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The Effect of Cervical Length Measurement on Pregnancy Outcomes in Women Experiencing Labor Pain before 34 Weeks of Gestation

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ABSTRACT

Background and Objective: Preterm labor before 34 weeks of gestation is associated with significant neonatal morbidity and mortality. Cervical length measurement is a valuable tool for predicting preterm labor, allowing for timely interventions to improve pregnancy outcomes. The present study was conducted to evaluate the clinical outcomes of women at risk for preterm labor who had a cervical length ≤30 mm.

Methods: This cross-sectional study was conducted among 189 pregnant women at gestational age ≤34 weeks who were admitted to Imam Khomeini Hospital in Ahvaz in 2023 and were at risk for preterm labor. Demographic and clinical information including cervical length, birth weight, mean length of stay for mother and infant, and neonatal complications were extracted from the medical records and examined.

Findings: The mean cervical length was 31.47±8.68 mm and the mean maternal weight was 71.46±14.22 kg. The mean birth weight was 2875.50±585.49 g. RDS was observed in 16.9% of the infants, the mean NICU stay was 4.89±2.17 days, and the maximum length of stay was 30 days. The mean maternal length of stay was 3.3±3.04 days and the mean length of stay before delivery was 38.69±3.01 days. The mean gestational age at delivery was 36.5 weeks. The neonatal mortality was 2.6% and obstetric complications were 9% (fetal growth restriction was 21.2% and postpartum infection was 4.2%). Most infants (97.9%) had five-minute Apgar scores greater than 7.

Conclusion: According to the results of this study, measuring cervical length effectively predicts outcomes in women at risk for preterm labor.

Keywords: *Preterm Labor, Cervix, Maternal Complications, Neonatal Complications.*

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Introduction

Preterm labor is a major concern for any pregnant mother. Preterm labor and the lack of adequate development of the infant's organs reduce the infant's resistance to diseases and infections and, in some cases, can lead to neonatal death (1). Studies have shown that premature infants are up to 6 times more likely to die in the first week of life and up to 3 times more likely to die in the first year of life compared to full-term infants. Respiratory problems, difficulty in regulating body temperature, and neurodevelopmental delay are among the major challenges for these infants (2). Preterm labor is known as the main cause of three-quarters of neonatal deaths and half of neurological disorders in children (3). Infants born before 32 weeks of gestation are at significantly higher risk of death (4). Despite medical advances in prenatal care, the prevalence of Preterm labor continues to increase, elevating by about 20% over the past two decades (5). Preterm labor usually occurs between 34 and 36 weeks of pregnancy, and various factors, including race, short interpregnancy intervals, stress, and some infections, are mentioned as effective factors (6).

These deliveries usually occur with the onset of uterine contractions between 20 and 37 weeks of gestation and are the second leading cause of neonatal mortality after congenital anomalies (7). To diagnose preterm labor, it is important to examine uterine contractions and cervical changes. If the cervix is not changed, preterm labor is rejected (8). Ultrasound and fetal fibronectin testing are also used as diagnostic tests (9). Several medications, such as corticosteroids, are used to delay labor until supportive treatments are completed and everything is ready for childbirth (9). The most common treatment is inhibition of uterine contractions, which is performed using medications such as ritodrine and magnesium sulfate (1).

Preterm labor can pose serious risks to the infant, including increased risk of cerebral hemorrhage, nutritional problems, infection, and dysglycemia (10). Studies have shown that women who experience vaginal bleeding between 12 and 24 weeks of pregnancy are at increased risk of preterm labor (11). Uterine abnormalities and placenta previa are the main causes of this bleeding and are associated with preterm labor. Because of the adverse outcomes and high costs of preterm labor, prevention of this condition is of great importance. Understanding predisposing factors can help identify women at risk, and thus, by eliminating these factors, the risk of preterm birth and related costs can be reduced (11). A study by Munivenkatappa et al. showed that preterm labor affected 20% of mothers and the average cost of hospitalization per mother was $2037 (12).

Preterm labor is a leading cause of neonatal morbidity and mortality, especially before 34 weeks of gestation. Cervical length measurement is a proven predictor of preterm birth, allowing for early interventions to improve outcomes. Given the increasing rate of preterm labors and their significant health and economic impact, it is essential to evaluate the effectiveness of this tool. This study aims to evaluate the role of cervical length measurement in improving pregnancy outcomes for mothers at risk of preterm birth before 34 weeks of gestation, and propose intervention strategies to reduce its complications.

Methods

After approval by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences with the ethics code IR.AJUMS.HGOLESTAN.REC.1402.100, this cross-sectional study was conducted among high-risk pregnant women with a gestational age ≤34 weeks and a cervical length ≤30 mm who were admitted to Imam Khomeini Hospital in Ahvaz in 2023. The selection criteria included patients who had referred due to pain but did not have cervical dilation. To achieve a total sample size of 189 patients in one group, a significance level of 0.05 and a power of 0.80 was considered. Based on standard statistical methods for assessing the effectiveness of an intervention, we calculated that an effect size of approximately 0.41

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was necessary. This configuration ensured that the inclusion of 189 patients provided us with strong statistical power to detect clinically meaningful outcomes of the intervention. Mothers with gestational age greater than 34 weeks, cervical length less than 30 mm, diabetic patients, patients with hypertension, suspected clinical chorioamnionitis (fever> 38.5°C), vaginal bleeding, history of cervical surgery, structural abnormalities of the cervix before pregnancy, autoimmune diseases, major fetal abnormalities identified in previous ultrasounds or screening tests in the first and second trimesters of pregnancy, and incomplete medical records were excluded from the study. All demographic information of the mother and infant, including gender, age, weight, height, and outcomes of this type of pregnancy, including previous complications, were recorded. Cervical length was measured during hospitalization by the perinatology department specialists.

This study was conducted in compliance with ethical standards. Before initiating the experiment, all participants were fully informed about the objectives, methods, and potential effects of the study, and written informed consent was obtained from each participant. This study adheres to the ethical guidelines of the Declaration of Helsinki and ensures the confidentiality and anonymity of all participants' data. This commitment to ethical standards emphasizes the integrity and reliability of our research findings and methodology. Finally, SPSS 22 was used for statistical analysis. The obtained data were analyzed using descriptive statistics including mean, standard deviation, frequency, and percentage. The normality of the data was examined using Kolmogorov-Smirnov test, and $p<0.05$ was considered significant.

Results

The mean cervical length was reported to be 31.468±8.675 mm, ranging from 30 to 44 mm. The mean maternal weight was 71.46±14.22 kg, ranging from 42 to 114 kg. The mean birth weight of the infants was 2875.50±585.49 g, ranging from 1500 to 4600 g. The mean length of stay in the NICU was 4.89±2.17 days, with a maximum length of stay of 30 days. The mean length of stay from admission to delivery was 3.3±3.04 days, and the mean time from referral to delivery was 38.69±3.01 days. Finally, the mean gestational age at delivery was 36.5 weeks, with pregnancies recorded between 25 and 41 weeks, while the mean gestational age at referral was 30.9 weeks, with a range of 21 to 34 weeks (Table 1).

Most pregnant women at risk for preterm labor had no history of such deliveries, and only 8.5% (16/189) reported previous incidents. Neonatal mortality was significantly low, with only 2.6% (5/189) of infants affected. Similarly, labor complications were reported in 9% (17/189) of cases, while postpartum infections were even less common, occurring in 4.2% (8/189) of cases. Respiratory distress syndrome was observed in 16.9% (32/189) of infants, indicating a significant concern for neonatal care in cases of preterm labor. Furthermore, most infants had five-minute Apgar scores greater than 7, indicating satisfactory neonatal health immediately after delivery in 97.9% of cases (185/189) (Table 2).

Table 1. Clinical and demographic variables in cases of preterm labor

Variable	Lowest	Highest	Mean±SD
Cervical length (mm)	30	44	31.468±8.675
Maternal weight (kg)	42	114	71.46±14.22
Neonatal weight (g)	1500	4600	2875.50±585.49
Number of days in NICU	0	30	4.89±2.17
Number of days the mother was hospitalized	0	18	3.3±3.04
Time of delivery (day)	7	102	38.69±3.01
Average gestational age at delivery (weeks)	25	41	36.5
Average gestational age (weeks)	21	34	30.9

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Table 2. Frequency of maternal and neonatal complications in the study subjects

Maternal and neonatal complications	Number(%)
Premature labor	
No	173(91.5)
Yes	16(8.5)
Infant mortality rate	
No	184(97.4)
Yes	5(2.6)
Complications of childbirth	
No	172(91)
Yes	17(9)
Postpartum infection	
No	181(95.8)
Yes	8(4.2)
Neonatal respiratory distress	
No	157(83.1)
Yes	32(16.9)
Apgar	
<7	4(2.1)
>7	185(97.9)

This study showed a low rate of maternal complications during delivery, with rare occurrences of postpartum hemorrhage, blood transfusions, and placental abruption, underscoring the effectiveness of current preventive measures and prenatal care. However, a small proportion of cases experienced complications, highlighting the need for continuous monitoring and responsive care during labor (Table 3).

Table 3. Distribution of maternal complications in the studied mothers

	Number(%)
Pph	
No	183(96.8)
Yes	6(3.2)
Blood transfusion	
No	187(98.9)
Yes	2(1.1)
Contraction	
No	184(97.4)
Yes	5(2.6)

Analysis of neonatal outcomes showed that most infants did not experience considerable complications. Fetal growth restriction (FGR) was observed in 40 infants (21.2%), growth failure in 4 infants (2.1%), intrauterine fetal demise (IUFD) in 4 infants (2.1%), meconium aspiration in 3 infants (1.6%), and neonatal death in 5 (2.6%). This indicated that the care and monitoring of the infants were robust. However, there were high-risk cases in each category which highlight the importance of continued vigilance and targeted interventions to further reduce these risks.

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Discussion

This study provided a comprehensive review of clinical and demographic variables in women at risk for preterm labor, highlighting significant maternal and neonatal health outcomes. The rarity of neonatal mortality and the overall lack of history of preterm labor among participants suggest the effectiveness of the present perinatal care strategies. However, the significant incidence of neonatal respiratory distress in some cases warrants further monitoring and preventive interventions. Nevertheless, serious maternal complications such as postpartum hemorrhage, blood transfusion, and placental abruption were uncommon, suggesting that effective protocols are in place. Their occurrence, even in a small number of cases, warrants ongoing review and modification of clinical practices. The present neonatal complications confirm the need for robust ongoing care and targeted interventions, and underscores the ongoing pursuit of improvement and adaptability in maternal and neonatal health care to address the challenges of at-risk populations.

Our findings regarding clinical and demographic variables in women at risk for preterm labor, particularly with respect to cervical length, are consistent with several established studies, but also present unique contrasts. The mean cervical length of 31.468±8.675 mm in all participants in our study is significantly greater than those reported in studies in which shorter cervical lengths predict higher risks of preterm labor. Munivenkatappa et al. found that a cervical length of less than 2.5 cm at 18-24 weeks could predict preterm labor in 35% of cases (12). In contrast, our study participants, with relatively longer cervical lengths, showed a lower incidence of severe neonatal outcomes, supporting the hypothesis that greater cervical length generally indicates a reduced risk of preterm labor. Van Baaren et al. reported the cost-effectiveness of combining cervical length measurement with fetal fibronectin testing, which could result in significant cost saving (13). However, our study did not include fibronectin testing. The low incidence of neonatal and maternal complications may suggest similar potential for cost-effective management strategies, albeit without the detailed economic analysis provided by Van Baaren et al. (13). Studies such as those conducted by Gudicha et al. (14) and Nooshin et al. (15), which highlight the sensitivity and predictive value of cervical length for preterm labor, emphasize the importance of personalized assessment and predictive strategies. The wider range of cervical lengths in our study suggests that, while mean cervical length can be reassuring, individual assessments are crucial for accurate risk stratification, as evidenced by the consistent occurrence of neonatal respiratory distress and other complications in our group.

Furthermore, studies by Berghella et al. (16) and Ho et al. (17) suggest that knowledge of cervical length can significantly alter outcomes by prolonging gestation or accurately predicting the time of delivery. Our findings support the need for regular cervical monitoring, as even with favorable overall outcomes, several cases of preterm labor and complications emphasize the need for ongoing and vigilant assessment. The differences in our findings compared with those in the literature may be attributed to variations in study populations, measurement methods, and local clinical practices. Furthermore, integrating cervical length measurements with other predictive markers such as uterine angle and fetal fibronectin may provide a more comprehensive approach to the management and prediction of preterm labor.

Our findings on cervical length and its association with preterm labor outcomes gain further context compared to larger studies. Studies by Fouad et al. (18) and Bhati et al. (19) demonstrated that shorter cervical length was associated with increased risks of preterm labor in high-risk and primiparous populations, respectively. These findings are consistent with our observations, where greater cervical length appeared to be associated with fewer preterm complications, suggesting a protective effect of longer cervical measurements against preterm labor. In addition, Wong et al. (20) and Youssry et al. (21) provide insights into the predictive accuracy of specific cervical length thresholds. Wong et al. reported that a cervical length ≤25.5 mm could predict delivery within one week with 100% sensitivity (20), while Youssry et al. found

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that a cervical length ≤2.56 cm predicted delivery within 24 hours (21). These studies emphasize the critical value of accurate cervical length measurement in timely intervention and management strategies and highlight the potential of cervical length as an independent predictive tool for imminent labor.

Gulersen et al. further emphasize the risks associated with having a short cervix, noting that women with a cervical length ≤10 mm are at increased risk of preterm labor before 34 weeks (22). This complements the notion in our study that monitoring cervical length as part of routine prenatal care can be important in managing and possibly reducing the risk of preterm birth. In contrast, our study's use of cervical length measurement is not associated with the impressive predictive power observed in the studies of Wong et al. (20). Youssry et al. continue to support the idea that longer cervical length generally indicates a lower risk of preterm labor (21). These differences could be due to our larger study population and different risk profiles, which may reduce the effect of cervical length observed in more targeted studies. Integrating cervical length measurements with other diagnostic tests has been highlighted in some studies, as proposed by Van Baaren et al. (13). For integration with fetal fibronectin, this study points to an emerging practice model in which multifactorial assessments can significantly increase the predictive accuracy and cost-effectiveness of preterm labor management. Implementation of such combined strategies could be particularly beneficial in healthcare settings similar to ours, potentially reducing unnecessary interventions while protecting maternal and neonatal health.

Thain et al. reported that cervical length was significantly shorter in the second and third trimesters in the preterm labor group. Cervical length is a moderate predictor of preterm labor with good negative predictive value and relatively good specificity. Screening for cervical length by ultrasound in Asian pregnant women between 18 and 22 weeks of gestation with a dilation ≥2.48 cm may help identify a group of women at risk for preterm birth (23). A study by Melamed et al. showed that cervical length is not a good predictor of preterm labor (24). However, in women without a history of preterm labor, cervical length was significantly associated with the interval between examination and delivery. In accordance with the present study, Palacio et al. measured cervical length to reduce the length of stay in patients hospitalized for preterm labor and concluded that patients with a cervical length greater than 25 mm who were discharged after 12 to 24 hours of observation did not differ from the control group regarding the age at termination of pregnancy and the rate of preterm labor (25).

Chiossi et al. developed a protocol for measuring cervical length to reduce the rate of spontaneous preterm labor in women with labor pain based on the discharge of patients with a cervical length greater than 30 mm and the hospitalization of patients. With a cervical length less than 20 mm and between 20 and 30 mm in case of labor pain, it is recommended to observe and care for them for 24 hours, and in the absence of pain, it is recommended to measure cervical length in all patients with preterm labor pain (26).

In our study, cervical length measurement was performed via transvaginal ultrasound, which increases our ability to predict preterm labor in primiparous patients, which is essential for timely medical interventions. However, the focus on primiparous patients limits the generalizability of our results. Furthermore, the effectiveness of this technique can vary with the skill of the operator, and its invasive nature may not be acceptable for all patients. It is better to integrate cervical length measurement with other clinical indicators for a comprehensive risk assessment.

The present study confirms the effectiveness of measuring cervical length by transvaginal ultrasound as a reliable predictor of preterm labor in nulliparous patients. This technique allows for timely and accurate assessment and facilitates early and potentially preventive interventions for preterm labor. Despite its strengths, the applicability of our findings is largely limited to primigravida women, and the invasiveness of this method may impact its acceptance among pregnant women. Although transvaginal ultrasound remains a powerful tool in obstetrics, its use should be considered alongside other noninvasive methods and

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clinical assessments to ensure comprehensive care for all pregnant women. Future studies should aim to extend these findings, examine predictive accuracy in broader populations, and explore additional predictive markers to improve the management and outcomes of preterm labor.

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