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ORIGINAL PAPER / OBSTETRICS

Comparison of Bishop's score and cervical length in determining the need for cervical maturation before labor induction

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Short title: Comparison of Bishop's score and cervical length in determining the need for cervical maturation

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ABSTRACT

Objectives: The aim of this study is to compare the evaluation of cervical length measured by the Bishop score and transvaginal ultrasonography in determining the need for prostaglandin application for cervical ripening in term nulliparous pregnancies.

Material and methods: In our study, a total of 120 patients who were admitted to our hospital between February 2015 and August 2015 were divided into two groups as cervical length group and Bishop score group according to hospitalization order by applying the

Permuted Block Randomization method, which is one of the Restricted Randomization methods. Each patient included in the study was evaluated with both the Bishop score and transvaginal ultrasonography. Groups were compared according to the APGAR scores in the 1st and 5th minutes, transition within 12 hours, birthing within 24 hours, birthing with only dinoprostone, birthing with only oxytocin, duration of administration of dinoprostone, duration of oxytocin administration, type of birth, rate of cesarean section, and need for neonatal intensive care.

Results: While cervical ripening with dinoprostone was applied to 28 (46.7%) of 60 pregnant women in the Bishop group, labor induction with oxytocin was applied to the remaining 32 (53.3%) pregnant women. In the cervical length group, these values were 33 (55.0%) and 27 (45.0%), respectively. There was no statistically significant difference between study groups in terms of the need for dinoprostone for cervical ripening ($p = 0.361$). Of those with a Bishop score of 4 or below, 78.6% (n = 22) had a cervical length of over 28 mm, and 71.4% (n = 20) needed oxytocin. Of those with a Bishop score above 4, none of them had a cervical length greater than 28 mm. A statistically significant difference was found between those with a Bishop score of 4 or below and those above 4 in terms of cervical length ($p < 0.05$). Among those with a Bishop score of 4 or below, the percentage of those with a cervical length above 28 mm was significantly higher than that of those with a Bishop score above 4.

Conclusions: In our study, the delivery time of those with a cervical length of 28 mm and above was significantly higher than those with a cervical length of less than 28 mm, while the bishop score was significantly lower. In order to develop a more objective method that can replace the Bishop scoring system in determining the need for cervical ripening before labor induction, prospective randomized studies that screen larger numbers of patients are needed.

Keywords: Bishop score; cervical length; labor induction

INTRODUCTION

Induction of labor is performed with medical indications in approximately 15% of < term pregnancies. It is reported to be accompanied by a higher cesarean section rate compared to spontaneous labor [1, 2]. The cesarean section rate is reported to be higher in nulliparous patients with an inappropriate cervix [3]. It has been shown that nulliparity is also associated with a longer duration of labor [4]. It has been reported that the reason why the duration of labor is longer in nulliparous pregnant women than in multiparous pregnant women may be due to the fact that the acceleration phase is longer in multiparous pregnant women in particular [5].

The most commonly used method for determining patients who will receive prostaglandins for cervical maturation purposes is the Bishop score. However, the evaluation of cervical changes with the Bishop score is subjective. A low Bishop score has a low predictive value in predicting induction failure in patients because the internal os cannot be evaluated when the external os is closed [6, 7]. Therefore, many patients with low Bishop scores, who were previously thought to benefit from prostaglandin therapy, may have been exposed to unnecessary medication, and this can be prevented by more appropriate, new cervical evaluation methods (*e.g.*, cervical sonography, fetal fibronectin determination) that complement digital cervical examination findings.

Transvaginal ultrasonography is a well-known objective technique in the evaluation of cervical length, and it has been reported that it will give an idea about the structure of the internal os even when the external os is closed [8, 9]. Sonographic measurement of cervical length is used as part of routine obstetric evaluation. Evaluation of cervical length in order to predict and prevent preterm labor in pregnant women between 16–24 weeks is the most important use of cervical length measurement in obstetrics [10, 11].

The aim of this study is to compare the evaluation of cervical length measured by the Bishop score and transvaginal ultrasonography in determining the need for prostaglandin administration for cervical ripening in term nulliparous pregnant women.

MATERIAL AND METHODS

A total of 120 nulliparous pregnant women hospitalized in our hospital between February 2015 and August 2015 due to delivery indication were included in the study. Inclusion criteria were determined as single pregnancy, head presentation, intact amniotic membranes, live pregnancy over 37 weeks, not starting labor (absence of painful regular uterine contractions), and no history of previous uterine surgery. A total of 120 patients who met these criteria were divided into two groups, the cervical length group and the Bishop score group, according to their hospitalization order, by applying the permuted block randomization method, which is one of the restricted randomization methods.

Each patient included in the study was evaluated with both the Bishop score and transvaginal ultrasonography. After the bladder was emptied, three measurements were taken by placing the probe into the vagina without creating cervical distortion with transvaginal ultrasound, and the shortest measurement value was accepted as the cervical length. The midsagittal view of the cervix and the lower uterine segment were included in the imaging field. Internal os, external os, the endocervical canal, and the endocervical mucosa, which is

more echogenic in the canal, were clearly visualized. Measurements were performed by placing the calipers in the internal and external os at the longest distance where the cervical walls were in contact. The measurement was performed when there was no uterine contraction [12]. A Bishop score of 4 or below was accepted as an indication for cervical ripening (using dinoprostone). In the cervical length group, a cervical length of 28 mm or more was accepted as an indication for cervical ripening. In patients who needed cervical ripening, a dinoprostone (PGE 2) vaginal insert (Propess 10 mg®, Ferring Pharmaceuticals, Israel) was wetted and properly placed in the posterior vaginal fornix; the insert was left in place for a maximum of 12 hours. The insert was quickly removed from the vagina in the cases of initiation of active labor other than spontaneous expulsion, rupture of membranes, uterine hyperstimulation (10 min > 5 contractions in the last 30 minutes) or presence of hypertonic uterine contractions (uterine contraction lasting 2 minutes or longer), fetal distress, and maternal systemic side effects related to dinoprostone (nausea, vomiting, tachycardia, or hypotension). The patients' uterine contractions and fetal heart rate were monitored and reported with an interval of 30 minutes in the first phase of labor and 15 minutes in the second phase; the condition of the cervix was checked with an hourly vaginal examination.

Oxytocin infusion was started with an infusion pump at a dose of 2 mU/min, defined as an "alternative low dose" by ACOG, for pregnant women with a Bishop score of > 4. It was increased by 2 mU/min every 15–30 minutes until sufficient uterine contraction (at least 3 contractions longer than 40 seconds in 10 minutes) was achieved. Intravenous oxytocin infusion was started with the same protocol in patients who underwent the cervical ripening method (dinoprostone) if adequate contraction was not observed at least 2 hours after the termination of the method. Amniotomies (standard amniotomies) were performed in cases with a cervical dilation of > 4 cm and an engaged head during follow-ups. A cesarean section was performed with the diagnosis of labor arrest if labor did not progress despite oxytocin augmentation for more than two hours and ≥ 200 montevideo unit uterine contractions for at least 4 hours, or if there was no cervical change for ≥6 hours in patients whose uterine contractions could not be created adequately [13]. Cesarean section was also performed in the 2nd phase of labor if the progression and rotation stopped for ≥ 3 hours [13]. Fetal distress was defined as a loss of basal variability, the presence of recurrent late decelerations, the presence of recurrent variable decelerations, or bradycardia [14].

Groups were compared according to the APGAR scores in the 1st and 5th minutes, transition within 12 hours, birthing within 24 hours, birthing with only dinoprostone, birthing

with only oxytocin, duration of administration of dinoprostone, duration of oxytocin administration, type of birth, rate of cesarean section, and need for neonatal intensive care. Statistical analysis was performed using SPSS 23.0 (SPSS Inc, Chicago, IL). Descriptive statistics were presented as mean ± standard deviation, frequency distribution, and percentage. The Pearson Chi-Square Test, Yates Corrected Chi-Square Test, and Fisher's Exact Test were used to evaluate categorical variables. The conformity of the variables to normal distribution was examined using visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk Test). Student's T Test was used as a statistical method to determine the statistical significance between two independent groups for the variables that were found to have a normal distribution. For the variables that do not fit the normal distribution, the Mann-Whitney U Test was used for significance between two independent groups. The statistical significance level was accepted as $p < 0.05$.

RESULTS

The distribution of weeks of gestation according to age, body mass index (BMI), last menstrual period, and first trimester ultrasonography according to study groups is presented in Table 1.

While cervical ripening with dinoprostone was applied to 28 (46.7%) of 60 pregnant women in the Bishop group, labor induction was applied to the remaining 32 (53.3%) pregnant women with oxytocin. In the cervical length group, these values were 33 (55.0%) and 27 (45.0%), respectively. There was no statistically significant difference between study groups in terms of the need for dinoprostone for cervical ripening ($p = 0.361$).

The distribution of some descriptive and clinical features between those with a Bishop score of 4 or below and those with a Bishop score above 4 is presented in Table 2. Among the patients in the Bishop group, a statistically significant difference was found between those with a Bishop score of 4 or below and those above 4 in terms of cervical length, the 1st and 5th minute APGAR score of the newborn, and the delivery time of the pregnant women who had normal deliveries ($p < 0.05$). The mean cervical length of those with a Bishop score of 4 or below, the 1st and 5th minute APGAR score of the newborn, and the delivery time of the pregnant women who had a normal delivery were significantly higher than those with a Bishop score of above 4.

In addition, 25.0% ($n = 7$) of the pregnant women with a Bishop score of 4 or below had a transition to active labor in the first 12 hours, while the normal delivery time was 24 hours or less in 40.0% ($n = 6$) of the pregnant women who had a normal delivery. For those

with a Bishop score above 4, while active labor was observed in 75.0% (n = 24) of the pregnant women in the first 12 hours, the normal delivery time was 24 hours or less in 86.4% (n = 19) of the pregnant women who had normal deliveries. A statistically significant difference was found between those with a Bishop score of 4 or below and those above 4 in terms of active labor status and duration of labor in the first 12 hours ($p < 0.05$). Among those with a Bishop score above 4, the percentage of those who had active labor within the first 12 hours and those who had labor in 24 hours or less were significantly higher than those with a Bishop score of 4 or below. In addition, 78.6% (n = 22) of those with a Bishop score of 4 or below had a cervical length of over 28 mm, while 71.4% (n = 20) needed oxytocin. Of those with a Bishop score above 4, none of them had a cervical length greater than 28 mm. A statistically significant difference was found between those with a Bishop score of 4 or below and those above 4 in terms of cervical length ($p < 0.05$). Among those with a Bishop score of 4 or below, the percentage of those with a cervical length above 28 mm was significantly higher than that of those with a Bishop score above 4 (Tab. 2).

The distribution of some descriptive and clinical features of those with a cervical length of 28 mm or above and those with a cervical length of less than 28 mm in the cervical length group are presented in Table 3. Among the pregnant women in the cervical length group, a statistically significant difference was found between those with a cervical length less than 28 mm and those with a cervical length of 28 mm or above in terms of the Bishop score and delivery time of those who had a normal delivery ($p < 0.05$). The delivery time of those with a cervical length of 28 mm and above was significantly higher than that of those with a cervical length of less than 28 mm, while the bishop score was significantly lower. (Tab. 3).

The Bishop score was 4 or below in 18.5% (n = 5) of those with a cervical length less than 28 mm, active labor was observed in 85.2% (n = 23) within the first 12 hours; and the duration was 24 hours or less in all pregnant women who had a vaginal birth. In those with a cervical length of 28 mm and above, these rates are 90.9% (n = 30), 18.2% (n = 6), and 45.8% (n = 11), respectively. A statistically significant difference was found between those with a cervical length less than 28 mm and those with a length of 28 mm or above in terms of the Bishop score, active labor status in the first 12 hours, and delivery time of those who had a normal delivery ($p < 0.05$). Among those with a cervical length of 28 mm and above, the percentage of those with a Bishop score of 4 or below was significantly higher than that of those with a cervical length of less than 28 mm, while the percentage of those with active labor in the first 12 hours and a delivery time of 24 hours or less was significantly lower (Tab. 3).

The distribution of some descriptive and clinical features between those in the bishop group with a bishop score of 4 or below and those in the cervical group with a cervical length of 28 mm or above is presented in Table 4. Those with a Bishop score of 4 or below, and a cervical length of 28 mm or above have similar data of age, BMI, weeks of gestation according to the last menstrual period and first trimester ultrasonography, induction indications, duration of application of the method, oxytocin need and oxytocin intake times, spontaneous expulsion states, active labor status in the first 12 hours, type of delivery, cesarean section indication, abnormal labor finding, need for neonatal intensive care unit, the 1^{st} and 5^{th} minute APGAR scores, delivery time and total delivery time ($p > 0.05$) (Tab. 4). No statistically significant difference was found between those with a Bishop score of 4 or above, and a cervical length of 28 mm or above in terms of BMI, weeks of gestation according to the last menstrual period and first trimester ultrasonography, induction indications, duration of application of the method, oxytocin need and oxytocin intake times, spontaneous expulsion states, active labor status in the first 12 hours, type of delivery, cesarean section indication, abnormal labor finding, need for neonatal intensive care unit, 1^{st} and 5^{th} minute APGAR scores, delivery time and total delivery time ($p > 0.05$) (Tab. 5).

Those with a Bishop and a cervical length group have no statistically significant difference in terms of the data of age, BMI, weeks of gestation according to the last menstrual period and first trimester ultrasonography, induction indications, duration of application of the method, oxytocin need and oxytocin intake times, spontaneous expulsion states, active labor status in the first 12 hours, type of delivery, cesarean section indication, abnormal labor finding, need for neonatal intensive care unit, 1st and 5th minute APGAR scores, delivery time and total delivery time ($p > 0.05$)

DISCUSSION

This study aimed to investigate the effect of cervical length and Bishop score on the determination of the indication of dinoprostone use for cervical ripening in pregnant women with term nulliparous delivery indication. Among the Bishop score and cervical length groups, no statistically significant difference was found in terms of age, BMI, gestational week according to last menstrual period and dating, types of methods used, indication of induction, duration of application of the method, oxytocin requirement and duration of oxytocin intake, spontaneous expulsion and active labor in the first 12 hours, mode of delivery, cesarean section (C/S) indication, abnormal labor finding, hospitalization in the neonatal intensive care unit, 1^{st} and 5^{th} minute APGAR scores, and duration of delivery ($p >$

0.05). Although the normal vaginal delivery rate was not statistically significant, it was found to be higher in the cervical length group.

In a study evaluating 154 pregnant women, Park et al. [15] compared the Bishop score and measurement of cervical length with transvaginal US in determining the need for cervical ripening in nulliparous pregnant women. It was reported that measuring cervical length with transvaginal US could reduce dinoprostone use by approximately 50% compared to the assessment with Bishop score [15]. In this study, while the cut-off value was accepted as 28 mm for cervical length in determining the cervical ripening need, the cut-off value was accepted as 4 for the Bishop score. In our study, no statistically significant difference was found between the cervical length group and the Bishop score group in terms of the use of dinoprostone for cervical ripening. In the aforementioned study, it was reported that delivery occurred within 24 hours in 58% of pregnant women in both groups. Similarly, in our study, while the delivery rate within 24 hours was 68.3% in the cervical length group, this rate was 67.6% in the Bishop group.

Gouri et al. [16] compared the efficacy of cervical length and the Bishop score to predict successful labor induction in 100 primigravid patients. In the study that included 37-42 weeks pregnant women, it was reported that the evaluation with only cervical length before labor induction and the evaluation with cervical length + Bishop score was statistically significantly successful in predicting normal vaginal delivery within 24 hours compared to the evaluation with only the Bishop score [16]. In this study, unlike ours, while misoprostol was used for cervical ripening purposes, the cut-off value was accepted as 5 in determining the cervical ripening need in patients evaluated with the Bishop score.

In the study of Pandis et al. [17], in which they compared cervical length and Bishop score in predicting delivery within 24 hours in 240 multiparous and nulliparous singleton pregnancies, a statistically significant correlation was found between cervical length and the time between the onset of induction and time of delivery ($r = 0.7061$, $p < 0.0001$). In this study, it was reported that the rate of delivery within 24 hours decreased as the cervical length increased. In the study of Pandis et al. [17], a statistically significant ($r = 0.6434$, $p < 0.0001$) relationship was found between cervical length and the Bishop score. Peterson-Brown et al. [18] reported that the Bishop score in 50 pregnancies evaluated before induction was associated with successful vaginal delivery, while sonographic measurement of cervical length was not correlated with both successful induction of labor and the Bishop score, unlike our study. In the study conducted by Gonen et al. [19] on 86 pregnant women, they reported that both the Bishop score and cervical length were statistically significant in predicting

successful labor induction and delivery time. However, in logistic regression analysis, it has been reported that only the Bishop score and parity are important in determining successful labor induction and the duration of labor[19]. Ware and Raynor [20] reported that both the Bishop score and cervical length were effective in predicting successful labor induction and duration of labor in their study, in which they evaluated 77 pregnant women, but they reported that only cervical length and parity were independent variables in predicting vaginal delivery in logistic regression analysis.

Gomez et al. [21] included both nulliparous and multiparous pregnant women in their study, in which they compared cervical length and the Bishop score in predicting delivery within 60 hours in 177 women. In this study, they reported that the evaluation of cervical length by transvaginal sonography was more successful in predicting the success of induction of labor with prostaglandin and oxytocin [21]. They suggested that the cut-off value for cervical length should be taken as 24 mm. Bishop score, cervical length, and parity were reported to be statistically significant independent variables in predicting successful vaginal delivery in multiple regression analyses.

Cubal et al. [22] evaluated the effectiveness of measuring Bishop score and cervical length by transvaginal ultrasonography in predicting cesarean delivery in their study, in which they analyzed 197 women. In univariate analysis, nulliparity, a Bishop score below 5, and a cervical length of over 30 mm were found to be significant in predicting cesarean delivery, while in multivariate analysis, only nulliparity was found to be statistically significant in predicting cesarean delivery [22]. In our study, the rate of cesarean section was 46% in the group with a Bishop score of 4 or below, while it was 31.3% in patients with a Bishop score above 4. Although the cesarean section rate was higher in the group with a Bishop score of 4 or below, it was not statistically significant ($p = 0.347$).

Ramathan et al. [23] investigated the value of routine transvaginal cervical length assessment in predicting delivery time and delivery outcomes in 37-week singleton pregnancies. In this study, they reported that routine evaluation of transvaginal sonographic cervical length at 37 weeks was successful in predicting normal delivery that started spontaneously before 40 weeks and predicting the rates of cesarean delivery due to induction failure in patients in whom labor induction was initiated because spontaneous delivery did not start until postterm [23].

CONCLUSIONS

Bishop scoring system is used to determine the need for cervical ripening before induction in pregnant women for whom labor induction is decided. However, this scoring system is based on subjective examination findings. Especially in pregnant women with closed cervical external os, 2 parameters of the scoring system (cervical opening and cervical effacement) cannot be evaluated, and patients have scored over 6 points. Evaluating cervical length by transvaginal ultrasonography both gives information about the internal os when the external os is closed and is a more objective method compared to the Bishop score.

In our study, similar results were found with the evaluation of the Bishop score in terms of cervical length evaluation, duration of application of dinoprostone for cervical maturation, oxytocin requirement and oxytocin intake times, active labor status in the first 12 hours, delivery type, cesarean section rates, abnormal labor findings, need for a neonatal intensive care unit, 1st and 5th minute APGAR scores, and the duration of delivery of pregnant women who had a normal delivery. However, the delivery time of those with a cervical length of 28 mm or above was significantly higher than those with a cervical length of less than 28 mm, while the bishop score was significantly lower.

In order to develop a more objective method that can replace the Bishop scoring system in determining the need for cervical ripening before labor induction, prospective randomized studies that screen larger numbers of patients are needed.

Article information and declarations

Data availability statement

The data supporting the findings of this study are publicly available.

Ethics statement

The approval of Zekai Tahir Burak Clinical Research Ethics Committee (decision dated 27.02.2015 and numbered 02/19).

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Hakan Demir and Ahmet Nuri Danışman . The first draft of the manuscript was written by Emre Köle and all authors commented on previous versions of the manuscript.

All authors read and approved the final manuscript.

Conceptualizatin: Hakan Demir; Methodology: Ahmet Nuri Danışman; Formal analysis and investigation: Ahmet Nuri Danışman; Writing — original draft preparation: Emre Köle, Merve Çakır Köle; Writing — review and editing: Emre Köle, Ahmet Güllüoğlu; Supervision: Emre Köle, Hakan Demir.

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Conflict of interest

No conflict of interest was declared by the authors.

Supplementary material

None.

REFERENCES

Table 1. Distribution of age, body mass index (BMI) and gestational week according to the groups

	Bishop (n = 60)	**Cervical length (n = 60)**	**p**
	$\acute{X}$ **± SD**	$\acute{X}$ **± SD**	
Age [year]	23.90 ± 3.72	24.37 ± 4.01	0.469
BMI [kg/m^2]	28.35 ± 3.91	28.76 ± 4.28	0.580
Week of pregnancy [LMP]	40.26 ± 1.46	40.16 ± 1.45	0.344
Week of pregnancy [dating]	40.21 ± 1.41	40.11 ± 1.34	0.252

$\acute{X}$ — mean; SD — standard deviation; LMP — last menstrual period

Table 2. Distribution of some descriptive and clinical characteristics by Bishop score

	Bishop score				**p**
	≤ 4		**> 4**		
	n	$\acute{X}$ **± SD/number**	**n**	$\acute{X}$ **± SD/number**	

		(%*)		(%*)	
Age [year]	28	24.75 ± 3.3	32	23.16 ± 3.78	0.106
BMI [kg/m^2]	28	29.45 ± .10	32	27.38 ± 3.52	0.060
Week of pregnancy [LMP]	28	40.56 ± 1.19	32	39.99 ± 1.63	0.617
Week of pregnancy [dating]	28	40.42 ± 1.16	32	40.02 ± 1.61	0.527
Cervical lenght	28	33.43 ± 6.44	32	20.25 ± 3.78	< **0.001**
< 28 mm	28	6 (21.4)	32	32 (100)	**—**
≥ 28 mm		22 (78.6)		0	
Induction indication					
Delay	28	19 (67.9)	32	19 (59.4)	0.681
Oligohydramnios		9 (32.1)		13 (40.6)	
Duration of the application of the method [hour]	28	10.43 ± 2.89	0	—	—
Oxytocin need					
No	28	8 (28.6)	32	0	**—**
Yes		20 (71.4)		32 (100)	
Oxytocin intake time [hour]	20	13.54 ± 7.84	32	11.24 ± 5.60	0.170
Spontaneous expulsion					
No	28	19 (67.9)	0	0	—
Yes		9 (32.1)		0	
Active labor status in the first 12 hours					
No	28	21 (75.0)	32	8 (25.0)	< **0.001**
Yes		7 (25.0)		24 (75.0)	
Type of delivery					
NVD	28	15 (53.6)	32	22 (68.8)	0.347
C/S		13 (46.4)		10 (31.3)	
C/S indication					
CPD	13	3 (23.1)	10	0	0.105
Non advancing labor		6 (46.2)		3 (30.0)	
Fetal distress		4 (30.8)		7 (70.0)	
Abnormal labor findings					
No	28	27 (96.4)	32	32 (100)	—
Tachysystole		1 (3.6)		0	
Need to stay in the neonatal intensive care unit					
No	28	27 (96.4)	32	32 (100)	—
Yes		1 (3.6)		0	
1st minute APGAR Score	28	7.79 ± 1.13	32	7.53 ± 0.67	**0.002**
5th minute APGAR Score	28	9.79 ± 1.13	32	9.47 ± 0.57	< **0.001**
Duration of delivery [hour]	15	26.16 ± 11.94	22	12.38 ± 7.39	< **0.001**
≤ 24 hour	15	6 (40.0)	22	19 (86.4)	**0.005**
> 24 hour		9 (60.0)		3 (13.6)	

$\acute{X}$ — Mean; SD — standard deviation; BMI — body mass index; LMP — last menstrual period; NVD — normal vaginal delivery; C/S — cesarean section; CPD — cephalopelvic disproportion; *Column percentage; Continuous variables were presented as “mean ± standard deviation” and categorical variables as “number (column percentage)”

Table 3. Distribution of some descriptive and clinical features by cervical length

	Cervical lenght				
	< 28 mm (n = ??)		≥ 28 mm (n = ??)		
	n	$\acute{X}$ ± SD/Sayı?? (%*)	n	$\acute{X}$ ± SD/Sayı?? (%*)	p
Age [year]	27	24.89 ± 3.85	33	23.94 ± 4.14	0.366
BMI [kg/m^2]	27	28.27 ± 4.76	33	29.17 ± 3.86	0.421
Week of pregnancy [LMP]	27	39.70 ± 1.44	33	40.53 ± 1.37	0.055
Week of pregnancy [dating]	27	39.68 ± 1.29	33	40.46 ± 1.29	0.051
Bishop score	27	6.11 ± 2.04	33	2.73 ± 1.04	< **0.001**
≤ 4	27	5 (18.5)	33	30 (90.9)	< **0.001**
> 4		22 (81.5)		3 (9.1)	
Induction indication					
Delay	27	16 (59.3)	33	20 (60.6)	0.916
Oligohydramnios		11 (40.7)		13 (39.4)	
Duration of the application of the method [hour]	3	7.82 ± 4.28	30	10.46 ± 2.70	—
Oxytocin need					
No	27	0 (0)	33	4 (12.1)	—
Yes		27 (100)		29 (87.9)	
Oxytocin Intake Time [hour]	25	9.99 ± 4.31	29	12.72 ± 7.38	0.256
Spontaneous expulsion					
No	0	0	30	22 (73.3)	—
Yes		0		8 (26.7)	
Active labor status in the first 12 hours					
No	27	4 (14.8)	33	27 (81.8)	< **0.001**
Yes		23 (85.2)		6 (18.2)	
Type of delivery					
NVD	27	17 (63.0)	33	24 (72.7)	0.596
C/S		10 (37.0)		9 (27.3)	
C/S indication					
CPD	10	0	9	2 (22.2)	0.277
Non advancing labor		5 (50.0)		3 (33.3)	
Fetal distress		5 (50.0)		4 (44.5)	
Abnormal labor findings					
No	27	25 (92.6)	33	33 (100)	—
Tachysystole		2 (7.4)		0	
Need to stay in the neonatal intensive care unit					
No	27	26 (96.3)	33	33 (100)	—
Yes		1 (3.7)		0	
1st minute APGAR score	27	7.48 ± 1.55	33	7.97 ± 0.58	**0.049**
5th minute APGAR score	27	9.48 ± 1.12	33	9.91 ± 0.52	**0.005**
Duration of delivery [hour]	17	9.62 ± 4.09	24	25.28 ± 16.68	< **0.001**
≤ 24 hour	17	17 (100)	24	11 (45.8)	—
> 24 hour		0		13 (54.2)	

$\acute{X}$ — Mean; SD — standard deviation; BMI — body mass index; LMP — last menstrual period; NVD — normal vaginal delivery; C/S — cesarean section; CPD — cephalopelvic

disproportion; *Column percentage; Continuous variables were presented as “mean ± standard deviation” and categorical variables as “number (column percentage)”

Table 4. Distribution of some descriptive and clinical characteristics between a Bishop score of 4 and below; cervical length 28 mm and over

	Bishop Score ≤ 4		**Cervical Length ≥2 8 mm**		**p**
	n	$\acute{X}$ ± **SD/Number (%*)**	**n**	$\acute{X}$ ± **SD/Number (%*)**	
Age [year]	28	24.75 ± 3.3	33	23.94 ± 4.14	0.419
BMI [kg/m^2]	28	29.45 ± .10	33	29.17 ± 3.86	0.783
Week of pregnancy [LMP]	28	40.56 ± 1.19	33	40.53 ± 1.37	0.720
Week of pregnancy [dating]	28	40.42 ± 1.16	33	40.46 ± 1.29	0.787
Induction indication					
Delay	28	19 (67.9)	33	20 (60.6)	0.749
Oligohydramnios		9 (32.1)		13 (39.4)	
Duration of the application of the method [hour]	28	10.43 ± 2.89	30	10.46 ± 2.70	0.970
Oxytocin need					
No	28	8 (28.6)	33	4 (12.1)	0.198
Yes		20 (71.4)		29 (87.9)	
Oxytocin intake time [hour]	20	13.54 ± 7.84	29	12.72 ± 7.38	0.604
Spontaneous expulsion					
No	28	19 (67.9)	30	22 (73.3)	0.866
Yes		9 (32.1)		8 (26.7)	
Active labor status in the first 12 hours					
No	28	21 (75.0)	33	27 (81.8)	0.738
Yes		7 (25.0)		6 (18.2)	
Type of delivery					
NVD	28	15 (53.6)	33	24 (72.7)	0.199
C/S		13 (46.4)		9 (27.3)	
C/S indication					
CPD		3 (23.1)		2 (22.2)	
Non advancing labor	13	6 (46.2)	9	3 (33.3)	0.783
Fetal distress		4 (30.8)		4 (44.5)	
Abnormal labor findings					
No	28	27 (96.4)	33	33 (100)	-----
Tachysystole		1 (3.6)		0	
Need to stay in the neonatal intensive care unit					
No	28	27 (96.4)	33	33 (100)	-----
Yes		1 (3.6)		0	
1st minute APGAR score	28	7.79 ± 1.13	33	7.97 ± 0.58	0.312
5th minute APGAR score	28	9.79 ± 1.13	33	9.91 ± 0.52	0.888
Duration of delivery [hour]	15	26.16 ± 11.94	24	25.78 ± 16.68	0.415

≤ 24 hour > 24 hour	15	6 (40.0) 9 (60.0)	24	11 (45.8) 13 (54.2)	0.980

$\acute{X}$ — Mean; SD — standard deviation; BMI — body mass index; LMP — last menstrual period; NVD — normal vaginal delivery; C/S — cesarean section; CPD — cephalopelvic disproportion; *Column percentage; Continuous variables were presented as “mean ± standard deviation” and categorical variables as “number (column percentage)”

Table 5. Distribution of some descriptive and clinical characteristics between a Bishop score of above 4 and cervical length less than 28 mm

	Bishop Skoru > 4		**Servikal uzunluk < 28 mm**		**p**
	n	**$\acute{X}$ ± SD/Sayı (%*)**	**n**	**$\acute{X}$ ± SD/Sayı (%*)**	
Age [year]	32	23.16 ± 3.78	27	24.89 ± 3.85	0.081
BMI [kg/m^2]	32	27.38 ± 3.52	27	28.27 ± 4.76	0.568
Week of pregnancy [LMP]	32	39.99 ± 1.63	27	39.70 ± 1.44	0.435
Week of pregnancy [dating]	32	40.02 ± 1.61	27	39.68 ± 1.29	0.138
Induction indication					
Delay Oligohydramnios	32	19 ± 59.4) 13 ± 40.6)	27	16 ± 59.3) 11 ± 50.7)	0.993
Oxytocin need					
No Yes	32	0 32 ± 100)	27	0 ± 0) 27 ± 100)	—
Oxytocin intake time [hour]	32	11.24 ± 5.60	25	9.99 ± 4.31	0.281
Active labor status in the first 12 hours					
No Yes	32	8 ± 25.0) 24 ± 75.0)	27	4 ± 14.8) 23 ± 85.2)	0.520
Type of delivery					
NVD C/S	32	22 ± 68.8) 10 ± 31.3)	27	17 ± 63.0) 10 ± 37.0)	0.848
C/S indication					
Non advancing labor Fetal distress	10	3 ± 30.0) 7 ± 70.0)	10	5 ± 50.0) 5 ± 50.0)	0.650
Abnormal labor findings					
No Tachysystole	32	32 ± 100) 0	27	25 ± 92.6) 2 ± 7.4)	0.205
Need to stay in the neonatal intensive care unit					
No Yes	32	32 ± 100) 0	27	26 ± 96.3) 1 ± 3.7)	0.458
1st minute APGAR score	32	7.53 ± 0.67	27	7.48 ± 1.55	0.180
5th minute APGAR score	32	9.47 ± 0.57	27	9.48 ± 1.12	0.187
Duration of delivery [hour]	22	12.38 ± 7.39	17	9.62 ± 4.09	0.092
≤ 24 hour > 24 hour	22	19 ± 86.4) 3 (13.6)	17	17 ± 100) 0	—

$\acute{X}$ — Mean; SD — standard deviation; BMI — body mass index; LMP — last menstrual period; NVD — normal vaginal delivery; C/S — cesarean section; CPD — cephalopelvic disproportion; *Column percentage; Continuous variables were presented as “mean ± standard deviation” and categorical variables as “number (column percentage)”

Table 6. Distribution of some descriptive and clinical characteristics between the Bishop and cervical length groups

	The Bishop group		**The cervical length group**		**p**
	n	**$\acute{X}$ ± SD/Number (%*)**	**n**	**$\acute{X}$ ± SD/Number (%*)**	
Age [year]	60	23.90 ± 3.72	60	24.37 ± 4.01	0.469
BMI [kg/m^2]	60	28.35 ± 3.91	60	28.76 ± 4.28	0.686
Week of pregnancy [LMP]	60	40.26 ± 1.46	60	40.16 ± 1.45	0.344
Week of pregnancy [dating]	60	40.21 ± 1.41	60	40.11 ± 1.34	0.252
Applied method					
Dinoprostone only		8 (13.3)		6 (10.0)	
Dinoprostone + Oxytocin	60	20 (33.3)	60	27 (45.0)	0.416
Only Oxytocin		32 (53.4)		27 (45.0)	
Induction indication					
Delay	60	38 (63.3)	60	36 (60.0)	0.851
Oligohydramnios		22 (36.7)		24 (40.0)	
Duration of the application of the method [hour]	28	10.43 ± 2.89	33	10.22 ± 2.89	0.798
Oxytocin need					
No	60	8 (13.3)	60	6 (10.0)	0.776
Yes		52 (86.7)		54 (90.0)	
Oxytocin intake time [hour]	52	12.13 ± 6.57	54	11.46 ± 6.25	0.371
Spontaneous expulsion					
No	28	19 (67.9)	33	23 (69.7)	0.998
Yes		9 (32.1)		10 (30.3)	
Active labor status in the first 12 hours					
No	60	29 (48.3)	60	31 (51.7)	0.715
Yes		31 (51.7)		29 (48.3)	
Type of delivery					
NVD	60	37 (61.7)	60	41 (68.3)	0.566
C/S		23 (38.3)		19 (31.7)	
C/S indication					
CPD		3 (13.0)		2 (10.5)	
Non-advancing labor	23	9 (39.1)	19	8 (42.1)	0.961
Fetal distress		11 (47.8)		9 (47.4)	
Abnormal labor findings					

No Tachysystole	60	59 (98.3) 1 (1.7)	60	58 (96.7) 2 (3.3)	0.998
Need to stay in the neonatal intensive care unit					
No Yes	50	59 (98.3) 1 (1.7)	60	59 (98.3) 1 (1.7)	1.000
1st minute APGAR score	60	7.65 ± 0.92	60	7.75 ± 1.14	0.061
5th minute APGAR score	60	9.62 ± 0.88	60	9.72 ± 0.86	0.102
Duration of delivery [hour]	37	17.97 ± 11.59	41	18.78 ± 15.09	0.741
≤ 24 hour > 24 saat	37	25 (67.6) 12 (32.4)	41	28 (68.3) 13 (31.7)	0.945

$\acute{X}$ — Mean; SD — standard deviation; BMI — body mass index; LMP — last menstrual period; NVD — normal vaginal delivery; C/S — cesarean section; CPD — cephalopelvic disproportion; *Column percentage; Continuous variables were presented as “mean ± standard deviation” and categorical variables as “number (column percentage)”