# Comparison of Bishop score and cervical length measurement through transvaginal ultrasound as prediction against labor induction

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ABSTRACT

**Objective:** To compare the Bishop score and cervical length measured by transvaginal ultrasound concerned with prediction over the success of labor induction. **Methods:** This cross-sectional observational analytical study was conducted from May 2017 to October 2017 at several teaching hospitals of Obstetrics and Gynecology Department, Faculty of Medicine Hasanuddin University of Makassar, India. There were 110 samples of pregnant women undergoing labor induction process including 79 samples of successful induction and 31 samples of induction failure. The data analysis used Pearson *Chi*-square test and multivariate logistic regression to see the effect of Bishop score and measurement of cervical length with successful induction of labor. **Results:** Number of samples with successful labor induction with Bishop score <3 was 25 (31.6%) and Bishop score ⩾3 was 54 (68.4%), with rate ratio=3.714 and $P$=0.000. With measurement of cervical length (cut-off point 2.98 cm), number of samples with successful labor induction with cervical length ⩽2.98 cm was 12 (15.2%) and cervical length >2.98 cm was 67 (84.8%), with rate ratio=3.124 and $P$=0.000. Multivahate analysis of logistic regression was found to be more influential in the predicted success of labor induction ($P$=0.014 with Bishop score <3, odds ratio=1.000 and Bishop score ⩾3, odds ratio=3.779. **Conclusions:** Bishop score is better in predicting the success of labor induction compared to the measurement of cervical length through transvaginal ultrasound.

## 1. Introduction

Labor is a process of the fetus movement from the intrauterine to the extrauterine area; the process was named as the diagnosis clinic. It is an initial as well as a permanent contraction to produce the leveling and clinical dilatation which is connected to each other. The exact mechanism responsible for this process has been not fully understood yet[1].

Induction of labor is performed in about 20% of pregnancies and the success of the induction process of labor is reported to be related to either cervical character or cervical maturity[1]. Labor induction is referred to the place where the uterus contraction will be started either through medical or surgery process which should be carried out before the spontaneous partus. Based on the latest studies, there

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is a variation of the ratio over 9.5%-33.7% from all pregnancies every year. In addition, the cervical condition which is not mature enough will affect the success of partus per vaginam. In conclusion, the maturation of cervical as well as induction preparation should be evaluated yet before conducting therapy[2].

There are several labor induction cases ended with spontaneous labor and several cases ended with sectiosecarea. As many as 1/5 cases of pregnancies women with labor induction ended with sectiosacarea. Within the same palpasi generation, cervical digital is an examination that has been used for evaluating a labor development of women in labor process[1,2]. The examination is subjective and has variability among the investigators. Bishop score was found in 1967 and now remains a gold standard to assess cervical maturity as its function is as a reference of labor induction. However, it has not shown a successful prediction. By the day, there are a lot of cervical evaluation studies through ultrasound. The examination of cervical length through transvaginal ultrasound has been successfully used on the cervical evaluation concerned with the prediction of pre-labor process and post labor induction[3].

An appropriate timing for induction of labor for patients with indications such as diabetes mellitus in pregnancy, post-term pregnancy, and hypertension in pregnancy, remains controversial. If the risk of failure of labor induction can be well predicted, then the timing for the induction of labor may be considered, especially in some cases with milder indications[3].

A study by Park *et al* reveals that the length of the cervix as measured by transvaginal ultrasonography is a better predictor of the success of labor induction compared to the Bishop score[4].

A study by Hatfield *et al* reports that transvaginal ultrasonography was not proven as a predictor to assess the inducibility of the cervix better compared with Bishop score[5].

Based on the description above, this study aims to compare the success of labor induction with Bishop score assessment and cervical length assessment using a transvaginal ultrasound.

## 2. Materials and methods

### 2.1. Location and time of study

This research was conducted at Wahidin Sudirohusodo Hospital, Hasanuddin Hospital and Maternity Hospital as the Educational Network of Medical Faculty, University of Hasanuddin Makasar, India. The research was conducted for 6 months from May 2017 until October 2017.

### 2.2. Design and variable

This was an observational analytical study using cross-sectional design.

### 2.3. Population and sample

The population in this study was all women who would get a birth service in the Educational Hospital while the study was in progress. The sample in this study was women of the population who met the selection criteria.

### 2.4. Method of data collection

This study used primary data obtained by using questionnaire, Bishop score examination and transvaginal ultrasound examination to obtain the length of the cervix.

### 2.5. Technique of data analysis

The data obtained was organized and processed using SPSS 17.0 computer program, Microsoft Excel and Microsoft Word. The data that were processed would be presented in tabular and description form.

## 3. Results

The observational analytical research was conducted using cross-sectional study. In this study, the results were obtained based on sensitivity and specificity test of cervical length. We obtained a cut-off point of a cervical length valued as 2.98 cm with a specificity of 84.8% and 54.8% sensitivity (Figure 1).
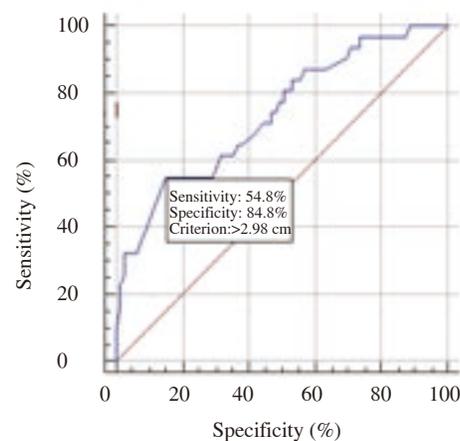


**Figure 1.** Coordinate curve of specificity and sensitivity of cervical length cut-off point.

The characteristics of subjects by sort of age showed that the majority of subjects were ≤35 years old with a Bishop score <3 of 35 subjects, Bishop score ≥3 of 49 subjects, cervical length ≤2.98 cm of 65 subjects and cervical length >2.98 cm of 19 subjects. According to parity, the highest number of subjects found in the multigravida group were Bishop score <3 of 38 subjects and with bishop score

⩾3 of 23 subjects. The results of cervical length measurements were also the highest point in the case of the history of premature rupture of membranes with an average cervical length of ⩽2.98 cm of 34 subjects and cervical length >2.98 cm by 10 subjects on patients with preeclampsia (Table 1). Gestational age, cervical dilatation, and indications (including prolonged 1st stage of labor, oligohydramnion, post-term, *et al*) were also shown in Table 1.

The analysis of the relationship between subject characteristics with the success of labor induction showed that 84 subjects with an average age ⩽35 years, as many as 62 people experienced the success of induction. While from 26 subjects with an average age > 35 years, as many as 17 people had successful induction of labor. Among 49 primigravida subjects, there were 34 people who had experienced successful induction. Whereas from 51 multigravida subjects, as many as 45 people had successful induction of labor. Among 91 subjects were induced with full-term pregnancy, and there

were 68 subjects experiencing successful induction. While from 19 subjects with post-term pregnancy, as many as 11 people had successful labor induction. Among 48 subjects who had a Bishop score <3, there were 25 people who had experienced successful induction. From the 62 subjects who had a bishop score⩾3, as many as 54 people had a successful labor induction. From the 82 subjects who had a cervical length based on cut-off point 2.98 cm, 67 people had a successful induction, while from 56 subjects with cervical length >2.98 cm as many as 12 people had successful induction of labor. The statistical test result showed $P$>0.05. It meaned that there was no statistical significance between age, gravida, parity, and gestational age with successful induction of labor. The Bishop scores and the cervical length were statistically significant with the success of labor induction ($P$<0.05) (Table 2).

Based on result of analysis on the Bishop score with labor induction, we obtained $P$-value=0.000, rate ratio ($RR$)=3.714 [95%

**Table 1**

Distribution of patients characteristics [$n$(%)].

| Characteristics | Bishop score | | Cervical length | |
|---|---|---|---|---|
| | < 3 | ⩾ 3 | > 2.98 cm | ⩽ 2.98 cm |
| Age | | | | |
|   > 35 years old | 13 (27.1) | 13 (21.0) | 9 (32.1) | 17 (20.7) |
|   ⩽ 35 years old | 35 (72.9) | 49 (79.0) | 19 (67.9) | 65 (79.3) |
| Parity | | | | |
|   Primipara | 25 (52.1) | 24 (38.7) | 13 (46.4) | 36 (43.9) |
|   Multipara | 23 (47.9) | 38 (61.3) | 15 (53.6) | 46 (56.1) |
| Gestational age | | | | |
|   Post-term | 12 (25.0) | 7 (11.3) | 9 (32.1) | 10 (12.2) |
|   Full-term | 36 (75.0) | 55 (88.7) | 19 (67.9) | 72 (87.8) |
| Cervical dilatation | | | | |
|   0 | 21 (43.8) | 2 (3.2) | 10 (35.7) | 13 (15.9) |
|   1 | 21 (43.8) | 24 (38.7) | 14 (50.0) | 31 (37.8) |
|   2 | 6 (12.5) | 32 (51.6) | 3 (10.7) | 35 (42.7) |
|   3 | 0 (0.0) | 4 (6.5) | 1 (3.6) | 3 (3.7) |
| Indication | | | | |
|   Prolonged 1st stage of labor | 2 (4.2) | 7 (11.3) | 1 (3.6) | 8 (9.8) |
|   Intra uterine fetal demise | 3 (6.3) | 2 (3.2) | 2 (7.1) | 3 (3.7) |
|   Preeclampsia | 17 (35.4) | 8 (12.9) | 10 (35.7) | 15 (18.2) |
|   Oligohydramnion | 9 (18.8) | 4 (6.5) | 6 (21.4) | 7 (8.5) |
|   Post-term | 3 (6.3) | 15 (24.2) | 3 (10.7) | 15 (18.3) |
|   Premature rupture of membranes | 14 (29.2) | 26 (41.9) | 6 (21.4) | 34 (41.5) |
| Total | 48 (100.0) | 62 (100.0) | 28 (100.0) | 82 (100.0) |

**Table 2**

Analysis of correlation between subject characteristics and successful induction of labor.

| | | Labor induction [$n$(%)] | | | $RR$ | $CI$ 95% | $P$–value |
|---|---|---|---|---|---|---|---|
| | | Failed | Succeed | Total | | | |
| Age | > 35 years | 9 (29.0) | 17 (21.5) | 26 (23.6) | 1.322 | 0.698-2.503 | 0.559 |
| | ⩽ 35 years | 22 (71.0) | 62 (78.5) | 84 (76.4) | | | |
| Parity | Primigravida | 15 (48.4) | 34 (43.0) | 49 (44.5) | 1.167 | 0.643-2.117 | 0.768 |
| | Multigravida | 16 (51.6) | 45 (57.0) | 51 (55.5) | | | |
| Gestational age | Post-term | 8 (25.8) | 11 (13.9) | 19 (17.3) | 1.666 | 0.883-3.143 | 0.229 |
| | Full-term | 23 (74.2) | 68 (86.1) | 91 (82.7) | | | |
| Bishop score | < 3 | 23 (74.2) | 25 (31.6) | 48 (43.6) | 3.714 | 1.824-7.559 | 0.000[*] |
| | ⩾ 3 | 8 (25.8) | 54 (68.4) | 62 (56.4) | | | |
| Cervical length | > 2.98 cm | 16 (51.6) | 12 (15.2) | 28 (25.5) | 3.124 | 1.787-5.462 | 0.000[*] |
| | ⩽ 2.98 cm | 15 (48.4) | 67 (84.8) | 82 (74.5) | | | |

Note: $P$ value was obtained by Pearson *Chi*-square test; *$P$<0.05; $RR$: rate ratio; $CI$: confidence interval.

confidence interval (*CI*): 1.824-7.559]. A statistically significant association was also obtained at cervical length (*P*=0.000) with *RR*=3.124, (95% *CI*: 1.787-5.462), based on a cut-off point of 2.98 cm.

The result of multivariate regression analysis between Bishop score and cervical length found that *P* was significant on Bishop score ⩾3 with *P*-value=0.014, odds ratio (OR)=3.779, (95% *CI*: 1.304-10.950). With Bishop score <3, OR=1.000. The *P*-value was significant in the measurement of cervical length ⩽2.98 cm (*P*=0.048), OR=2.951 (95% *CI*: 1.009-8.663). With cervical length >2.98 cm, OR=1.000. The statistical analysis also showed that vaginal examination with Bishop score ⩾3 had an effect of 3.779 times on the likelihood of successful induction of labor, compared with measurement of cervical length with a cut-off point of 2.98 cm with only 2.951 times at successful labor induction.

## 4. Discussion

The result of data on the study of 110 subjects were processed into the receiver operating characteristic curve to get the cut-off point of the cervical length in this study. The cut-off point of this study obtained the cervical length 2.98 cm with 54.8% sensitivity and 84.8% specificity.

Tendean who analyzed cervical length as a predictor of successful induction of labor in 39 women who underwent labor induction and received a cut-off point of <2.895 cm with 79.41% sensitivity and 80.0% specificity[6].

In the study, there was no statistical significance between age, parity, and gestational age with successful induction of labor. Similarly, Abdelazim *et al* who conducted a study of 120 pregnant women undergoing labor induction found that age, parity, and gestational age did not affect the success of labor induction[7].

The result of bivariate analysis found that there was a statistically significant correlation between Bishop score with successful induction of labor (*P*=0.000, *RR*=3.714; 95% *CI*: 1.824-7.559). Ivars *et al* found that in nulliparous women, the success rate of labor induction reached up to 90%, but their study used a modified Bishop score by not assessing consistency and cervical position, and used the Bishop score 4 limits as a reference. They also found a significant association between Bishop's score with successful induction of labor (*P*<0.001)[8].

Cubal *et al* who conducted a study about 206 women undergoing labor induction suggested that Bishop score is a good predictor of labor induction[9]. Banu *et al* in his study of 125 nulliparous women also suggested that Bishop score and cervical length measurement were also good predictors of delivery status[10]. A systematic review study conducted by Banos *et al* also concluded that cervical status remained an important parameter in assessing the success of labor induction[11]. From a total of 507 studies screened in the database

search, the researchers obtained 7 studies for further analysis. 3 of 7 studies concluded that although Bishop's score was one of the predictive factors of significant labor induction success, and Bishop's score was not the only independent predictive factor[7–9].

In the study, the cut-off point from receiver operating characteristic curve based on measurement of cervical length was 2.98 cm. We used this value to categorize the subject into two groups: the group with the length of the cervix ⩽2.98 cm and >2.98 cm. Then we performed bivariate analysis to find the relationship between the cervical length with the success of labor induction. It can be concluded that cervical length was significantly associated with successful induction of labor. The results of this study are supported by Park *et al* who conducted a prospective study of 154 full-term pregnant women and concluded that measurement of cervical length by using transvaginal ultrasound reduces the use of prostaglandins by 50%[2].

Hatfield *et al* performed a systematic analysis of 20 articles whereas in subgroup analysis a 30 mm cut-off point was used. They concluded that cervical length before induction could not be a predictor of successful vaginal delivery in patients eligible for induction of labor (95% *CI*: 0.67-2.22). They also compared the rates of successful labor induction by measuring the cervical length and Bishop score. However, these two variables were not significant to predict the success of labor induction[5].

In bivariate analysis, several variables in our study is proven to be significantly related to the success of labor induction, Bishop score ⩾3 (*P*=0.000), and cervical length ⩽2.98 cm (*P*=0.000), but to answer the question of whether the measurement of cervical length measured by transvaginal ultrasound is better than Bishop score, we do multivariate analysis of logistic regression by only analyzing two variables. From our analysis, we found that Bishop score has a statistically stronger significance level of *P*=0.014 (OR: 3.779) when compared to cervical length with *P*=0.048 (OR: 2.951).

The difference between the results of this study and the results of previous study may be due to the variations in research methods, sampling techniques, and determination of sample inclusion criteria. Some studies also have variations in the determination of cut-off parameters and additional parameters. Then, there are some variations in the determination of various characteristics of the sample.

In the study, Bishop's score was better in assessing the success of labor induction. The examination on Bishop score was performed by more than two inverstigators who had not passed the Intern Tests among inverstigators, therefore, this research in term of measurement of Bishop score can be said to have a high variability and subjectivity that can give bias results in the study. In the same case, the cervical length measurements by inverstigators have not performed the standardized internal tests.

Our study is also limited in terms of the number of research subjects who receive the same treatment in the labor induction

process, because the subject of the study receives different treatment of induction actions that match the Bishop score of the subject.

The ultrasound device used in the measurement of cervical length is a different tool depending on the location of the hospital and the device availability at the place of the study subjects.

In conclusion, based on the overall statements above, Bishop's score is better in predicting the success of labor induction compared to the measurement of cervical length through transvaginal ultrasound. The researchers suggest additional parameters of cervical such as measurement by posterocervico angle from the cervix and cervical elastography examination.

## Conflict of interest statement

The authors declare that there is no conflict of interest.

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