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1Original Research Article

Midtrimester cervical length as a predictor of labour outcomes: a prospective observational study

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ABSTRACT

Background: Preterm birth remains a major contributor to neonatal morbidity and mortality worldwide. Mid-trimester cervical length assessment using transvaginal ultrasound is useful in predicting a spectrum of labour outcomes, including preterm birth, post-dated pregnancy, need for labour induction, and operative delivery.
Methods: This hospital-based prospective observational study was conducted at Justice K. S. Hegde Charitable Hospital from June 2023 to November 2024. Mid-trimester cervical length was measured using transvaginal ultrasound between 18 and 24 weeks of gestation in 96 asymptomatic primigravida and second gravida women with singleton pregnancies. Participants were followed until delivery, and labour outcomes were recorded. Statistical analysis was performed using statistical package for the social sciences (SPSS) version 20.0.
Results: The mean cervical length was 3.71±0.38 cm. Spontaneous labour occurred in 72.9% of participants, while 27.1% required labour induction. Vaginal delivery occurred in 72.9% and caesarean section in 27.1%. Cervical length showed a statistically significant association with the onset of labour (p=0.012) and mode of delivery (p=0.023), suggesting its potential role as an independent predictor of labour dynamics beyond traditional risk stratification. Shorter cervical lengths were associated with spontaneous labour, whereas longer cervical lengths were linked to labour induction and caesarean delivery.
Conclusions: Mid-trimester cervical length measurement by transvaginal ultrasound, even within the normal range, serves as a clinically relevant predictor of labour outcomes. Its integration into routine antenatal assessment may enable more precise risk stratification, improved counselling, and individualized obstetric management, extending its role beyond traditional preterm birth prediction.

Keywords: Cervical length, Preterm birth, Labour induction, Caesarean delivery, Transvaginal ultrasound, Pregnancy outcomes

INTRODUCTION

Preterm birth significantly contributes to neonatal morbidity and mortality worldwide.[1] Iatrogenic or medical causes account for approximately 20–25% of preterm births (PTBs), whereas 75–80% arise spontaneously as a result of either preterm labour or preterm prelabour rupture of membranes (PPROM). Spontaneous preterm labour is a multifactorial event rather than a standalone condition, arising from interactions between infections such as chorioamnionitis, urinary tract infections, and bacterial vaginosis, along with uterine overdistension, cervical or placental abnormalities, and various maternal, fetal, and sociodemographic factors.[2]

It is widely acknowledged that a short cervical length during the second trimester is consistently associated with an increased risk of preterm birth.[3-5] Recent studies have demonstrated that transvaginal cervical length assessment not only predicts preterm birth but also serves as an objective tool for assessing labour induction outcomes and delivery patterns, often outperforming traditional clinical methods such as the Bishop score.[26] Transvaginal ultrasound enables precise assessment of cervical length, diameter, and changes in the shape and curvature of the cervix, often detecting these changes earlier than clinical examination.[6]

Preterm birth remains a leading cause of neonatal mortality and morbidity, often resulting in complications such as neonatal sepsis, respiratory distress syndrome, birth asphyxia, hypoxic-ischemic encephalopathy, neurological impairment, and necrotising enterocolitis.[7] Postdated pregnancies is associated with increased risks of meconium-stained amniotic fluid, meconium aspiration syndrome, fetal macrosomia, oligohydramnios, labour dystocia, and operative interventions.[8]

Cervical remodelling in labour involves structural and biochemical changes in cervical tissue. Preterm labour occurs when inflammatory pathways (complement activation) trigger premature cervical collagen breakdown via matrix metalloproteinases, whereas term labour mainly relies on progesterone withdrawal.[9]

Accurate prediction of preterm birth is crucial for timely intervention. Cervical length measurement by transvaginal ultrasound during the mid-trimester, between 16 and 24 weeks, is the most reliable predictor, with a cervical length of less than 25 mm indicating increased risk. Additional predictive tools include fetal fibronectin testing, uterine artery Doppler, maternal serum biomarkers, and risk or symptom based assessment.[10] Emerging techniques, including cervical elastography and evaluation of the uterocervical angle, may enhance prediction, although their routine use is limited by technical and logistical constraints.[11]

Recent evidence suggests that cervical length should be interpreted as a dynamic and continuous variable influencing the entire spectrum of labour outcomes, including induction success and caesarean delivery risk, rather than as a fixed threshold parameter.[27] Transvaginal ultrasounds is preferred over transabdominal or transperineal approaches due to its superior precision, reproducibility, and minimal interference from maternal or fetal structures. Cervical length remains stable until approximately 28 weeks of gestation, after which gradual shortening occurs. The World Health Organization recognises preterm birth as a global health priority requiring evidence-based prevention, while the International Society of Ultrasound in Obstetrics and Gynaecology and the Society for Maternal-Fetal Medicine recommend mid-trimester transvaginal cervical length screening protocols for risk stratification and management in pregnancy.[24,25] Incorporating mid-trimester cervical length assessment into routine antenatal care enables early identification of high-risk women, facilitates preventive interventions such as progesterone therapy or cerclage, and contributes to improved pregnancy outcomes.[12]

METHODS

Study design

This is a hospital based prospective observational longitudinal study.

Study place and duration

The study was conducted in the Department of Obstetrics and Gynaecology at Justice K. S. Hegde Charitable Hospital, a teaching hospital attached to K. S. Hegde Medical Academy, Nitte (Deemed to be University), from June 2023 to November 2024.

Selection criteria

A total of 96 asymptomatic primigravida and second gravida women with singleton pregnancies between 18 and 24 weeks of gestation and a cervical length ≥2.5 cm on transvaginal ultrasound were enrolled after Institutional Ethics Committee approval. Women with multiple pregnancies, polyhydramnios, cervical length ≤2.5 cm, previous history of preterm birth/cervical surgery/second-trimester pregnancy losses, uterine or fetal anomalies, medical comorbidities, smoking history, or unwillingness for follow-up were excluded. The exclusion of women with cervical length ≤2.5 cm allowed focused evaluation of cervical length variability within the normal range, which is less explored in the literature and may have implications for broader obstetric outcomes beyond high-risk populations.

Method of study

Gestational age was determined using the last menstrual period and confirmed by first-trimester ultrasound. Basic demographic details and a detailed medical history were obtained, and a clinical examination was performed for the study participants. Cervical length was measured during the routine anomaly scan using transvaginal ultrasound with a 5–9 MHz probe, with three measurements taken over three minutes and the mean value recorded. Participants were followed until delivery, and outcomes assessed including mean cervical length, onset of labour (spontaneous or induced), gestational age at delivery, and mode of delivery and neonatal follow up.

Statistical analysis

Statistical analysis was conducted using statistical package for the social sciences (SPSS) 20.0. Continuous variables were reported as mean values with standard deviations, while categorical variables were reported as frequencies

and percentages. The unpaired t-test was used to determine the statistical significance of mean differences between two groups. A one-way analysis of variance (ANOVA) was applied to compare the means of continuous variables across more than two groups. To assess differences in proportions of categorical variables between groups, the Chi-square test was employed. A p value of less than 0.05 was deemed statistically significant.

RESULTS

Participant demographics

The majority of participants in this study were aged between 20 and 30 years (77.1%), followed by those aged 30 and above (17.7%). Only a small portion of participants (5.2%) were under 20 years of age. The average age of the study population was 25.80±4.44 years. In terms of parity, 65.6% were primigravidas, while 34.4% were second gravidas. The majority of participants (56.3%) had a normal body mass index (BMI), while 30.2% were classified as overweight or obese, and 13.5% were underweight. The average BMI was 22.78±4.23.

Labour and delivery outcomes among the participants

The onset of labour was predominantly spontaneous (72.9%), while the remaining 27.1% required induction of labour. In terms of mode of delivery, 72.9% of participants had a vaginal delivery, and 27.1% had caesarean section. The most common reason for caesarean section was non-progression of labour (38.4%), followed by various other obstetric indications (46.3%) and failed induction (15.3%). Birth weight data indicated that 81.2% of infants had a normal birth weight, with an average birth weight of 2.90±0.46 kg. In this study, shorter cervical length measured during the mid-trimester was related to a higher risk of preterm birth, which in turn led to extended NICU care and neonatal complications, including sepsis and respiratory distress of the newborn. There was no statistically significant difference in neonatal complications between preterm and postdated babies.

Cervical length grouping

To explore the relationship between cervical length and pregnancy outcomes, participants were categorised into three groups based on cervical length measurements taken between 18 and 24 weeks of pregnancy - group A: cervical length between 2.6 and 2.9 cm (n=2), group B: cervical length between 3.0 and 3.9 cm (n=69), and group C: cervical length of ≥4.0 cm (n=25).

Cervical length and onset of labour

Cervical length was also correlated with the onset of labour. All those participants in the 2.6–2.9 cm group (group A) experienced spontaneous onset of labour. In the 3–4 cm group (group B), 75.4% experienced spontaneous labour, while 24.6% required labour induction. For those with cervical lengths ≥4 cm (group C), 64% had spontaneous labour, and 36% required induction of labour. The difference in cervical length between the spontaneous and induced labour groups was statistically significant (p=0.012), with induced labour being associated with longer cervical lengths.

Table 1: Distribution of demographic characteristics, cervical length groups, and labour outcomes among study participants (n=96).

Parameter	N (%)	Cervical length group distribution	P value
Age group (years)			
<20	5 (5.2)	Mean: 3.54±0.52 cm	0.303
20–30	74 (77.1)	Mean: 3.72±0.38 cm	
≥30	17 (17.7)	Mean: 3.69±0.39 cm	
BMI (kg/m²)			
Underweight (<19)	13 (13.5)	Mean: 3.83±0.40 cm	0.484
Normal (19–25)	54 (56.3)	Mean: 3.70±0.34 cm	
Obese (≥25)	29 (30.2)	Mean: 3.67±0.40 cm	
Onset of labour			
Spontaneous (70)	70 (72.9)	Group A: 2 (100%), group B: 53 (76.8%), group C: 15 (60.0%)	0.012
Induced (26)	26 (27.1)	Group A: 0 (0%), group B: 16 (23.2%), group C: 10 (40.0%)	
Gestational age at delivery (weeks)			
<32	1 (1.0)	Group B: 1 (1.4%)	0.028
32–37+6	11 (11.5)	Group A: 2 (100%), group B: 7 (10.1%), group C: 2 (8.0%)	
38–41+6	84 (87.5)	Group B: 61 (88.4%), group C: 23 (92.0%)	
Mode of delivery			
Normal vaginal delivery (70)	70 (72.9)	Group A: 2 (100%), group B: 55 (79.7%), group C: 13 (52.0%)	0.023
Caesarean section (26)	26 (27.1)	Group A: 0 (0%), group B: 14 (20.3%), group C: 12 (48.0%)	

Cervical length and gestational age

When comparing cervical length with gestational age at delivery, significant differences were observed. Most participants with a cervical length of 3–4 cm (group B) and ≥4 cm (group C) delivered between 38 and 41+6 weeks (88.4% and 92.0%, respectively), while those with a cervical length between 2.6–2.9 cm (group A) delivered earlier (all between 32 and 37+6 weeks). The p value of 0.028 suggests that cervical length is a significant factor in determining gestational age at delivery.

Cervical length and mode of delivery

Cervical length was also found to influence the mode of delivery. All participants with a cervical length of 2.6–2.9 cm (group A) had normal deliveries, while those in the 3–4 cm group (group B) had a higher rate of normal deliveries (79.7%), though 20.3% required caesarean section. In contrast, only 52.2% of participants with a cervical length ≥4 cm (group C) had normal delivery, with 48% requiring caesarean sections. This suggests that longer cervical lengths may be associated with a higher likelihood of caesarean delivery.

DISCUSSION

In our study, the mean maternal age of the study population was 25 years, and the average BMI was 22.78±4.23. Cervical length showed no statistically significant association with maternal age or BMI. These findings were consistent with Salomon et al and Arora et al, who concluded that mid-trimester cervical length remains largely independent of maternal demographic characteristics.[13,14] The average cervical length of the women in our study was 3.71±0.38 cm. Likewise, Hassan et al found the mean cervical length in their study population as 37.5 mm.[15]

Although none of the participants in this study had a cervical length ≤2.5 cm (as these were excluded), even the lower-normal range (2.6–2.9 cm) showed increased preterm risk. Recent studies have demonstrated that transvaginal cervical length assessment serves as a valuable predictor of both labour induction outcomes and preterm birth risk, with shorter cervical length being associated with higher rates of successful vaginal delivery and a progressive increase in the risk of spontaneous preterm birth, even within ranges not meeting the traditional cutoff for a short cervix.[4,16,17,28]

Emerging evidence suggests that cervical length should be interpreted as a continuous variable rather than using a strict cutoff value.

Another significant association was observed between cervical length and onset of labour (p=0.012), with women in the longer cervical length groups demonstrating higher rates of labour induction, similar to the observations reported by Li et al.[18] In addition, Soysal et al reported that cervical length measured in the midtrimester may predict late and post-term pregnancy.[19] Our study mirrors these findings, as women with a cervical length ≥4 cm had higher rates of postdated delivery, supporting the hypothesis that a longer cervix may reflect delayed cervical ripening and reduced responsiveness to endogenous prostaglandins, thereby necessitating medical intervention.

This finding is supported by recent observational studies which report that increased cervical length is associated with prolonged induction-to-delivery intervals and lower success rates of vaginal delivery.[27]

In our study, longer mid-trimester cervical length was associated with increased caesarean delivery rates, likely reflecting unfavourable cervical conditions leading to failed induction or non-progress of labour, consistent with findings from recent studies.[20,21,29] Rani et al also reported higher caesarean rates among women with cervical length >4 cm.[22]

In our study, 48% of women with cervical length ≥4 cm underwent caesarean section. Additionally, Datta et al stated that cervical length exceeding 40 mm is linked to an increased likelihood of primary caesarean delivery.[23]

Unlike most previous studies focusing on preterm birth prediction, the present study addresses the limited evidence on the predictive value of mid-trimester cervical length within the normal range and demonstrates that even within this range, variations significantly influence labour onset, induction requirements, and mode of delivery.

This highlights its role as a continuous predictor of overall labour behaviour and supports its broader clinical application as a non-invasive tool in routine antenatal care, consistent with international guidelines.

Limitations

The study is limited by operator-dependent measurements, a single-centre design, and a small sample size.

CONCLUSION

From a clinical perspective, mid-trimester cervical length assessment can assist obstetricians in anticipating labour patterns, counselling women regarding the likelihood of induction and operative delivery, and optimising intrapartum preparation. Its incorporation into routine antenatal evaluation may facilitate individualized obstetric planning and improve maternal and neonatal outcomes.

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