

## Assessment of the Cervical Length by Transvaginal Sonography in Predicting the Success of Labor Induction

Gupteswar Mishra<sup>1</sup>, Sambit Kumar Mohanty<sup>2</sup>, Prabir Kumar Biswal<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of Obstetrics and Gynecology, Hi-Tech Medical College & Hospital, Bhubaneswar, Odisha, India

<sup>2</sup>Assistant Professor, Department of Surgery, Hi-Tech Medical College & Hospital, Bhubaneswar, Odisha, India

<sup>3</sup>Junior Resident, Department of Obstetrics and Gynecology, Hi-Tech Medical College & Hospital, Bhubaneswar, Odisha, India

---

Received: 26-01-2023 / Revised: 20-02-2023 / Accepted: 25-03-2023

Corresponding author: Dr. Gupteswar Mishra

Conflict of interest: Nil

---

### Abstract

**Objective:** The objectives of the research were to evaluate the Bishop Score in women undergoing labor induction procedures followed by transvaginal sonography measurements of cervical length and to examine the contribution of transvaginal sonographic cervical assessment to the prediction of induction of labor outcomes.

**Method:** For one year, 200 pregnant women who were having inductions at Hi-Tech Medical College & Hospital, Bhubaneswar participated in this prospective observational study. Prior to labor induction, all the women had transvaginal ultrasounds done to measure the cervical length and calculate the Bishop score.

**Results:** This study has shown that 66.7% of singleton pregnancies with labor inductions at 36–40 weeks of gestation resulted in a successful vaginal delivery within 24 hours of the induction. The study also showed that the pre-induction Bishop score and sonographically measured cervical length are significantly related to the time from induction to delivery; the higher the Bishop score and lower the cervical length, the greater the likelihood of vaginal delivery within 24 hours of induction. The ROC curve revealed that the best cutoff points for effective induction were  $\geq 4$  for Bishop score and 2.0 cm for cervical length.

**Conclusion:** The success of labor induction was better predicted by transvaginal ultrasonography measurement of cervical length.

**Keywords:** Bishop scores, cervical length, labor induction, Transvaginal sonography.

---

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

---

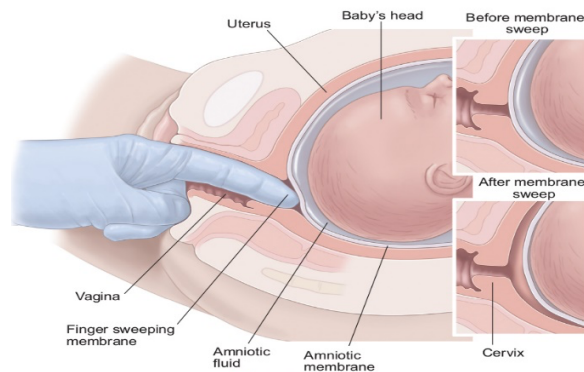
### Introduction

The term "induction" refers to the stimulation of regular contractions in term pregnant women before to the commencement of labour that may or may not be accompanied by a ruptured membrane. Labor induction frequently starts with cervical ripening, a

method that typically uses prostaglandins to soften and open the cervix, when it is closed and uneffaced [Figure 1 [1]. When the advantages of starting labour outweigh the disadvantages of continuing the pregnancy, induction is advised. Membrane rupture

without labor, prenatal hypertension, oligohydramnios, an unconvincing foetal state, post-term pregnancy, and a number of

maternal medical disorders, including chronic hypertension and diabetes, are some of the most prevalent indicators [2].



**Figure 1: Labor Induction**

The success of vaginal birth after labour induction depends on a number of factors. Multiparity, a body mass index (BMI) of less than 30, a healthy cervix, and a birthweight of less than 3500 g are all favourable variables [3, 4]. Induction of labour is often required to end pregnancy in roughly 20% of pregnant women [5]. When the cervix is not prepared for induction, there is a higher probability of caesarean birth following labour induction [6]. Delivery occurring within 24 hours of induction is considered a successful induction of labor, and this depends on the cervix's length, location, softness, and dilation. Since its initial introduction in 1964, the Bishop score has remained the gold standard for determining whether to induce labour [7].

The traditional digital examination is vulnerable to observer variability both within and between individuals. The supravaginal section of the cervix, which varies from woman to woman, makes up 50% of the cervical length. This portion's evaluation is challenging to digitally estimate and is quite individualized. Transvaginal ultrasound has been used to measure cervix length and predict the start, length, and result of labor as well as the obstetric outcome following labor induction. This approach has been contrasted

with the Bishop score, which produced contentious outcomes [8].

The objectives of this research were to evaluate the Bishop score in women who were having inductions of labor followed by transvaginal sonography measurements of cervical length, as well as to see how well these measurements predicted how the induction of labor would go.

## Methods

**Study Design:** This was a cross-sectional research where pregnant women who met the inclusion criteria and were admitted to Hi-Tech Medical College & Hospital, Bhubaneswar for induction of labor were included in the study. The research was carried out for one year,

**Methodology:** This was a prospective observational study that involved 200 pregnant women who had been admitted to our hospital's antenatal unit for labor induction for a variety of reasons. Women who are pregnant and meet the inclusion criteria were included. Following a general physical and obstetric examination, a basic obstetric history was obtained. To assess the cervix and record the standard Bishops score—which examines a number of factors including cervical position, dilatation,

effacement, consistency, and station of the fetus' head—a digital vaginal examination was performed.

An experienced obstetrician performed a transvaginal scan on the woman using a diagnostic ultrasound machine and a TVS probe to measure the cervical length. The induction of labor was done in accordance with our hospital's regular procedures. For the purposes of this study, a successful induction was defined as a vaginal delivery within 24 hours of labor induction. Successful induction was defined as having entered the active stage within 24 hours of induction for individuals who underwent a cesarean section less than 24 hours after being induced.

The first and foremost objective was to determine the optimum Bishop's Score and cervical length cutoff values for transvaginal scanning in order to accurately forecast the outcome of successful labor induction. Mode of induction, the time between induction and delivery, and the delivery method are secondary.

**Sample Size:** 200 pregnant women.

**Inclusion criteria:** Singleton pregnancies have a gestational age of 36 to 40 weeks, a living fetus with a cephalic presentation, a patient who is not in labor, and membranes that are still intact.

**Exclusion criteria:** Women who have had a previous cesarean surgery, women who have cpd, women who have hemorrhaged during

pregnancy, women who have signs of a deformed fetus, and women who have PROM

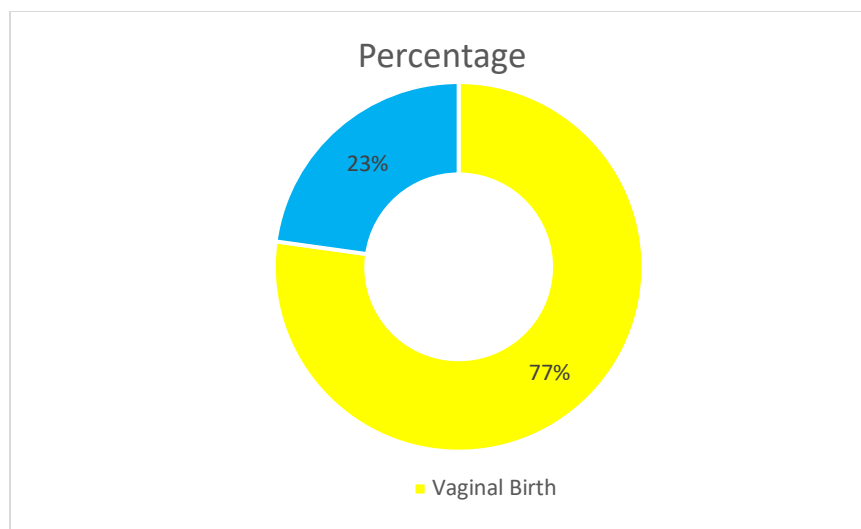
### Statistical Analysis

Microsoft Excel 2013 and SPSS statistical and multivariate analytic tools, version 2012, were used for the statistical analysis. The group of women was sorted roughly into quartiles based on their cervical length and Bishop Score. There was a linear regression analysis. The two factors were examined using multivariate Cox regression analysis as independent predictors of effective labor induction. Comparing the receiver operating characteristic curves for the two approaches. Throughout, two-sided p values were presented; p0.04 was regarded as statistically significant.

### Results

200 people made up the entire research population. Prior to labor induction, the Bishop score was determined per vaginal examination and the cervical length by TVS. The ROC curve was used to determine the best cutoff for cervical length, which was 2.0 cm, and for Bishop, which was  $\geq 4$ . The many causes for labor induction are explained in the above table. Pregnancy-induced hypertension, gestational diabetes, oligohydramnios, and past dates were the most prevalent symptoms among the participants in this study.

In the study population, vaginal births accounted for 77.2%, and cesarean births for 22.8% [Figure 2].



**Figure 2: Percentage Vaginal Birth**

60% of the women in this study gave birth within 24 hours of induction, 25% gave birth between 24 and 48 hours of induction, and 15% gave birth beyond 48 hours of induction [Table 1].

**Table 1: Based on the time from induction until delivery, individuals are distributed in the study.**

Induction to delivery interval	Percentage
<24 hours	60%
25-48 hours	25%
>48	15%

70 of the 160 research subjects who had effective induction had a Bishop score of less than 2, and 110 had a Bishop score of 3 or higher. In contrast, 28 of the 40 unsuccessful inductions had a score of 3 or higher and a score of less than 12. This statistically significant disparity between the proportion of successful and unsuccessful candidates.

85.2% of research participants had successful inductions when the cervical length was less than 2.0 cm, as opposed to those with cervical lengths greater than 2 cm, who had lower success rates. Given that the p-value is 0.002, the difference in the proportion of successful and unsuccessful participants was statistically significant. This demonstrates that the likelihood of a successful induction increases with decreasing cervical length.

With a sensitivity of 61% and a specificity of 86%, the cervical length cut-off value with the best ability to predict a successful induction of labor was 2.0 cm. The Bishop score's cutoff value of 4 had a sensitivity of 62% and a specificity of 56%, making it the greatest indicator of successful induction of labor [Table 2].

**Table 2: Analysis of the sensitivity and specificity of the main indicators of successful labor induction.**

Primary outcome measures	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
TVS cervical length $\leq 2.0$ cm	61%	87.40%	85.2%	64.0%
Bishop score $\geq 4$	63.5%	57.6%	64.7%	56.4%

## Discussion

200 pregnant women who were admitted to our hospital's antenatal ward for labor induction participated in this prospective observational study. A systematic evaluation conducted by Crowley P *et al.* revealed that over 20% of women who had an induction delivered their babies through cesarean section [9]. According to research by Vallikkannu P *et al.*, emergency cesarean deliveries (14.5%) had a greater prevalence of intraoperative difficulties than elective cesarean deliveries (68%) [10].

Bishop Score is a typical method for determining if the cervix is favourable for induction of labour. In a closed cervix, digital examination makes it difficult to detect effacement that begins at the internal os. In this case, transvaginal sonography can be used to quickly determine the cervical length. This study compared transvaginal sonography for determining the cervical length and digital examination for determining the Bishop Score in women who were having term labour induced.

This study has shown that successful vaginal birth within 24 hours of labour induction happened in 66.7% of singleton pregnancies at 36–40 weeks of gestation. The study also showed that the preinduction Bishop score and sonographically measured cervical length are significantly related to the time from induction to delivery; the higher the Bishop score and lower the cervical length, the greater the likelihood of vaginal delivery within 24 hours of induction.

A more accurate indicator of a successful induction of labour was TVS cervical length. Tan *et al.* compared digital examination and transvaginal sonography for determining the Bishop score in women undergoing term labour induction. They came to the conclusion that sonographic cervical length

measurement is more tolerable than digital examination [11]. In this study, roughly 77.2% of the women delivered vaginally and 22.8% received caesarean section after labour was induced. CPD in labor, a failed induction, and foetal distress were the usual causes for caesarean delivery. The prevalence was between 60 and 74% in the investigations by Pandis *et al.*, Cubal *et al.*, and Ranjana *et al.*, but only 40% in the study by Roshan *et al.* [12–15].

In this study's sample population, 61.2% of women gave birth within 24 hours, 25% between 24 and 48 hours, and 12.6% after 48 hours. Contrary to research by Park *et al.*, only 59% of women who had vaginal deliveries in our study were effectively induced and delivered within 24 hours of induction [16].

The best cut-off point for the prediction of a successful induction, according to the receiver operating characteristic (ROC) curves, was 4 for the Bishop score, with a sensitivity of 63% and a specificity of 56%, and 2.0 cm for cervical length, with a sensitivity of 61% and a specificity of 86%. In contrast to the 40 unsuccessful inductions, where 28 participants had scores less than 2.5 cm and 12 participants had scores more than 2.0 cm, 90 people in the 160 successful inductions had cervical measurements less than 2.0 cm and 70 participants had scores greater than 2.0 cm. Because the p value is 0.002, the difference between the proportion of successful and unsuccessful was statistically significant.

According to this study's sensitivity and specificity tests, Bishop Score is not a more accurate predictor of a successful vaginal birth than ultrasonography cervical length. In an investigation by Gomez *et al.* [20]. The optimum cut-off for cervical length was 2.4

cm and a modified Bishop score of 4, and in a study by Shreya *et al*, it was 2 cm and a score of 4 for Bishop score [17,18]. Tan *et al.*, discovered that a cutoff value for the cervical length of 2 cm had an 80% sensitivity rate and a Bishop Score of more than 5 had a 64% sensitivity rate. They came to the conclusion that both the cervical length and the Bishop Score are reliable indicators of the requirement for a cesarean delivery after labor induction [11].

Bishop score and cervical length are connected, according to Pandis *et al*, but cervical length is a stronger indicator of a successful labour induction (R value cervical length=0.70 >R value, cervical length=0.51; p0.0001) [16]. The two parameters were also examined by Ware and Raynor, who concluded that cervical length was a better indicator of a successful induction of labour (R value cervical length=0.69 >R value BS=0.65). Our investigation produced comparable findings [19-21].

To evaluate and compare Bishop score with other measures to determine cervical ripening prior to labour induction, a Cochrane review was recently published. They came to the conclusion that neither modality was better than the other when compared to transvaginal ultrasound, that transvaginal ultrasonography is not practical in resource-poor situations, and that additional research is required to address problems and cutoff points.22 Our study's findings agree with those of Gomez *et al*, Yang *et al*, and Tan *et al* in the ROC curves, although Pandis *et al* concluded that Bishop score and cervical length were independent predictors of successful labour induction [11,12,20–23]. Bishop Score's lower success rate estimates as compared to cervical length may be due to the fact that digital exams aren't always able to accurately gauge how the internal os changes when the external os is closed. In this instance, it would be challenging to determine the internal os arrangement and the total length of the cervix

alone from palpation. The length of the latent phase may not be affected equally by all of the Bishop score's components. Bishop score is determined by palpating the vaginal part of the cervix, however the uterine cervix dynamically changes before or during labor, beginning with the internal OS and moving to the external OS.

Bishop Score's less accurate forecasts of effective induction when compared to cervical length could have several causes, including the fact that digital exams cannot accurately measure how the internal os changes when the external os is closed. By palpation alone, it would be challenging to determine the internal os arrangement and the full length of the cervix in this circumstance. The multiple Bishop score components might not have an equal impact on the latent phase's duration.

The vaginal section of the cervix is palpated to determine the bishop score, however the dynamic changes of the uterine cervix happen before or during delivery, starting from the internal OS and moving to the external OS. The ordinal scale, as opposed to the continuous scale, is used for bishop scoring, which may have lowered its quantification. The possibility of interobserver and intraobserver variances is higher for the bishop score.

The sensitivity for cervical length was not significantly higher despite the fact that it was superior to Bishop score in the assessment of labour induction. This could be explained by the fact that only the latent phase of labour—and not the active phase—should be connected with cervical length. Consequently, a lengthier latent phase of labour may occur for women whose cervical length was lengthy at the time of induction. Additionally, additional elements including cervical resistance, uterine contractions, and forward pressure on the foetus' head may also have an impact on how quickly the latent

phase of labour progresses. The active phase and second stage of labour were substantially correlated with factors such maternal stature, foetal weight, and primipara [16].

### Limitation

The current study's limitation was that all Bishop Score components were not individually examined to determine which could be a more accurate predictor of the outcome of labor induction. We excluded from our study a number of cervix-related factors that would have improved the predictability of TVS assessment, such as dilatation, wedging, angulation, etc. Cervix assessment was not possible in all cases between the time of assessment and induction at a set interval.

### Conclusion

Transvaginal ultrasonography measurement is simple to perform with little discomfort for the patients, and it is helpful in predicting induction response. Cervical length can be measured quantitatively and objectively using sonography, and interobserver variation is minimal. But individuals conducting this measurement ought to be properly trained.

Bishop Score evaluation of the cervix using digital inspection does not require any additional costs, tools, or training. The majority of effective inductions occur in patients between the ages of 21 and 30, with cervical lengths under 2.0 cm and Bishop scores below 4. The cervical length has been shown to be a reliable indicator of a successful induction.

### References

1. Martin JA, Hamilton BE, Ventura SJ. Births: final data for 2011. Natl Vital Stat Rep. 2013;62 (1):1-10.
2. ACOG Practice Bulletin No. 107: Induction of labor. Obstet Gynecol. 2009;114(2):386-97.
3. Peregrine E, O'Brien P, Omar R. Clinical and ultrasound parameters to predict the risk of cesarean delivery after induction of labor. Obstet Gynecol. 2006;107(2):227.
4. Pevzner L, Rayburn WF, Rumney P. Factors predicting successful labor induction with dinoprostone and misoprostol vaginal inserts. Obstet Gynecol. 2009;114(2):261.
5. Bueno B, San-Frutos L, Salazar F, Pérez-Medina T, Engels V, Archilla B, *et al.* Variables that predict the success of labor induction. Acta Obstet Gynecol Scand. 2005;84(11):1093-7.
6. Faltin-Traub EF, Boulvain M, Faltin DL, Extermann P, Irion O. Reliability of the Bishop score before labour induction at term. Eur J Obstet Gynecol Reprod Biol. 2004;112(2):178-81.
7. Bishop EH. Pelvic scoring for Elective induction. Obstet Gynaecol. 1964; 24:269-71.
8. Bansawal R, Rao R, Mishra N, Kapur V. Int J Reprod Contracept Obstet Gynaecol. 2013;2(4):611-5.
9. Crowley P. Interventions for preventing or improving the outcome of delivery at or beyond term. Cochrane Rev. 2001; 3:42-9.
10. Vallikkannu N, Lam WK, Omar SZ, Tan PC. Insulin like growth factor binding protein 1, Bishop Score, and sonographic cervical length: tolerability and prediction of vaginal birth and vaginal birth within 24 hours following labour induction in nulliparous women. BJOG. 2016; 42:25-9.
11. Tan PC, Vallikkannu N, Suguna S, Quek KF, Hassan J. Transvaginal sonographic measurement of cervical length versus Bishop's score in labour induction at term: tolerability and prediction of cesarean delivery. Ultrasound Obstet Gynecol. 2007;29(5):568-73.

12. Pandis GK, Papageorgiou AT, Ramanathan VG, Thompson MO, Nicolaides KH. Preinduction sonographic measurement of cervical length in the prediction of successful induction of labor. *Ultrasound Obstet Gynecol.* 2001;18(6):623-8.
13. Adelaide C, Joana C, Maria F, Graça R, Olímpia C. Value of Bishop score and ultrasound cervical length measurement in the prediction of cesarean delivery. *J Obstet Gynaecol Res.* 2013; 39:127-30.
14. Atal R, Mokharia J, Chauhan M. Study on comparison of transvaginal cervical length and bishop score in predicting successful labour induction. *Int J Recent Trends Sci Technol.* 2016; 18(1):181-4.
15. Nikbakht R and Hemadi M. Transvaginal cervical length and Bishop score value in predicting successful labor induction with an emphasis on the parity. *Int J Pharma Res Allied Sci.* 2016;5(2):114-8.
16. Park KH. Transvaginal ultrasonographic cervical measurement in predicting failed labor induction and cesarean delivery for failure to progress in nulliparous women. *J Korean Med Sci.* 2007;22(4): 722-7.
17. Elghorori MR, Hassan I, Dartey W, Abdel-Aziz E, Bradley M. Comparison between subjective and objective assessments of the cervix before induction of labour. *J Obstet Gynaecol.* 2006;26(6):521-6.
18. Shreya MS, Savitha C. Significance of transvaginal sonographic assessment of cervical length before induction of labour. *Int J Reprod Contracept Obstet Gynecol.* 2018; 7:3702-6.
19. Kaur P, Kaur M, Rao M, Mohan M. Role of transvaginal sonography in preinduction cervical assessment. Is it helpful? *Int J Contemp Med Res.* 2017;4(7):1549-54.
20. Gomez-Laencina AM, Sanchez FG, Gimenez JH, Martinez MS, Valverde Martinez JA, Vizcaino VM. Comparison of ultrasonographic cervical length and Bishop in predicting successful labour induction. *Acta Obstet Gynecol Scand.* 2007;86(7):799-804.
21. Ware V, Raynor BD. Transvaginal ultrasonographic cervical measurement as a predictor of successful labor induction. *Am J Obstet Gynecol.* 2000; 182(5):1030-103.
22. Ezebialu IU, Eke AC, Eleje GU, Nwachukwu CE. Methods for assessing pre-induction cervical ripening. *Cochrane Database Syst Rev.* 2015;6: CD010762.
23. Yang SH, Roh CR, Kim JH. Transvaginal ultrasonography for cervical assessment before induction of labor. *J Ultrasound Med.* 2004; 23(3):375-82.