

Cervical Length Versus Modified Bishop's Score for Prediction of Successful Labor

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Received date: 29-08-2015; **Accepted date:** 17-10-2016; **Published date:** 30-06-2017

Abstract

Background: Bishop's score is a subjective scoring system, investigators tried to find another way to objectively predict the success of labor induction.

Aim: The aim of this study is to compare the cervical length (CL) measured by transvaginal ultrasound (TVS) versus modified Bishop's score for prediction of successful labor induction in nulliparous women.

Subjects and Methods: A total of 210 nulliparous women admitted with premature rupture of membranes for induction of labor included in this comparative prospective study conducted in Ain Shams University, Department of Obstetrics and Gynaecology from February 2013 to February 2015. Studied women examined by TVS for measurement of CL and vaginally to calculate the modified Bishop's score, followed by induction of labor. Collected data analyzed using the independent Student's t-test, and Chi-square tests of Statistical Package for Social Sciences, (Chicago, IL, USA). Outcome measures; success of induction process defined as vaginal birth after induction and duration of labor induction.

Results: One hundred and forty-three women of studied women had CL <28 mm; 76.25% (122/160) of them delivered vaginally and 21 delivered by cesarean section (P 0.03). One hundred and forty-six women of studied women had modified Bishop's score >4; 80% (128/160) of them delivered vaginally and 18 delivered by cesarean section (P 0.006). Out of 67, 38 women had CL ≥ 28 mm delivered vaginally, and this difference was statistically significant (P 0.002). The CL <28 mm was significantly more specific with more positive predictive value (PPV) as the predictor of successful labor induction (86.25% and 61.4%, respectively) compared to modified bishop's score (50% and 23.8%, respectively), (P 0.007 and P 0.001; respectively). Induction to delivery time was significantly less in women with CL <28 mm compared to women with CL ≥ 28 mm (8.5 [5.2] vs. 15.2 [6.4]h, respectively) (P 0.02, 95% confidence interval [CI]; 4.9, 6.7, 8.4). Women with modified Bishop's score >4 had significantly less induction to delivery time compared to women with modified Bishop's score of ≤ 4 (7.7 [4.25] vs. 10.8 [5.30] h, respectively) (P 0.01, 95% CI; 1.6, 3.1, 4.5). Conclusion: CL <28 mm measured by TVS was significantly more specific with more PPV compared to modified bishop's score in prediction of successful induction of labor. Both CL measured by TVS and modified bishop's score were complementary tool and associated with successful induction.

Keywords: Cervical length; Labor induction; Modified Bishop's score

Introduction

Premature rupture of membranes (PROM) is rupture of the fetal membranes before the onset of labor. Management of rupture of fetal membranes (ROM) should be conservative if ROM occurs before 37 weeks' gestation, whereas labor should induce if ROM occurs at term [1].

Induction of labour is a process where the uterine contractions initiated by medical or surgical mean before the spontaneous onset of labor [2]. The reported rate of labor induction increased in the past decade [3].

Multipara, non-obese, tall women with estimated fetal weight <3500 g are favourable factors for vaginal delivery [4,5].

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DOI:

10.4103/2278-960X.194488

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The success of induction of labor is highly related to the cervical condition [6]. In 1964, Bishop stated that cervical condition is the most important factor for prediction of successful labor induction and developed a scoring system based on cervical dilatation, effacement, consistency, and position as well as the station of the presenting part [7].

Bishop reported no failure with a score of ≥ 9 and the American College of Obstetricians and Gynaecologists generally defines an unfavourable cervix at Bishop's score ≤ 6 [2].

In an attempt to minimize the subjectivity of Bishop's score, the original system has been modified to replace the cervical effacement with cervical length (CL), which is known as modified Bishop's score [8]. and it is commonly used in clinical practice.

Another modification to the original Bishop's score proposed by Elghorori et al., in which the ultrasound measurement of the CL was used instead of the clinical assessment of CL [9].

Ben-Harush concluded that CL is correlated linearly to the time interval between induction of labor and delivery. A CL of <28 mm was found to be statistically significant in predicting a shorter time to delivery [10].

Ultrasound is available in most of obstetrics centres, safe, accurate, and inexpensive. Transvaginal approach is preferred route for ultrasound assessment of the CL. Transvaginal ultrasound (TVS) assessment of the CL reported in the diagnosis of cervical incompetence, prediction of preterm labor, and prediction of successful induction of labor [11,12].

This study was designed to compare the CL measured by TVS versus modified Bishop's score for prediction of successful labor induction in nulliparous women.

Subjects and Methods

Two hundred and ten nulliparous women admitted with PROM were included in this comparative prospective study conducted in Ain Shams University, Department of Obstetrics and Gynaecology over 2 years from February 2013 to February 2015 for labor induction after informed consent and approval of the study protocol by the local Institute Ethical Committee.

Nulliparous women admitted with PROM, single fetus, vertex presentation, and estimated fetal weight between 2.5 and 4 kg by ultrasound and reactive pre-induction non-stress test included in this study.

Women with non-vertex presentation, multiple pregnancies, previous caesarean section, oversized baby, abnormal bony pelvis, and any contraindication of vaginal delivery excluded from this study.

PROM diagnosed by a history of gush of amniotic fluid, positive fern, and nitrazine tests, confirmed by leaking fluid from the cervix during speculum examination and amniotic fluid index ≤ 5 cm by abdominal ultrasound. Gestational age of the studied women calculated accurately from the last menstrual and early ultrasound scan performed before 20 weeks [1].

Studied women subjected to thorough evaluation and trans-abdominal ultrasound (TAS) to confirm; fetal lie, cardiac activity, placental site, absence of congenital anomalies, estimated fetal weight, and amount of amniotic fluid.

TAS followed by digital vaginal examination to record the modified bishop's score and TVS to record the CL in mm.

TVS done for all studied women in lithotomy position, the vaginal probe inserted under direct visualization, and after the evacuation of the urinary bladder. The amniotic fluid, presenting part, the midline sagittal plane of the cervix localized and the vaginal probe pulled back until the lightest touch provided a good image of the cervical canal with fixation of the internal cervical os in the proximal one-third of the ultrasound image.

The probe then moved slightly to get the best longitudinal axis of the cervix.

The measurement of the CL was accurate when the following criteria fulfilled [5].

- Sagittal plane of the cervix that allows imaging the entire length of the cervical canal
- Placement of the cervical plane in the middle of the ultrasound screen as horizontal as possible
- The absence of excess pressure on the ultrasound probe, cursors placed in precise contact with the closing points of the internal and external cervical os.

The external cervical os identified more precisely by following the distal contour of the posterior cervical lip. The head can gently push away by the sonographer's hand above the symphysis pubis to separate the fetal head from internal cervical os if necessary [5].

The standard anatomical landmarks during the examination were the presenting fetal part, urinary bladder, internal cervical os, external cervical os, and the cervical canal. CL considered the hyperechoic line extending from the internal cervical os to external cervical os, after pulling back the probe until the lightest touch provided a good image of the cervical canal. The internal cervical os identified as a dimple against the hypoechoic background of the amniotic fluid. CL measured three times, and the mean CL recorded [5].

TVS examinations carried out by an expert sonographer, blinded to the patients' clinical data, using Philips HD9 with two-dimensional convex probe 4-9 MHz (Philips International; Amsterdam; the Netherlands).

Digital vaginal examination carried out to record the modified Bishop's score by the clinical investigator blinded to the CL measured by TVS.

After measurement of CL by TVS and calculation of the modified Bishop's score, induction of labor done by either prostaglandin E1 25 micrograms vaginal tablets, misoprostol (Cytotec[®], Pfizer Limited, Ramsgate Road, UK) inserted in the posterior vaginal fornix.

Prostaglandin E1 used for labor induction if the modified Bishop's score was <5 (unfavourable cervix). Vaginal examination done 6 hourly after prostaglandin E1 insertion and further prostaglandin E1 might be inserted if uterine contractions were inadequate (maximum three doses). Oxytocin started 2 h after the last prostaglandin E1 if the uterine contractions were inadequate, the cervix was ≥ 3 cm dilated, and the presenting part was at station ≥ 0 .

In established labor with regular uterine contractions (4-5 uterine contractions every 10 min, each contraction lasting for 45-60 s), vaginal examination for assessment the progress of labor done every 4 h [2,5].

Intrapartum fetal surveillance done by intrapartum fetal heart monitoring using cardiotocography. After delivery, success (defined as vaginal birth) and duration of labor induction reviewed and statistically analyzed to compare the CL measured by TVS versus modified Bishop's score for prediction of successful labor induction in nulliparous women.

Sample size and statistical analysis

The required sample size was calculated using previous study [5]. and G* Power software, version 3.17 for sample size calculation (Heinrich Heine Universität; Düsseldorf, Germany). The effective sample size needed to produce statistically accepted figure was ≥ 202 women after calculation of 10% drop rate.

Collected data statistically analyzed using Statistical Package for Social Sciences; version 18 (Chicago, IL, USA). Mean (standard deviation) were used to represent numerical variables, whereas number and percentage were used to represent categorical variables. Independent Student's t-test used for numeric parametric variables, and Chi-square test used for categorical variables analysis. $P < 0.05$ was considered statistically significant.

Results

Two hundred and ten nulliparous women were studied; the mean age of studied women was 24.13 (2.34) years, and the mean gestational age was 38 (1.2) weeks' gestation.

Nearly, 76.19% (160/210) of the studied women delivered vaginally, whereas 23.81% (50/210) delivered by caesarean section.

The indications for caesarean sections were failed induction in 32% (16/50), failure of labor progress in 40% (20/50), and fetal distress in 28% (14/50).

There was no statistically significant difference between the women delivered vaginally and those delivered by caesarean section regarding; mean maternal age (24.89 [4.01] vs. 24.67 [3.34] years, respectively), mean gestational age at labor induction (39.6 [1.82] vs. 39.92 [1.62] weeks' gestation, respectively) and mean fetal birth weight (2.77 [0.85] vs. 2.71 [1.22] kg, respectively).

One hundred and forty-three women of studied women had CL <28 mm; 76.25% (122/160) of them delivered vaginally and 21 delivered by caesarean section (P 0.03).

One hundred and forty-six women of studied women had modified Bishop's score >4; 80% (128/160) of them delivered vaginally and 18 delivered by caesarean section (P 0.006).

Thirty-eight out of 67 women had CL ≥ 28 mm delivered vaginally and this difference was statistically significant (P 0.002). Thirty-two out of 64 women had modified Bishop's score ≤ 4 delivered vaginally and this difference was statistically insignificant [Table 1].

Variables	Vaginal delivery (%)	Cesarean section (%)	P
Cervical length (mm)			
<28	122 (76.25)	21 (42)	<0.05* (0.03)
≥ 28	38 (23.75)	29 (58)	<0.01* (0.002)
Total	160 (100)	50 (100)	210
Modified Bishop's score			
≤ 4	32 (20)	32 (64)	>0.05**
>4	128 (80)	18 (36)	<0.001* (0.006)
Total	160 (100)	50 (100)	210

Data presented as n (%)
 Statistical analysis performed using Chi-square test. **Nonsignificant difference
 *Significant difference

Table 1: Mode of delivery in relation to cervical length measured by trans-vaginal ultrasound and modified Bishop's score.

Receiver operator characteristics curve analysis showed that CL <28 mm had 87.5% sensitivity, 86.25% specificity, 61.4% positive predictive value (PPV), and

96.5% negative predictive value (NPV) for successful labor induction, whereas modified Bishop's score >4 had 62.5% sensitivity, 50% specificity, 23% PPV, and 84.2% NPV for prediction of successful labor induction [Figure 1].

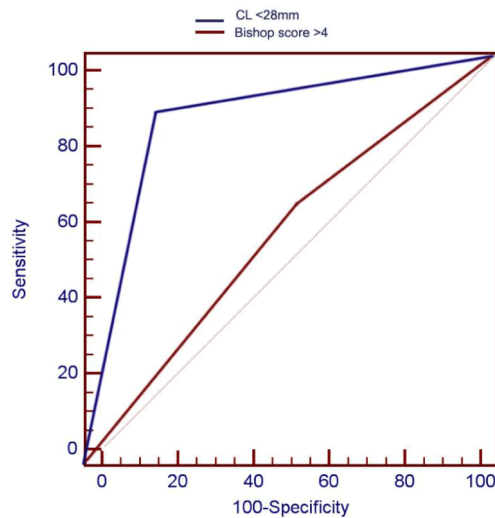


Figure 1: Receiver operating characteristic curve of modified Bishop's score and cervical length as predictors of successful labor induction.

The CL <28 mm was significantly more specific with more PPV as predictor of successful labor induction (86.25% and 61.4%, respectively) compared to modified bishop's score (50% and 23.8%, respectively), (P 0.007 and P 0.001; respectively) [Table 2].

Variables	Cervical length <28 mm (%)	Modified Bishop's score >4 (%)	P
Sensitivity	87.5	62.5	>0.05**
Specificity	86.25	50	<0.01* (0.007)
PPV	61.4	23.8	<0.001* (0.001)
NPV	96.5	84.2	>0.05**

Analysis done using Chi-square test

**Nonsignificant difference

*Significant difference

PPV=Positive predictive value

NPV=Negative predictive value

Table 2: Accuracy of cervical length and modified Bishop's score as predictors of successful labor induction.

Induction to delivery time was significantly less in women with CL <28 mm compared to women with CL ≥ 28 mm (8.5 [5.2] vs. 15.2 [6.4] h, respectively) (P 0.002, 95% confidence interval [CI]; 4.9, 6.7, 8.4). In addition, women with modified Bishop's score >4 had significantly less induction to delivery time compared to women with modified Bishop's score of ≤ 4 (7.7 [4.25] vs. 10.8 [5.30] h, respectively) (P 0.01, 95% CI; 1.6, 3.1, 4.5) [Table 3].

Variables	Number	Induction to delivery interval	P (95% CI)
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Cervical length (mm)			
<28	143	8.5 (5.2)	<0.05 (0.02)* (95% CI; 4.9, 6.7, 8.4)
≥ 28	67	15.2 (6.4)	
Total	210 (100)		210
Modified Bishop's score			
≤ 4	64	10.8 (5.30)	<0.05 (0.01)* (95% CI; 1.6, 3.1, 4.5)
>4	146	7.7 (4.25)	
Total (%)	210 (100)		210

Data presented as mean (SD)
 Statistical analysis performed using Student's t-test. *Significant difference
 SD=Standard deviation
 CI=Confidence interval

Table 3: Duration of labor induction according to cervical length and modified Bishop's score.

Discussion

Since the Bishop's score introduction in 1964, various scoring system has been suggested to evaluate cervical condition before induction of labor [8,9].

Bishop's score is subjective scoring system; investigators tried to find another way to objectively predict the success of labor induction. Ware and Raynor, suggested that cervical shortening by TVS is equal to cervical effacement detected during vaginal examination [13,14].

Conflicting results detected between studies comparing CL measured by TVS versus modified Bishop's score as predictor for successful labor induction.

In this study and Abdelazim and Faza study, both modified Bishop's score and CL measured by TVS were good predictors of successful labor induction [5].

In a multicentre study, Pandis et al. assessed preinduction modified Bishop's score and CL measured by TVS and reported that both methods were significantly related to induction to delivery interval [15].

Pandis et al. concluded that the best cut-off points were 28 mm for CL and three for the modified Bishop's score for prediction of successful labor induction [15].

Previous studies concluded that modified Bishop's score as well as CL measured by TVS can predict successful labor induction and were associated with the likelihood of vaginal delivery [14-17].

Crane, in a systematic review, stated that successful labor induction may be predicted by modified Bishop's score as well as sonographic cervical assessment and recommended further studies for better evaluation of these predictors [18].

Recently, Stupar et al. found that CL measured by TVS and modified Bishop's score are reliable predictors for successful labor induction and they concluded that both methods are complementary for cervical assessment [19].

Although, Hatfield et al., in a systematic review concluded that CL measured by TVS is not effective in the prediction of successful labor induction [20].

Ezebialu et al. systematic review through Cochrane Pregnancy and Childbirth Group's Trials Register concluded that the two different methods for assessing preinduction cervical ripening (Bishop score and TV ultrasound) did not demonstrate superiority of one method over the other [6]. Both methods could be complementary, and the choice of a particular method of assessing preinduction cervical ripening may differ depending on the environment (where one is practicing) since some methods (TV) may not be readily available in and affordable in poor resource settings [6].

Ware and Raynor concluded that both CL measured by TVS and Bishop's score can predict the duration of labor and the likelihood of vaginal delivery [14].

Ware and Raynor also concluded that only CL and parity were independent predictors for the mode of delivery [14].

In this study, CL <28 mm measured by TVS was significantly more specific with more PPV compared to modified bishop's score in prediction of successful labor induction.

Tan et al. concluded that CL measured by TVS is better tolerated than digital examination for Bishop's score assessment and both CL and Bishop's score are useful predictors for the need of cesarean delivery following labor induction [21].

Tan et al. also concluded that CL >20 mm is an independent predictor of cesarean delivery after labor induction at term [21].

Uzun et al. concluded that in nulliparous women with prolonged pregnancy, the Bishop's score predicts the need for cesarean section better than the ultrasonographic assessment of the CL [22].

Maitra et al. concluded that a preinduction CL measurement on TVS was an independent predictor of successful vaginal delivery. At < or = 3 cm CL, the probability of a lower segment cesarean section (LSCS) was <30% while with 4 cm CL, the probability became >75%. One unit increase in CL increased the probability of LSCS by 45% [23].

In addition, Park et al. concluded that the use of cutoff value of ≥ 28 mm for CL before labor induction can reduce the need for prostaglandin administration by approximately 50% without adversely affecting the outcome of induction at term [24].

Recently, Papillon-Smith and Abenhaim conducted a systematic review and concluded that studies did not demonstrate the superiority of CL measured by TVS compared to the Bishop's score, the evidence indicates that CL measured by TVS could be useful in planning induction of labor, and reducing significantly the need for cervical ripening agents [25].

The strength of this study is coming from the comparative nature of the study, the proper sample size, and statistical analysis methods used. Women refused to participate in the study were the only limitation faced during this study.

This study concluded that CL <28 mm measured by TVS was significantly more specific with more PPV compared to modified bishop's score in prediction of successful induction of labor. Both CL measured by TVS and modified bishop's score were complementary tool and associated with successful induction.

Further future studies needed to confirm whether the CL measured by TVS is superior than Bishop's score or both are a complementary tool in preinduction cervical assessment.

Acknowledgments

The Authors are grateful to all women agreed to participate in this study.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

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