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Cervical length as a predictor for preterm birth in low-risk women

Mohamed. K. Etman [1], Mohamed. S. Bakry [1], Vivian. A. Shehata [1*], Sahar. M. Y. El baradai [1]

[1] Obstetrics & Gynecology Department, Faculty of Medicine, Fayoum University, Fayoum 63511, Egypt.

* Correspondence: Vivian. A. Shehata, va1111@fayoum.edu.eg; Tel.: (002) 01065133787.

Abstract

Introduction: A common method used to calculate the potential risk of preterm birth is CL measurement. The development of markers with enhanced test characteristics is an important challenge because of the high falsely positive rate.

Aim of the study: The current study aimed to determine the value of cervical length (CL) measurements (as determined by the single- and two-line techniques) in predicting of preterm birth (PTB).

Subjects and Methods: The current study was a prospective cohort study carried out on 120 asymptomatic primigravida women at low risk of preterm labor (PTL), attending the Gynecology and Obstetrics department at Fayoum University Hospital, between February 2022 to August 2022. the study was designed to evaluate the role of the Cervical length (CL) measurements in Preterm birth (PTB) prediction. cervical length was measured by trans-vaginal ultrasound. Pregnancy data and maternal history were documented, then, delivery-related statistics were obtained.

Results: The average age of included women was (21.79 ±3.3) years old, an average BMI (24.6 ±5.8) kg/m^2, and an average GA at delivery of (38.46 ±1.98) weeks. Out of the studied 120 women fifteen (12.5%) experienced a preterm. birth Cervical length was estimated by single and two-lines methods; CL was significantly shorter among pre-term women as compared with term. There was a positive linear moderate correlation between GA and CL-one line (r= 0.260, *P =0.004*). Also, a positive linear strong correlation between GA and CL-two lines (r= 0.716, *P <0.001*). Using ROC curve analysis, the sensitivity and specificity of CL for prediction of pre-term birth was evaluated.

Conclusions: The CL (single and two-lines) approaches are effective at predicting preterm birth. However, by incorporating additional factors as CL, maternal demographics, and obstetric history, the detection of sPTB rate can be enhanced even further.

Key words: Cervical Length; Preterm Birth; Low-Risk Women.

1. Introduction

Preterm birth can be defined as birth prior to 37 weeks of gestation period. The incidence of preterm birth was 10.6% in 2014, about 14.84 million live premature births [1]. Additionally, it is a diverse phenotype with numerous molecular mechanisms. almost all of preterm deliveries occur as a result of spontaneous labor that has no known cause and cannot be prevented [2].

Preterm birth (PTB) prediction requires the identification of risk factors, however existing approaches are ineffective at identifying pregnant women who are more likely to have PTB due to their low sensitivity to demographic and behavioral risk factors [3].

Because preterm delivery has multiple etiologies, accurate preterm labor/preterm birth prediction in asymptomatic women still a challenging clinical problem. The past history of PTB is the most important indicator of future PTB [4]. All known historical risk factors for PTB (such as obesity), with the exception of prior PTB, have a limited ability to predict future PTB. As a result, efforts are still being made to find new ways to determine women who are at risk of PTB [5].

2. Subjects and methods

2.1. Subjects

This is a Prospective Cohort study, conducted over six months between February 2022 to August 2022 after obtaining the approval of the Scientific Research Ethics Committee of the Faculty of Medicine, Fayoum University. The study was approved by local research ethics committee of faculty of medicine Fayoum University, number (M570) in its session (91) on 13/2/2023.

The study population were 120 asymptomatic primigravida women with low risk of preterm labor (PTL), with intact membranes and singleton gestations, attending the Gynecology and Obstetrics department at Fayoum University Hospital in order with the following inclusion and exclusion criteria:

According to data from multiple research, cervical characteristics such the cervical length (CL) and fetal fibronectin can be used for prediction of preterm labor. Some individual practitioners have begun using universal cervical length screening, however there is ongoing discussion on its therapeutic value and cost-effectiveness in the low-risk group [6].

Preterm birth prediction and avoidance in asymptomatic women have advanced significantly; uterine cervix measurement currently has a 55% sensitivity for a 10% misleading rate, and administration of progesterone to pregnant females with short (15 mm) cervix can reduce the chance of preterm birth at less than 34 weeks of pregnancy by 45% [7].

Inclusion criteria

Age of Patients from 18-35 years old, only primigravida women who will not be showing any symptoms at the time of their CL assessment will be eligible for inclusion to our study between (20+ 0 to 28+ 0 weeks gestation). Women considered asymptomatic if they had no signs or symptoms of preterm labor (i.e. uterine contractions, abdominal or lower back pain, pelvic pressure, vaginal bleeding, or leakage of amniotic fluid) and patient acceptance to join the study after signing an informed consent.

Exclusion criteria

Patient's refusal, women who have had multiple pregnancies or who exhibit contraction pain signs, cervical cerclage,

massive vaginal bleeding, tocolysis at admission, or cervical manipulation such as vaginal douche, intercourse or digital examination within the previous 24 hours and preeclampsia, Diabetes mellitus (DM), hyperthyroidism or asthma.

The researcher explained the study's goals to the participants, the examination, and the investigation that was done. Additionally, the study's right to keep their information private and respect their decision not to participate. Before participating in the study, everyone who participated provided their written consent.

2.2. Methods

Detailed history taking

At study entry, baseline demographics, age and parity of the mother, gestational age at conception and delivery, detailed pregnancy history, including any prior preterm births and any pregnancy complications

Scan Procedure

All women who were pregnant underwent TVS examinations under aseptic precautions. The pregnant women were positioned in the dorsal lithotomy posture after being told to empty their bladders. With minimal pressure, the vaginal probe was inserted into the anterior fornix. With the best magnification, the sagittal view of the cervix and anterior uterine wall was obtained. The surrounding hypoechoic zone of cervical mucosa assisted in the identification of the echogenic endocervical canal. Internal OS was recognized as the point where the cervical mucosa ends in the lower uterine

segment. External OS was recognized as the junction of the anterior and posterior lips of the cervix in the vaginal canal.

The measurement of Cervical Length (CL) was done as follows:

- The single-line method: The cervix was visible in sagittal plane. The cervical canal is a line that passes through the central portion of the cervix's straight axis. This image is magnified as it takes up at least 50% of the screen, and the probe should apply as little pressure to the cervix as feasible. The examination should last three to five minutes, and the cervical length is determined by measuring the single line from the internal to external OS (Figure 1A).
- Two-line method: The distance between the point of maximal curvature and the direct line joining the two cervical OS was measured to determine the CL in a group of 22 women. The cervical curve's maximum excursion points and the distance from this point of curvature to the internal OS and external OS were added together to get the distance of two-line method to measure the cervical length [8]. If the greatest excursion distance is less than 5 mm, the single-line measurement is sufficient. The two-line approach or tracing method is advised to obtain an accurate measurement of the cervical length when the distance is more than 5 mm (Figure 1B).
- Following that, women were monitored during the remainder of their pregnancies, and the gestational age at delivery was noted. The pregnant women were evaluated in two groups as a result: Pregnant women who delivered before (36,6) weeks

3

gestation were in group (A), while those who did so after that time were in group (B).
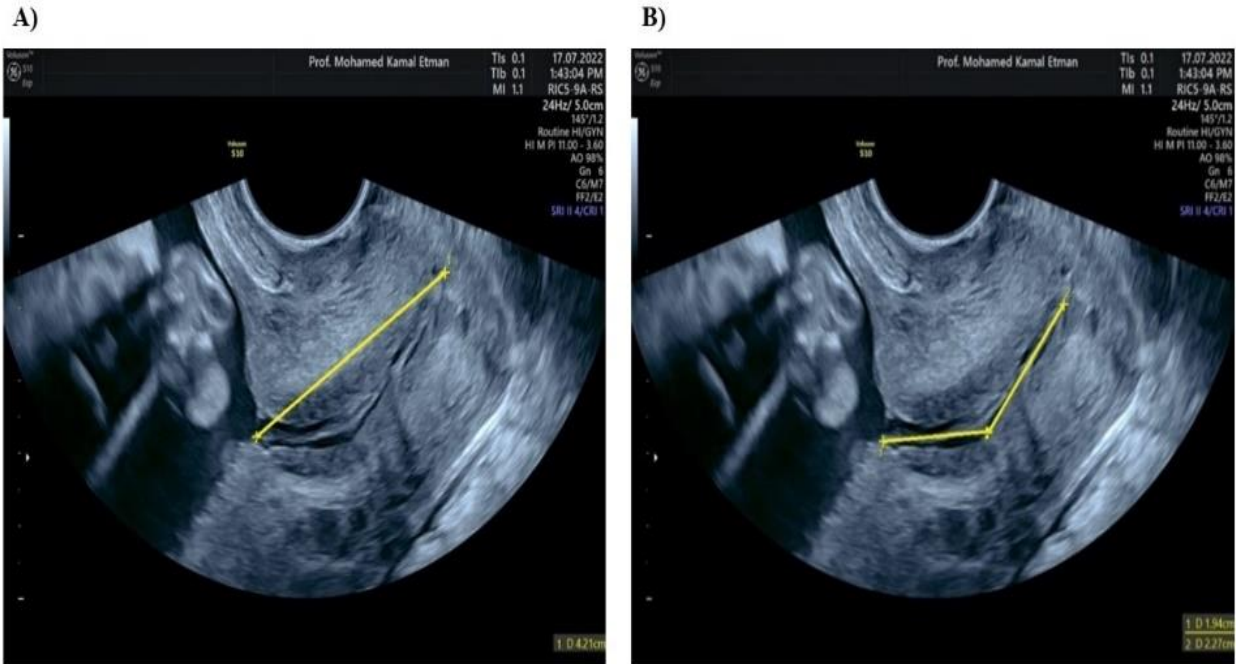

Figure 1: The measurement of Cervical Length (CL). A) The single-line method, B) The two-line method.

2.3. Statistical Methods

Data were gathered, reviewed, coded, and entered into IBM SPSS version 20 of the Statistical Package for Social Science.

Quantitative data were presented as mean, standard deviations, and ranges when their distribution was found to be parametric, while qualitative data were given as numbers and percentages.

3. Results

The distribution of the studied women depending on the outcome of pregnancy showed that out of 120 women, 15 (12.5%) experienced a preterm birth, while the remaining, 105 (87.5%) women had term birth complete after 37 weeks gestation (Figure 2). Among 22 women in the current study, we further assessed the CL by two-line method and as showed in table (2), CL by 2-line method was significantly shorter among pre-term as compared with term women (4.25 ±0.42 vs. 3.71 ±0.27, $P =0.025$).

The correlation between GA at delivery with Cervical Length (CL) at assessment revealed positive linear moderate correlation between GA and CL-one line (r= 0.260, $P=0.004$). There was positive linear strong correlation between GA and CL-two lines (r= 0.716, $P<0.001$), as well.
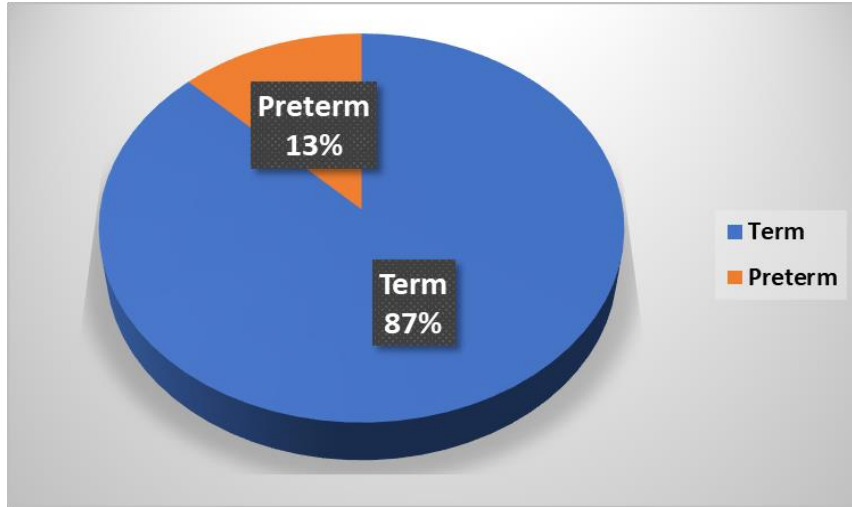
Figure 2: Distribution of the studied population according to the outcomes of pregnancy.

A shown in Figure 3A, the comparison of cervical length evaluated by single-line method revealed that CL was obviously shorter among pre-term women as compared with term. Also, we further assessed the CL by two-line method, where CL was significantly shorter among pre-term as compared with term women (Figure 3B).
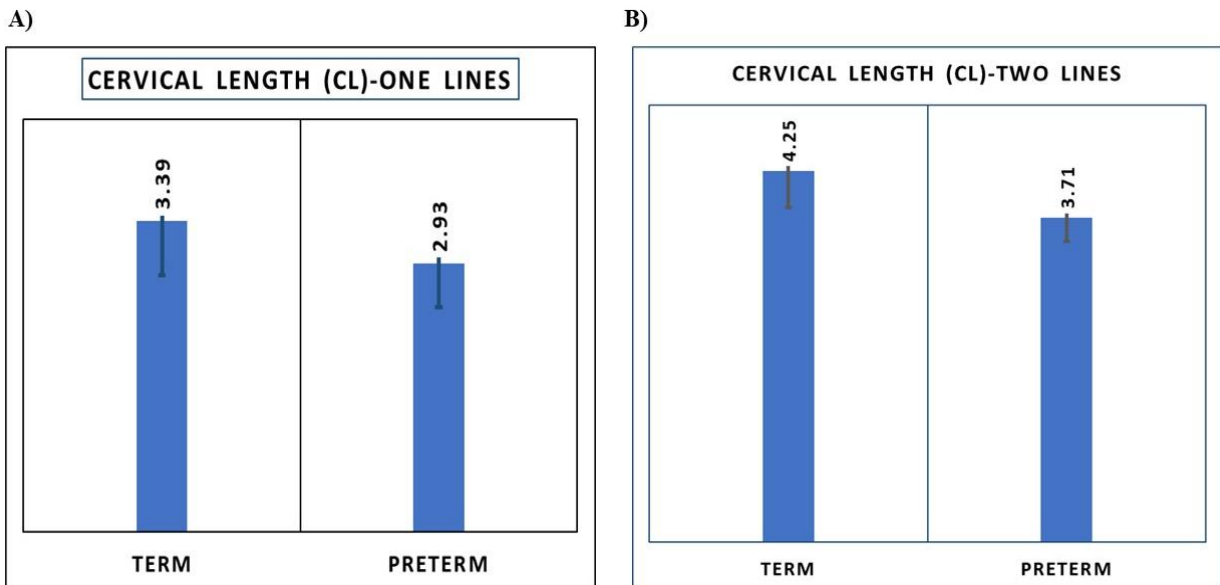

Figure 1: Comparison of cervical length assessed by A) one-line and B) two-lines methods between the studied population according to the outcomes of pregnancy. (term vs. pre-term).

4. Discussion

Preterm birth (PTB) is the term used to describe live births that happen before 36 weeks of pregnancy. It is thought to be the main factor in perinatal death and morbidity, as well as one of the main contributors to long-term morbidity and higher medical expenses [9]. Approximately 70% of PTBs are spontaneous [10]. The ultrasound measurement of the cervix according to cervical length (CL) has been discovered to be a reliable predictor of preterm birth during the first and second trimesters [11]. However, there is conflicting evidence about the efficacy of universal CL screening in the second trimester [12,13].

Preterm birth rates among the women in the current research were 12.5%. In prior research, PTB prevalence was 9.6% (n = 84) at under 37 weeks of pregnancy. An Egyptian study found a higher prevalence of 28% [14]. Additionally, Khamees *et al.* (2022) observed a 26% PTB rate. Studies have linked varying rates to varying sample sizes [15]. Furthermore, PTB rates prior to the 37th week of pregnancy are represented in our data. For the prediction of sPTB, CL is an extensively used marker, particularly in high-risk pregnancies [16]. According to one- and two-line methods, CL was shown to be considerably shorter in pre-term women compared with term women in singleton asymptomatic pregnancies. Additionally, we discovered a statistically significant positive linear connection between GA at delivery and CL at the time of evaluation (16+0 to 24+0 weeks of gestation). The CL and GA at delivery have a clear linear positive connection, similar to what was previously documented for singletons [17], In their investigation, Conde-Agudelo *et al.* (2010) found that CL and GA have a linear relationship [18]. Therefore, CL might be applied as a sPTB marker [19]. Transvaginal sonography (TVS) was used in their study to assess cervical length (CL) as a predictor of spontaneous preterm birth (sPTB). They found that sPTB at 37 weeks was associated with CL 2.5 cm, with a low sensitivity of 31.1% and a high specificity of 95.6%. This was also in line with findings by Iams *et al.* (1996), who noted that in a cohort with a sPTB rate of 4.3%, For PTB before 35 weeks, CL 2 cm at 24 weeks shows a sensitivity of 23 percent and a specificity of 97%. [20]. other studies made comparable findings in their own research. According to numerous studies, CL has a poor sensitivity (60%) and a 10% maximum false-positive ratio when used to predict premature labor [21-23].

According to prior studies, progesterone therapy may avoid PTB in pregnant females whose cervix appeared short on an ultrasound. Women with incidentally short cervices (CL 20 mm but more than 10 mm) are advised to use vaginal progesterone, according to the American College of Obstetricians and Gynecologists [24]. The findings of our studies demonstrate the necessity of updating the current recommendations.

The current study had the advantage of being prospective, whereas the majority of earlier investigations were retrospective and, as a result, had limits. Despite this, there are several drawbacks to the current study. Second, we had to rely on the mothers'

responses when we called in certain cases to assess the gestational age at birth as the pregnancy's final result. The third drawback was that we only considered a small number of PTB-affecting elements, despite the fact that we are aware of additional, equally important factors.

Conclusion

According to our study, a novel screening technique for sPTB (spontaneous preterm birth) prediction is the cervical length (CL) single and two-line method. However, by incorporating additional factors such as maternal demographics and obstetric history, the detection rates of sPTB can be increased even more. This would be crucial in the early detection of sPTB to enable prompt measures for its best management, which may improve newborn outcomes.

Ethical approval and consent to participate: All of the participants in the study received information on the study's protocols as well as information about their right to decline participation or withdraw from the trial without providing a reason. Participants received guarantees of anonymity and confidentiality for all information given. The necessary administrative requirements were met. Prior to starting the work, the research ethical commission (REC) of the Fayoum University faculty of medicine gave its ethical permission.

Conflict of interest: None declared.

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