26 mm during the second measurement. Consistent with previous research, this data confirms that shorter cervical lengths raise the likelihood of premature delivery.

The high rates of vaginal delivery compared to instrumental and Caesarean sections indicate that, despite the risks of preterm labour, most patients still delivered vaginally. The significant differences in cervical length between pregnancies under and over 37 weeks highlight the utility of cervical length measurements in predicting pregnancy outcomes.

The mean rate and absolute changes in cervical length being greater in pregnancies less than 37 weeks further

emphasize the dynamic changes occurring in the cervix during preterm labour risk. The high sensitivity (76.19%) and specificity (90.91%) of cervical length measurements reinforce their reliability and effectiveness as a screening tool.

These results support the continued use of cervical length measurement as a standard practice in prenatal care to identify and manage the risk of preterm labour. Future studies could explore interventions for patients identified with short cervical lengths to further reduce the incidence of preterm labour and improve pregnancy outcomes.

5. Conclusion

This study highlights the significant association between cervical length and the risk of preterm labour. The average patient age was 28.37 years, with most participants falling between 26 and 30 years. The distribution between first-time mothers (primigravida) and those with previous pregnancies (multigravida) was fairly even. Notably, 30% of the patients experienced preterm labour, predominantly among those with a length of cervix less than 26 mm during the second assessment.

Length of cervix emerged as a strong predictor of preterm labor, with significant differences observed between pregnancies that lasted less than 37 weeks and those that exceeded this gestational period. Patients who delivered before 37 weeks had a shorter cervical length, with more substantial mean rate and absolute changes, emphasizing the dynamic nature of cervical shortening as a risk factor for preterm labour.

Vaginal delivery was the predominant mode of birth, followed by caesarean sections (LSCS). The high sensitivity and specificity of cervical length measurements underscore their effectiveness as a predictive tool in managing pregnancy outcomes.

Overall, the findings support the importance of cervical length evaluation in prenatal care, especially for identifying and managing the risk of preterm labour. Shorter cervical lengths were consistently associated with higher risks of early delivery, reinforcing the need for regular monitoring. Implementing standardized cervical length assessments could significantly improve early detection and intervention strategies, ultimately enhancing maternal and neonatal health outcomes.

6. Source of Funding

None.

7. Conflict of Interest

None.

8. Ethical Approval

Ethical No.: 2022/800.

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