Al-Azhar International Medical Journal

Volume 4 | Issue 1 Article 4

1-2023

The role of pre-induction transvaginal ultrasound assessment of cervix in prediction of labor induction success

Mohammed Mohammed Gebreil
Department of Obstetrics and Gynecology, Al-Azhar University, Faculty of Medicine for boys, Cairo, Egypt

Ahmed Mohammed El-Sadek
Department of Obstetrics and Gynecology, Al-Azhar University, Faculty of Medicine for boys, Cairo, Egyp

Mohammed Abd El-Azim Shokry
Department of Obstetrics and Gynecology, Al-Azhar University, Faculty of Medicine for boys, Cairo, Egypt, shokry92@yahoo.com

How to Cite This Article

Gebreil, Mohammed Mohammed; El-Sadek, Ahmed Mohammed; and Shokry, Mohammed Abd El-Azim (2023) "The role of pre-induction transvaginal ultrasound assessment of cervix in prediction of labor induction success," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 1, Article 4.
DOI: https://doi.org/10.58675/2682-339X.1617

ORIGINAL ARTICLE

The Role of Preinduction Transvaginal Ultrasound Assessment of Cervix in Prediction of Labor Induction Success☆

Mohammed Mohammed Gebreil, Ahmed Mohammed El-Sadek, Mohammed Abd El-Azim Shokry*

Department of Obstetrics and Gynecology, Al-Azhar University, Faculty of Medicine for Boys, Cairo, Egypt

Abstract

Background: **When the benefits to the mother or the fetus outweigh the risks of continuing the pregnancy, such as postdated pregnancy, preeclampsia, or fetal growth restriction, induction of labor is indicated. Induction of labor is performed in ~20% of all pregnancies, and successful induction has been linked to cervical characteristics, or 'ripeness'. However, the Bishop score's assessment of the cervix's 'favorability' prior to initiation is very subjective, and numerous investigations have indicated that it has a poor prognostic value, particularly for women with low Bishop scores.**

Aim: **The aim was to assess the accuracy of transvaginal and other ultrasonographic measures in predicting the outcomes of labor induction.**

Patients and methods: **In this research, 100 pregnancies between 37 and 42 weeks of gestation had labor induction. A digital check of the cervix was done before induction, and the Bishop score was recorded. Transvaginal ultrasonography was used to measure the cervical length.**

Results and conclusion: **There was a statistically significant negative relation between Bishop score and failure of induction and chance of cesarean section, and there was a statistically significant positive relation between cervical length as evaluated by ultrasonography and those two outcomes.**

Keywords: Bishop score, Cervical ripening, Induction of labor, Ultrasonography

1. Introduction

Induction of labor is carried out in ~20% of all births, and effective induction is stated to be connected to cervical features, or 'ripeness', in cases where the advantages to the mother or the baby outweigh those of continuing the gestation, like postdated gestation, preeclampsia, or fetus growing limitation.[1]

To this day, forecasting the length and result of an induced labor still relies on the Bishop score. However, assessment of the cervix's 'favorability' before induction by the Bishop score is very subjective, and numerous investigations have shown that it has a poor prognostic value, particularly for women with low Bishop scores.[2]

An alternate tool to the Bishop score for predicting cesarean deliveries and effective labor inductions is the cervical length using transvaginal ultrasonography. An alternate tool to the Bishop Score for predicting caesarean deliveries and effective labor inductions is transvaginal ultrasonography cervical length. in particular discovered that TVU CL, as opposed to Bishop Score, was a superior indicator of a effective labor induction in nulliparous women.[3]

To determine the risk of premature delivery and to forecast effective labor induction, cervical length using transvaginal ultrasound has been measured in

Received 6 July 2022; accepted 19 August 2022.
Available online 15 May 2023

☆ All authors have substantially contributed to the article.

* Corresponding author at: Department of Obstetrics and Gynecology, Al-Azhar University, Faculty of Medicine for Boys, Cairo, 62511, Egypt. Tel.,: 01200339267.
E-mail address: shokry92@yahoo.com (M.A.E.-A. Shokry).

https://doi.org/10.58675/2682-339X.1617

a variety of groups, including asymptomatic and symptomatic preterm laboring women.[4]

The supravaginal part of the cervix, which typically accounts for about 50% of the cervical length, is extremely challenging to evaluate digitally in a closed cervix, so theoretically, digital cervix assessment may not be as accurate or objective as transvaginal ultrasound scanning of the cervi×.[5] Additionally, with a closed cervix, it will be difficult to forecast the evaluation of the effacement, which begins at the internal os. Additionally, sonographic cervical length assessment is a quantitative, repeatable approach of evaluating the cervix that may be performed with little pain to the patient.[6]

The study's objectives were to investigate the accuracy of transvaginal cervical length measures in predicting effective labor induction and to identify the ideal cervical length cutoff point for successful induction predictions.[7]

2. Patients and methods

This was prospective cohort research done at the Department of Gynecology and Obstetrics of AL-Azhar University hospitals. This study was conducted on 100 pregnant women not in labor who were indicated for termination of pregnancy, during the period from April 2021 till the end of study.

The cases were divided into two groups after induction: group A with successful induction, and group B with failed induction.

Inclusion criteria for the study group were age below 35 years, singleton pregnancy, above 37 weeks of gestation, living fetus, cephalic presentation, primigravida, normal BMI, and pelvis proportion.

Exclusion criteria for groups were extremes of age (below 17 years and above 38 years), fetal macrosomia (more than 4500), malpresentation, dead fetus, multifetal pregnancy, oligohydramnios, polyhydramnios, preinduction nonreassuring nonstress test, any extent of the placenta previa and/or vasa previa, women who have had cervix surgery in the past and have been identified by conventional clinical testing as having a significant degree of cephalopelvic asymmetry (e.g. cautery, cerclage, and cervical amputation or conization), patients already in active labor on admission, any contraindication to vaginal delivery, multipara, and obese or underweight patients.

3. Methods

The eligible participants included in this study were subjected to the following: detailed record collection, including personal history such as name, age, occupation, and address; obstetrics history such as pregnancy, abortion, delivery, puerperium, fetuses, newly born infants and children and contraception; past history of medications; hypertension and diabetes; past history of surgeries or prior cervical procedures (e.g. cautery, cerclage, and cervical amputation or conization); menstrual history; present history such as pregnancy duration, and the first day of the last menstrual cycle; and warning signs like headache, visual disorders, edema of the face and fingers, increased vomiting, heartburn, epigastric pain, pain in the loin, watery vaginal discharge, vaginal hemorrhage, decreased fetus's motions, and edema of the lower limbs.

Examination included general examination such as blood pressure, pulse, temperature, and respiration rate, which are vital data metrics; assessment of the heart and lungs for any anomalies; evaluation of the lower extremities for bilateral severe edema; and identification of proteinuria in a fresh mid-stream urine sample.

Abdominal clinical examination included abdominal inspection and abdominal palpation such as light palpation of the abdomen, deep palpation of the abdomen, abdominal percussion, and abdominal auscultation.

Vaginal inspection was done to assess the Bishop score of the cervix by assessment of cervical dilation or cervical funneling, cervical length, cervical position, cervical effacement, cervical consistency, fetus station, condition of the membranes, pelvic adequacy, fetal presentation, and posterior cervical angles.

Abdominal ultrasonographic examination (Fig. 1) was performed by an investigator using a 3.5–5 MHz transabdominal probe for assessment of fetal well-being, fetal presentation, amniotic fluid index, fetal biometry, and fetal biometric measures (Biparietal Diameter (BPD), Abdominal Circumference (AC), Femur Length (FL), and Head Circumference (HC)).

Transvaginal ultrasonographic examinations using 5–9 MHz transvaginal probe were done to measure the cervical length (Fig. 2).

Successful labor induction was the main result (capacity to progress into the active stage of the labor process; cervical dilatation of at least 4 cm). Induction to delivery interval and the newborn's Apgar score at 1 and 5 min were the secondary outcomes.

Ethical considerations: the study protocol was submitted for approval by the Institutional Review Board, Al-Azhar University. Each individual who participated in the research provided informed

Fig. 1. Abdominal ultrasonographic finding of a 19-week fetus.

verbal permission. At every stage of the research, confidentiality, and personal privacy were protected.

4. Results

From April 2021 to September 2021, this research was carried out at the Department of Gynecology and Obstetrics of Al-Azhar University Hospitals. The aim of this research was to evaluate two measures, that is, sonographically assessed cervical length and Bishop score, in the prediction of a complete vaginal birth within 24 h and to assess the link between preinduction sonographically assessed cervical length and Bishop score.

At 37–42 weeks of conception, 100 women planned for induction of labor had transvaginal ultrasound and a digital screening to calculate the Bishop score.

The age ranged between 17 and 35 years, with a mean age of 23 ± 3.87 years. The gestational age ranged between 37 and 42 weeks, with median gestational age of 39 ± 1.4 weeks. The BMI varied between 19 and 35, with median BMI of 26.7 ± 2.78. The Estimated Fetal Weight (EFW) ranged between 2.40 and 3.80 kg, with mean EFW of 3.08 ± 0.36 (Table 1).

Table 2 shows that the most common cause of induction was hypertension and preeclampsia (60 females), where 42 of them delivered vaginally, followed by post-term (23 females), where 12 of them delivered vaginally, followed by decreased Daily Fetal Movement Count (DFMC) (17 females), where 13 of them delivered vaginally.

A total of 33 cesarean sections (CSs) and 67 vaginal deliveries were performed on expectant patients. Indications of CS were failed induction (patient received four doses of misoprostol 25 mg with 6-h interval and no labor pains or cervical dilatation or effacement was noted) (Fig. 3).

Age and gestational age had no statistically significant connection with labor induction success; however, a greater BMI did have a significant connection with induction failure (Table 3).

Fig. 2. Cervical length measurement.

Table 1. Descriptive statistics of the whole study group.

	Minimum	Maximum	Mean ± SD
Age	17	35	23 ± 3.87
Gestational age	37	42	39 ± 1.4
BMI	19	35	26.7 ± 2.78
EFW (kg)	2.40	3.80	3.08 ± 0.36

Table 2. Indications for induction of labor.

Indication	Number of patients	Number of success in induction of labor
HTN and preeclampsia	60	42
Post-term	23	12
Decreased DFMC	17	13
Total	100	67

HTN, hypertension.

In the preceding table, we discovered a statistically significant positive connection between the ultrasound-measured cervical length and the likelihood of a C-section failure and a statistically significant negative connection between the Bishop score and the likelihood of a C-section failure (Table 4).

Table 5 shows that the cutoff value of cervical length was 2.85 and shows that sensitivity of ultrasound measures of cervical length in predicting effective induction was 94% and specificity was 100%.

Table 6 shows that the cutoff value of bishop score was 6.5 and shows that sensitivity of Bishop score in forecasting induction outcome was 86% and specificity was 62% (Fig. 4).

5. Discussion

Bishop score continues to be performed as the gold standard for estimating the length and efficacy of induced labor. However, the assessment of the cervix's 'favorability' before induction by Bishop score is very subjective, and many investigations have indicated that it has a poor prognostic value, particularly for women with low Bishop scores.[8]

The purpose of this research was to compare the Bishop score and preinduction sonographically assessed cervical length to establish their link to successful vaginal delivery prediction. In this research, 100 pregnant women between the gestational ages of 37 and 42 weeks underwent induction of labor owing to high blood pressure and preeclampsia using vaginal misoprostol at doses of 25 μg to postdate and reduce DFMC. The dosage was administered again every 6 h for a total of 24 h.

The current investigation discovered a strong correlation between a labor induction success and the ultrasonographic cervical length ($P < 0.001$) and Bishop score ($P < 0.064$).

Yang et al.[9] studied labor induction in 105 women. A post-term pregnancy of at least 41 completed weeks followed by a large-for-gestational-age fetus was the most frequent cause of induction. Additionally, they discovered a great correlation between cervical length and parity and effective induction. Maternal age and gestational age were not significant predictive factors.

Moreover, Peregrine et al.[10] evaluated the induction of labor in 267 women who were 36 weeks or more pregnant just before induction of labor, and they also found the same outcomes. To identify the parameters that most accurately predicted the probability of cesarean birth, logistic regression analysis was used. BMI, height, and ultrasonic transvaginal cervical length were shown to be the most reliable variables for predicting the likelihood

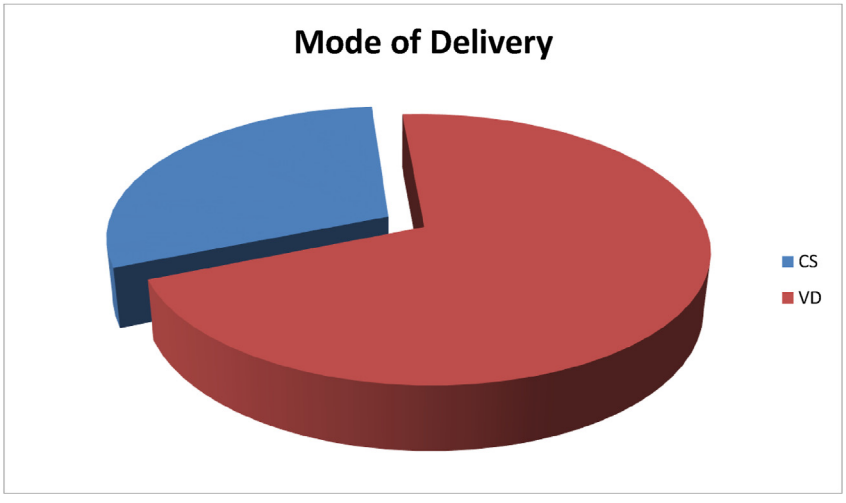

Fig. 3. The percentage of vaginal delivery, which is 67%, and cesarean section, which is 33%.

Table 3. Descriptive statistics according to the mode of delivery.

	VD	CS	*P* value
Age	23.23 ± 3.64	23.69 ± 4.43	0.589
BMI	26.17 ± 2.59	28.03 ± 2.83	0.002
Gestational age	39.08 ± 1.38	39.38 ± 1.50	0.347

CS, cesarean section; VD, vaginal delivery.

Table 4. Bishop score and cervical length.

	VD	CS	*P* value
Bishop score	8.30 ± 1.79	6.55 ± 1.27	0.064
Cervical length (mm)	2.63 ± 0.14	3.06 ± 0.11	0.001

CS, cesarean section; VD, vaginal delivery.

of a cesarean birth after labor induction ($P < 0.001$, 0.005, and <0.001, respectively). Additionally, we discovered that ultrasonic transvaginal cervical length is one of the more accurate characteristics in our research ($P < 0.001$).

Of our 100 participants, 67% of the women gave birth vaginally, and 33% were delivered via CS Bishop score and ultrasonographically determined cervical length both contributed independently to the prediction of the chance of giving birth vaginally within 48 h. The optimal cutoff point for the receiver operating characteristic (ROC) curves was 28.5 mm for cervical length [area under curve (AUC) = 0.973 and $P < 0.001$] and greater than 6.5 for the Bishop score (AUC = 0.808 and $P < 0.064$) for forecasting a productive induction. However, cervical length seems to be a better predictor than the Bishop score, with sensitivity of 94.4%, specificity of 100%, positive predictive value of 100%, negative predictive value of 87%, and diagnostic accuracy of 96% compared with sensitivity of 85.9%, specificity of 62.1%, positive predictive value of 84%, negative predictive value of 64%, and accuracy of 79%, respectively.

Bastani et al.[11] studied 200 singleton expectant mothers who had their labor induced between weeks 37 and 42. Before induction, transvaginal ultrasound was performed on each participant. ROC curves were drawn, and the equality of the AUC was checked to compare the approaches' predictive power. Bishop score's AUC was computed as 0.39 (95% confidence interval: 0.3–0.48). The ultrasonography-derived AUC for cervical length was 0.69 (95% confidence interval: 0.6–0.77). The ROC for cervical length was significantly different from the Bishop score when the ROC curves for these two approaches were compared ($P < 0.001$). Agreeing with our results, they found that if a transvaginal ultrasonography facility is accessible when required, it may be able to substitute the conventional Bishop score in determining cervical length.

Laencina et al.[12] assessed Bishop score of 177 women with a single gestation, 36–42 weeks of conception, and a live baby with cephalic presentation, as scored by digital examination, and assessed cervical length by transvaginal ultrasound before induction of labor with both prostaglandin and oxytocin. Similar to our results, they found that the likelihood of having a vaginal delivery within 60 h was predicted independently by the Bishop score, cervical length, and parity. The cervical length cutoff of 24 mm (28 mm in our research) and the Bishop score cutoff of 4 mm (>6.5 in our result) were the best cutoff points for predicting effective induction using ROC curves. Cervical length was a greater predictive than the Bishop score, similar to our outcome (sensitivity and specificity of 94% and 100% versus 85% and 62%, respectively).

In their prospective research, Tan et al.[7] used data from 249 hospitalized women for labor induction. They discovered that analysis of the ROC curves for cervical length and Bishop Score revealed that both were predictors of CS (AUC, 0.611 vs. 0.607; $P = 0.012$ vs. $P = 0.015$, respectively), with the best cutoffs for predicting CS being greater than 20 mm for cervical length and 5 for Bishop score. Cervical length had greater sensitivity (80 vs. 64%) and

Table 5. Accuracy of ultrasonographic cervical length in predicting induction success.

Area under the curve	*P* value	95% confidence interval		Cutoff	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy
		Lower bound	Upper bound						
0.973	<0.001	0.940	1.000	2.85	94.4	100	100.00	87.88	96.04

NPV, negative predictive value; PPV, positive predictive value.

Table 6. Accuracy of the Bishop score in predicting induction success.

Area under the curve	*P* value	95% confidence interval		Cutoff	Sensitivity (%)	Specificity (%)	PPV	NPV	Accuracy
		Lower bound	Upper bound						
0.808	<0.064	0.720	0.897	6.5	85.9	62.1	100.00	87.88	96.04

NPV, negative predictive value; PPV, positive predictive value.

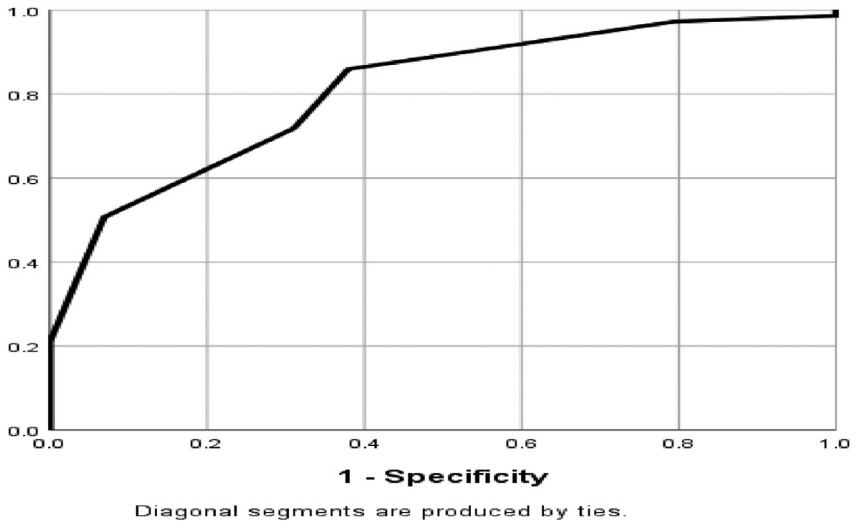

Fig. 4. Bishop score's receiver operating characteristic curve and its connection to effective induction.

modestly improved positive (30 vs. 27%) and negative (89 vs. 83%) predictive values.

Bueno et al.[13] analyzed the diagnostic and sonographic factors that influence labor induction success. To predict a vaginal birth success within 24 h after induction, 196 pregnant women's Bishop scores, cervical lengths, and parities were examined. When parity was initially implemented, the optimal statistic sequence that forecasts the labor induction was discovered. Contrary to our research, which found that ultrasonic transvaginal cervical length is a more reliable metric in predicting a successful induction, Bishop and cervical length both predicted the labor induction success similarly.

Chandra et al.[14] studied transvaginal ultrasound and digital vaginal examinations among on 122 women with postdated pregnancies just before induction of labor. The Bishop score components and ultrasound measures of cervical length, dilatation, and funneling were compared. They discovered that no ultrasonography feature indicated a successful vaginal delivery. Maternal age, the Bishop score, and the cervical position each independently predicted vaginal delivery. Multiple signs of induction of labor in our research sample might account for the disparities between these two investigations.

In another research, Roman et al.[15] showed that the cervical length calculated by ultrasonography is not a more accurate labor induction outcome predictor when compared with the Bishop score. This disagreed with our study, which showed that cervical length had more sensitivity and specificity than bishop score (94 vs. 85%, and 100 vs. 62%, respectively).

Rozenberg et al.[16] reported that the Bishop score was shown to be more accurate than cervical length in a study of 166 women who had labor induced with prostaglandins, and this disagreed with our study, which showed that the bishop score was not better than cervical length, with diagnostic accuracy of 79% only versus 96% for cervical length.

6. Conclusion

In this research, authors found a great correlation between the Bishop score and the ultrasonography cervical length and effective induction. Furthermore, the Bishop score appears to be inferior to cervical length calculated by ultrasonography in terms of predicting successful vaginal delivery within 24 h. The cutoff value for cervical length is 2.8 cm, and cervical length has higher levels of sensitivity, specificity, and diagnostic accuracy than the Bishop score.

Conflict of interest

There are no conflicts of interest.

References

1. Ezebialu IU, Eke AC, Eleje GU, Nwachukwu CE. Methods for assessing pre-induction cervical ripening. *Cochrane Database Syst Rev*. 2015.
2. Alavifard S, Meier K, Shulman Y, Tomlinson G, D'Souza R. Derivation and validation of a model predicting the likelihood of vaginal birth following labour induction. *BMC Pregnancy Childbirth*. 2019;19:1–9.
3. Wafa YA, Mohamed NF, Abouzeid MS. Comparative study between 2D and 3D ultrasound cervicometry and digital assessment of the cervix before induction of labour. *Egypt J Hosp Med*. 2018;71:5.

4. Antsaklis P. Intrapartum ultrasound and Bishop score: a new obstetric tool. In: *Intrapartum ultrasonography for labor management*. Cham: Springer; 2021:75–84.
5. Balaji TE. *Study on comparison of cervical length measured transvaginally and bishop score in predicting successful labour induction* [doctoral dissertation]. Chennai: Madras Medical College; 2016.
6. Alanwar A, Hussein SH, Allam HA, et al. Transvaginal sonographic measurement of cervical length versus Bishop score in labor induction at term for prediction of caesarean delivery. *J Matern Fetal Neonatal Med*. 2021;34:2146–2153.
7. Tan PC, Vallikkannu N, Suguna S, Quek KF, Hassan J. Transvaginal sonographic measurement of cervical length vs. Bishop score in labor induction at term: tolerability and prediction of cesarean delivery. *Ultrasound Obstet Gynecol*. 2007; 29:568–573.
8. Selhi M, Surapaneni T. Pre induction sonographic measurement of cervical length: an adjunct to Bishop score? *Fernandez Hosp J Perinatal*. 2010;1:2.
9. Yang SH, Roh CR, Kim JH. Transvaginal ultrasonography for cervical assessment before induction of labor, obstetrical gynecological survey: obstetrics: management of labor, delivery. *J Ultrasound Med*. 2014;59:577–579.
10. Peregrine E, O'Brien P, Omar R. Clinical and ultrasound parameters to product the risk of cesarean delivery after induction of labor. *Obstet Gynecol*. 2016;107(pt 1): 227–233.
11. Bastani P, Kobra H, Fatemeh A, Parisa P, Fatemeh G. Transvaginal ultrasonography compared with Bishop score for predicting cesarean section after induction of labor. *Int J Womens Health*. 2011;3:277–280.
12. Laencina AMG, Sanchez FG, Gimenez JH, Martínez MS. Comparison of ultrasonographic cervical length and the Bishop score in predicting successful labor induction. *Acta Obstet Gynecol Scand*. 2017;86:799–804.
13. Bueno B, San-frutos L, Salazar F, et al. Variables that predict the success of labor induction. *Acta Obstet Gynecol Scand*. 2015; 84:1093–1097.
14. Chandra S, Crane JM, Hutchens D, Young DC. Transvaginal ultrasound and digital examination in predicting successful labor induction. *Obstet Gynecol*. 2011;97:2–6.
15. Roman H, Verspyck E, Vercoustre L, et al. Does ultrasound examination when the cervix is unfavorable improve the prediction of failed labor induction? *Ultrasound Obstet Gynecol*. 2014;23:357–362.
16. Rozenberg P, Chevret S, Chastang C, Ville Y. Comparison of digital and ultrasonographic examination of the cervix in predicting time interval from induction to delivery in women with a low Bishop score. *BJOG*. 2015;112: 192–196.