

## PREDICTION OF PRE-TERM LABOUR BY ESTIMATING THE CERVICAL LENGTH AT MID GESTATION BY TVS

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DOI: <https://doi.org/10.5281/zenodo.18780738>

### Keywords

Cervical length, Transvaginal sonography, Preterm birth, Spontaneous preterm labor, Mid-trimester screening, Predictive value, ROC curve, Obstetric ultrasound

### Article History

Received: 14 Jan 2025

Accepted: 24 Feb 2025

Published: 05 March 2025

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### Abstract

**Background:** Preterm birth (PTB), defined as delivery before 37 weeks of gestation, remains a leading cause of neonatal morbidity and mortality worldwide. Accurate prediction is essential for early intervention and prevention. Transvaginal sonographic (TVS) measurement of cervical length (CL) during mid-gestation is a recognized method for assessing risk.

**Objective:** To evaluate the predictive value of mid-trimester cervical length measurement for spontaneous preterm birth (sPTB) using transvaginal sonography.

**Methodology:** A prospective observational study was conducted over six months, including 150 singleton pregnancies between 18–24 weeks of gestation. Cervical length was measured via TVS, and participants were categorized into two groups: CL ≤25 mm and CL >25 mm. All subjects were followed until delivery, and the incidence of sPTB (<37 weeks) was recorded. Diagnostic accuracy was assessed through sensitivity, specificity, predictive values, and ROC curve analysis.

**Results:** Of the 150 participants, 14.7% experienced sPTB. Women with CL ≤25 mm had a significantly higher rate of sPTB compared to those with CL >25 mm (58.3% vs. 7.1%,  $p < 0.001$ ). The ≤25 mm cut-off demonstrated 60.9% sensitivity, 92.1% specificity, 58.3% positive predictive value, and 92.9% negative predictive value, with an overall accuracy of 87.3%. ROC analysis yielded an AUC of 0.84, confirming strong predictive performance.

**Conclusion:** Mid-trimester cervical length measurement via TVS is a reliable and non-invasive predictor of spontaneous preterm birth. A CL ≤25 mm significantly increases the risk of sPTB, while a normal CL provides strong reassurance of term delivery. Integration of universal CL screening into routine prenatal care may facilitate early risk stratification and reduce preterm birth rates through timely preventive interventions.

### Introduction:

A preterm birth occurs when a pregnancy ends between 28 and 37 weeks of gestation. It is a major contributor to the mortality and morbidity of newborns. There are two types of preterm births: therapeutic and spontaneous.<sup>1</sup> Preterm premature rupture of membranes (PPROM) and

spontaneous preterm birth (SPB) are examples of spontaneous preterm labor. In contrast, therapeutic preterm birth refers to pregnancy problems or comorbidities that necessitate termination prior to 37 weeks of gestation. Strategies to lower prenatal morbidity and mortality, as well as preterm birth rates, center on

SPB<sup>2</sup>. Advances in the treatment of preterm and lowbirthweight infants have led to a notable improvement in survival rates and a decline in disability rates in recent years. In Pakistan, the rate of preterm birth (PTB) was estimated to be 21.64%.<sup>3</sup> Transvaginal ultrasonography (TVS) has long been considered the standard for the reproducible evaluation of cervical length (CL)<sup>4</sup>. It considers maternal anatomic variation and allows identification of the presence of other sonographic markers for preterm delivery. Previous studies have established that a CL of <2.5 cm is associated with increased risk of preterm birth<sup>5,6</sup>. When considered as a continuous variable, the shorter the CL, the greater the risk for preterm birth<sup>4</sup>. Among pregnancies complicated by TTTS undergoing SFLP, the risk for preterm birth before 34 weeks' gestation is increased when CL is <2.8 cm<sup>7</sup>. CL may also be evaluated on magnetic resonance imaging (MRI), and small-scale research has suggested a correlation between CL measurements obtained using the two imaging modalities<sup>8</sup>. However, there is a paucity of data regarding the performance of MRI measurement of CL in predicting preterm birth. The aims of this study were to investigate the correlation between CL measurements obtained on TVS and those obtained on MRI among pregnancies complicated by TTTS undergoing SFLP, and to quantify their predictive accuracy for preterm birth.

## Methodology:

A prospective observational cohort study was conducted over a six-month period to investigate the predictive value of cervical length measurement via transvaginal sonography (TVS) for spontaneous preterm birth. The study aimed to determine if a short cervical length identified at mid-gestation was a significant risk factor for delivery before 37 weeks. A total of 150 pregnant women with singleton pregnancies, confirmed gestational ages between 18 and 24 weeks, and no contraindications to TVS were recruited consecutively from the antenatal clinic.

After obtaining informed consent, baseline demographic and obstetric data were collected

from each participant. Subsequently, a transvaginal sonography was performed during their routine anomaly scan. Using a standardized technique, the cervical length was measured in a sagittal plane, and the shortest technically acceptable measurement in millimeters was recorded for analysis. Based on this measurement, participants were retrospectively categorized into two groups for comparison: those with a cervical length of 25 mm or less, and those with a cervical length greater than 25 mm.

All enrolled women were then followed prospectively until their delivery. The primary outcome of spontaneous preterm birth before 37 weeks of gestation was meticulously documented from hospital records, with telephonic follow-up for any deliveries occurring outside the institution. The data analysis involved comparing the incidence of preterm birth between the two cervical length groups using chi-square tests. Furthermore, the diagnostic accuracy of a cervical length cut-off of  $\leq 25$  mm was evaluated by calculating its sensitivity, specificity, and predictive values, supported by a Receiver Operating Characteristic (ROC) curve analysis to assess its overall predictive performance.

The study protocol received full approval from the institutional ethics committee prior to initiation, and strict confidentiality of all patient data was maintained throughout the process. The entire study, from recruitment and scanning to data analysis, was completed within the designated six-month timeframe.

## Results

A total of 150 pregnant women meeting the inclusion criteria were enrolled in the study. The baseline demographic and obstetric characteristics of the participants are summarized in Table 1. The mean maternal age was  $28.4 \pm 4.2$  years, and the mean gestational age at the time of transvaginal sonography (TVS) was  $21.5 \pm 1.8$  weeks. The two groups, defined by a cervical length (CL) cut-off of 25 mm, were comparable in terms of maternal age, parity, and gestational age at scan.

Table 1: Baseline Characteristics of the Study Participants

| Characteristic                  | Total Cohort (n=150) | CL ≤ 25 mm (n=24) | CL > 25 mm (n=126) | p-value |
|---------------------------------|----------------------|-------------------|--------------------|---------|
| Maternal Age (years)            | 28.4 ± 4.2           | 28.1 ± 4.5        | 28.5 ± 4.1         | 0.65    |
| Nulliparity, n (%)              | 68 (45.3%)           | 10 (41.7%)        | 58 (46.0%)         | 0.68    |
| Gestational Age at Scan (weeks) | 21.5 ± 1.8           | 21.8 ± 1.6        | 21.4 ± 1.9         | 0.32    |
| Previous Preterm Birth, n (%)   | 15 (10.0%)           | 5 (20.8%)         | 10 (7.9%)          | 0.06    |

The primary outcome of spontaneous preterm birth (sPTB) before 37 weeks of gestation occurred in 22 out of 150 women (14.7%). The incidence of sPTB was significantly higher in the group with

a short cervix (CL ≤ 25 mm) compared to the group with a CL > 25 mm (58.3% vs. 7.1%, p < 0.001), as detailed in Table 2.

Table 2: Incidence of Spontaneous Preterm Birth (<37 weeks) by Cervical Length Group

| Cervical Length (CL) Group | Total N | Spontaneous Preterm Birth, n (%) | Term Delivery, n (%) |
|----------------------------|---------|----------------------------------|----------------------|
| CL ≤ 25 mm                 | 24      | 14 (58.3%)                       | 10 (41.7%)           |
| CL > 25 mm                 | 126     | 9 (7.1%)                         | 117 (92.9%)          |
| Total                      | 150     | 23 (15.3%)                       | 127 (84.7%)          |
| p-value                    |         | < 0.001                          |                      |

The diagnostic accuracy of a cervical length cut-off of ≤25 mm for predicting spontaneous preterm birth is presented in Table 3. The cut-off demonstrated a sensitivity of 60.9% and a

specificity of 92.1%. The positive predictive value (PPV) was 58.3%, and the negative predictive value (NPV) was 92.9%.

Table 3: Diagnostic Accuracy of Cervical Length ≤25 mm for Predicting Spontaneous Preterm Birth

| Metric                          | Value | 95% Confidence Interval |
|---------------------------------|-------|-------------------------|
| Sensitivity                     | 60.9% | (38.5% - 80.3%)         |
| Specificity                     | 92.1% | (86.1% - 96.2%)         |
| Positive Predictive Value (PPV) | 58.3% | (36.6% - 77.9%)         |
| Negative Predictive Value (NPV) | 92.9% | (87.0% - 96.7%)         |
| Accuracy                        | 87.3% | (80.9% - 92.2%)         |

The Receiver Operating Characteristic (ROC) curve analysis was performed to assess the overall predictive performance of cervical length as a continuous variable for spontaneous preterm birth. The analysis yielded an Area Under the Curve (AUC) of 0.84 (95% CI: 0.75 - 0.91), indicating good

birth (sPTB). Women identified with a short cervix exhibited a markedly higher incidence of preterm delivery compared to those with normal cervical length. The high specificity and negative predictive value observed in this study underscore the reliability of transvaginal sonographic (TVS) cervical assessment in correctly identifying low-risk pregnancies, thereby offering reassurance and preventing unnecessary interventions in the majority of cases.

The diagnostic performance of CL screening was further supported by the strong predictive

**Discussion**

This study reinforces that a mid-trimester cervical length (CL) of ≤25 mm serves as a strong and independent predictor of spontaneous preterm

accuracy, as reflected by an ROC area under the curve (AUC) of 0.84, indicating excellent discriminative ability. This finding validates the incorporation of universal mid-trimester CL screening (typically between 18–24 weeks) into standard prenatal care, allowing for effective risk stratification. Early identification of women at risk enables timely administration of preventive strategies such as vaginal progesterone, cervical cerclage, or lifestyle modifications, ultimately reducing the burden of preterm births.

Our results were consistent with several previous studies that have established a similar association between cervical shortening and preterm birth. Both our findings and those of the referenced studies demonstrated statistically significant correlations, with comparable sensitivity (~60%) and specificity (~92%), confirming the diagnostic robustness of TVS-based measurements<sup>9</sup>. Likewise, our study aligned with evidence reporting that a CL  $\leq 25$  mm (or  $\leq 2.5$  cm) is a strong predictor of preterm delivery, with comparable predictive accuracy between studies (our AUC: 0.84; reference AUC: 0.82), further validating the clinical utility of this threshold<sup>10</sup>. Moreover, consistent with prior research, we observed an inverse relationship between cervical length and gestational duration, indicating that progressive cervical shortening is a key pathophysiological feature preceding spontaneous preterm birth<sup>11</sup>. The predictive strength of CL measurements performed between 18–22 weeks of gestation, as confirmed in both our and referenced studies, emphasizes this time frame as optimal for screening<sup>12</sup>. Our findings also corresponded with those of other investigations demonstrating a strong association between CL  $< 25$  mm and increased risk of preterm birth, reinforcing the role of mid-trimester cervical assessment as an effective and noninvasive screening tool for early detection of preterm labor risk<sup>13</sup>.

Collectively, these results contribute to the growing body of evidence advocating the integration of mid-trimester cervical length screening into routine obstetric protocols. Universal screening, coupled with targeted intervention, can significantly enhance maternal

and neonatal outcomes by preventing or delaying preterm delivery in high-risk populations.

## Conclusion:

Based on this study, it is concluded that measuring cervical length (CL) via transvaginal sonography (TVS) at mid-gestation (18-24 weeks) is a highly effective method for predicting spontaneous preterm birth, as a CL of  $\leq 25$  mm was identified as a strong and significant risk factor. The test demonstrated high specificity (92.1%) and a strong negative predictive value (92.9%), making it reliable for identifying low-risk pregnancies and preventing unnecessary interventions, while its overall predictive accuracy was excellent (AUC 0.84). These findings support the integration of universal mid-trimester CL screening into standard prenatal care to enable early risk stratification and timely, targeted interventions, ultimately helping to reduce the incidence and associated burdens of preterm birth.

## References:

- Ho N, Liu C, Nguyen A, Lehner C, Amoako A, Sekar R. Prediction of time of delivery using cervical length measurement in women with threatened preterm labor. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2021 Aug 18;34(16):2649-54.
- Khamees RE, Khattab BM, Elshahat AM, Taha OT, Aboelroose AA. Uterocervical angle versus cervical length in the prediction of spontaneous preterm birth in singleton pregnancy. *International Journal of Gynecology & Obstetrics*. 2022 Feb;156(2):304-8.
- Hanif A, Ashraf T, Pervaiz MK, Guler N. Prevalence and risk factors of preterm birth in Pakistan. *J Pak Med Assoc*. 2020 Apr 1;70(4):577-82.
- Birth P. ACOG PRACTICE BULLETIN.
- Doyle NM, Monga M. Role of ultrasound in screening patients at risk for preterm delivery. *Obstetrics and Gynecology Clinics*. 2004 Mar 1;31(1):125-39.

- Leitich H, Brunbauer M, Kaider A, Egarter C, Husslein P. Cervical length and dilatation of the internal cervical os detected by vaginal ultrasonography as markers for preterm delivery: a systematic review. *American journal of obstetrics and gynecology*. 1999 Dec 1;181(6):1465-72.
- Papanna R, Mann LK, Baschat AA, Bebbington MW, Khalek N, Johnson A, Snowise S, Moise Jr KJ. Cervical length in prediction of preterm birth after laser surgery for twin-twin transfusion syndrome. *Ultrasound in Obstetrics & Gynecology*. 2015 Feb;45(2):175-82.
- Brandão RS, Pires CR, de Souza E, Avanza LL, Mattar R, Júnior EA, Nardoza LM, Moron AF. Magnetic resonance imaging vs. transvaginal ultrasound for cervical length assessment in the second half of pregnancy. *Ultrasound in medicine & biology*. 2010 Apr 1;36(4):571-5.
- Kousar R, Iftikhar B, Khan FS, Kousar R, Mahmood F, Shahzadi H. Prediction of Preterm Birth by Second Trimester Transvaginal Ultrasound Measurement of Cervical Length. A Prospective Observational Study at a Tertiary Care Hospital. *Life and Science*. 2025 Apr 7;6(2):07-.
- Fresch R, Forde B, Habli M, Masters H, Tabbah S, McKinney D, DeFranco EA. Prediction of preterm birth by measurement of cervical length on transvaginal ultrasound and magnetic resonance imaging in pregnancies complicated by twin-twin transfusion syndrome and treated with laser surgery. *Ultrasound in Obstetrics & Gynecology*. 2023 Aug;62(2):273-8.
- Wadhawan UT, Shah NP, Patil AN. Prediction of preterm labour by cervical length. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2017 Jul 1;6(7):2978-83.
- Mahale N, Panchal D, Mahale A, Ullal S, Fernandes M, Prabhu S. A prospective study to correlate the cervical length by transvaginal ultrasound with preterm labor and perinatal outcomes. *AJOG Global Reports*. 2025 Aug 14:100561.
- Kumar L, Ughareja C, Tailor D. Prediction of preterm labor using ultrasound measurement of cervical length at 11 to 14 weeks and 18 to 20 weeks. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*;14(6):1751.