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Original Research Article

A STUDY ON COMPARISON BETWEEN CERVICAL LENGTH MEASURED TRANSVAGINALLY AND BISHOP SCORE IN PREDICTING THE SUCCESS OF LABOUR INDUCTION

Dheepa C[1], Devi A[2], Abinaya M S[3]

[1]Senior Assistant Professor, Department of Obstetrics and Gynaecology, Government medical College, Omandurar Government estate, Tamilnadu, India
[2]Senior Assistant Professor, Department of Obstetrics and Gynaecology, Government Medical College, Omandurar Government estate, Tamilnadu, India
[3]Assistant Professor, Department of Obstetrics and Gynaecology, Government Virudhunagar medical College, Tamilnadu, India.

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Corresponding Author:
Dr. Dheepa C,
Email: drdheepa@gmail.com.

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Abstract

Background: Labour induction accounts for 20% of the global population. While the Bishop score assesses cervical favourability, transvaginal ultrasonographic measurement of cervical length is more accurate and objective in predicting induction success. This study aimed to compare the predictive value of the Bishop score and transvaginal ultrasonography measurement of cervical length for successful labour induction. **Materials and Methods:** This prospective observational study included 126 pregnant women at the Institute of Obstetrics and Gynecology, Egmore between 2022 and 2022. Women at 37-40 weeks of gestation with a singleton foetus underwent transvaginal ultrasound for cervical length and a masked Bishop Score assessment before labour induction. Induction followed the standard protocol with Prostaglandin E2 gel; successful induction was defined as active labour within 12 hours, and failed induction indicated caesarean delivery. **Results:** As the Bishop score increased, the incidence of vaginal deliveries increased, with a score of 5 having the highest rate (98.1%) and a score of 1 having the lowest (14.3%). A score of 2 had the highest LSCS rate (88.9%) and a score of 5 had the lowest (1.9%). A Bishop score > 3 and cervical length < 2.5 cm were positively associated with vaginal deliveries, suggesting that these cutoffs could predict successful induction of labour. **Conclusion:** A Bishop score ≥ 3 and a cervical length ≤ 2.5 cm were significantly associated with vaginal delivery and shorter induction-to-delivery time, showing similar sensitivity, specificity, and accuracy in predicting labour outcomes, suggesting TVS as an additional tool to the Bishop score.

INTRODUCTION

Induction of labour (IOL) is defined as the process of artificial initiation of uterine contractions, any time after attainment of foetal viability, by a method that aims to secure vaginal delivery.[1] It which is one of the most common procedures in the present era, accounting for about 20% of the global incidence.[2] One of the most common indications for induction is prolonged pregnancy. Evidence has suggested that the induction of labour has been helpful in reducing maternal and foetal morbidity and mortality. Labour induction with a low cervical score has been associated with failure of induction, prolonged labour, and high rate of caesarean deliveries. With the developed evidence, predicting whether induced labour will result in successful vaginal delivery relies on the pre-induction favorability of the cervix.[3]

One of the traditional methods uses the Bishop score. However, this assessment is subjective, and hence, there will be wide variation in subjective prevalence. Therefore, the chances of poor predictive value for the outcome of induction, especially among women with a low Bishop score, might be high. However, this assessment is subjective, and several studies have demonstrated a poor predictive value for the outcome of induction, especially in women with a low Bishop score.[4,5] Hence, the most accurate method, transvaginal cervical length measurement, has been used to detect cervical changes in women at risk of preterm delivery. However, the same cervical changes can

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also be detected to predict the success of labour induction.[6]

Theoretically, transvaginal ultrasonographic measurement of cervical length could represent a more accurate and objective assessment of the cervix than a digital examination. Because the supra-vaginal portion of the cervix usually comprises approximately 50% of the overall cervical length, it is very difficult to assess digitally in a closed cervix.[7] In addition, the assessment of effacement which starts at the internal OS will be difficult to predict in a closed cervix. In contrast to the Bishops, transvaginal sonographic measurement of cervical length is quantitative and also an easily reproducible method of assessing the cervix which can be achieved easily with minimal discomfort to the patient.[4] Hence, more clinical evidence is needed in this regard.

Therefore, this study was performed to determine whether transvaginal ultrasound, with the ability to objectively measure cervical length, could predict the outcome of induction better than the clinical assessment obtained by the Bishop score. If so, transvaginal ultrasonographic measurement of cervical length can be used as an adjunct tool to the traditional Bishop score and can add yet another dimension of information in the field of successful induction of labour.

Aim

This study aimed to compare the predictive value of the Bishop score and transvaginal ultrasonography measurement of cervical length for successful labour induction.

MATERIALS AND METHODS

This prospective observational study included 126 pregnant women at the Institute of Obstetrics and Gynaecology, Egmore, between March 2022 and November 2022. The study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

Inclusion Criteria

Patients with primigravida aged between 18 and 30 years, singleton pregnancy, live foetus with vertex presentation, intact amniotic membranes, gestational age between 37-41 weeks, no previous uterine surgical procedures, absence of labour pain, reassuring NST pattern before induction, no contraindications for vaginal delivery, and willingness to give consent for the study were included.

Exclusion Criteria

Patients with non-vertex presentation, premature rupture of membranes, previous uterine surgery, multiple pregnancies, foetal or maternal complications that might cause caesarean section, liquor abnormalities, foetal weight > 4 kg, abnormal umbilical artery Doppler indices or non-stress test, and asthmatic patients or women with allergy to prostaglandins were excluded from the study.

Methods

Women at a gestational age between 37 and 40 weeks with a singleton foetus, intact membranes, and cephalic presentation were asked to empty their bladder before transvaginal ultrasound examination and sonography were performed. The cervical length was measured by keeping the probe 3 cm away from the posterior fornix. Cervical length was defined as the length between the internal and external OS in a straight line. After sonography, the Bishop Score was determined by digital examination by the resident obstetrician responsible for induction.

Labour was induced according to the standard protocol of our hospital. Prostaglandin E2 gel was inserted into the cervical canal within 1 hour of cervical assessment. The patient was reassessed after six hours. If she did not exhibit regular uterine contractions or cervical changes, a second dose of PG was administered intracervically. A maximum of two doses were repeated. The subsequent dose was withheld if the patient was in active labour, rupture of the membrane if cervical effacement was > 60% and OS $\geq$ 3 cm, and regular uterine contractions were 2-3 in 10 minutes.

Augmentation of labour was done according to the labour room protocol, and the active phase of labour was diagnosed as 3-4 contractions every 10 minutes, each lasting for 45 to 60 seconds. The cervix was dilated by $\geq$ 3 cm, and the effacement of the cervix was $\geq$ 80%. Successful induction of labour was defined as active labour occurring at the end of the induction protocol (12 h from the last dose). Failed induction was defined as an inability to achieve the active phase of labour corresponding to a cervical dilatation of $\geq$ 3 cm within 12 h from the last dose of PG E2. Failure to progress was defined as no cervical dilation during the active phase of labour for the last 2 hours or no descent of the foetal head during the second stage of labour for at least 1 h despite adequate uterine contractions. This was considered an indication of caesarean delivery due to failure to progress.

Statistical Analysis

Descriptive and inferential statistical analyses were conducted. Results of continuous measurements are presented as mean ± SD and results of categorical measurements are presented as number (%). Significance was assessed at the 5% significance level. The following assumptions on data were made: dependent variables should be normally distributed, samples drawn from the population should be random, and cases of the samples should be independent. The Chi-square/ Fisher Exact test has been used to find the significance of study parameters on a categorical scale between two or more groups in a non-parametric setting for Qualitative data analysis. Fisher's exact test was used when the cell samples were very small. Statistical P value was set at $p < 0.05$. Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for data analysis, and Microsoft

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Word and Excel were used to generate graphs, tables, and ROC.

RESULTS

The majority of patients were aged 21-25 years (74.6%), and the most common indication for labour was post-dated pregnancy (54.76%), whereas gestational diabetes was the least common (22.22%). The Bishop scores were highest at 5 (42.1%) and lowest at 1 (5.6%). Most patients had a transcervical length of less than 2.5 cm (60.3%). Vaginal delivery was the predominant mode of delivery (84.9%), and LSCS was less common (15.1%). Among the LSCS cases, the most frequent indication was non-progression of labour after induction (36.84%), with foetal distress and thick meconium at 31.57%. [Table 1]

As the Bishop score increased, the incidence of vaginal deliveries also increased. Patients with a Bishop score of 5 had the highest rate of vaginal delivery (98.1%), whereas those with a score of 1 had the lowest (14.3%). Patients with a Bishop score of 2 had the highest rate of LSCS (88.9%), whereas those with a score of 5 had the lowest (1.9%). [Table 2]

The highest frequency was observed for funnel length and width ≤ 1 cm, both at 74.6%, whereas the lowest frequency was for the absence of funnel length and width, both at 11.1%. The majority of patients had a cervical length of < 2.5 cm (60.3%) and a distance of presenting part from external os ≤ 3 cm (60.3%), whereas a smaller proportion had a cervical length of ≥ 2.5 cm (39.7%) and a distance of presenting part from external os > 3 cm (39.7%). [Table 3]

Bishop score > 3 and cervical length < 2.5 cm were positively associated with the incidence of vaginal deliveries. A higher incidence of developing vaginal births was predicted according to the guidelines suggested. Hence, a cutoff Bishop score of 3 and a cutoff transvaginal cervical length of less than 2.5 cm could predict the outcome of normal vaginal delivery. Therefore, induction of delivery should be considered. [Table 4]

The average time taken from induction to delivery among the patients with Bishop score ≤ 3 was 20.3±1.8 hours and for Bishop > 3 was 17.24±2.1 hours respectively, with a significant p-value of < 0.01. Hence, we can observe that women with a Bishop score ≤ 3 are at risk of prolonged labour. The average time taken for induction and delivery among the patients with cervical length ≤ 2.5 cm was 19.85±2.6 hours and those with cervical length > 2.5 cm were 16.11±2.5 hours with significant intra-group difference. [Table 5]

The BISHOP score showed high sensitivity (95.45%) and accuracy (94.44%) with a strong positive predictive value (98.13%). Cervical length demonstrated an even higher sensitivity (98.68%) and similar accuracy (93.81%). Both parameters had good specificity (87.50% for the BISHOP score and 86.00% for cervical length); however, the BISHOP score had a higher PPV than cervical length (98.13% vs. 94.74%). The negative predictive values were lower for both, with a BISHOP score of 73.68% and a cervical length of 70.09%. [Table 6]

The average weight of the neonates was 2.9±0.8 kg and 3.1±0.5 kg among those with normal vaginal delivery and LSCS respectively. All newborns had APGAR scores ≥ 7, and none of them developed any complications. There was no need for ventilatory support or NICU admission but only five neonates from the LSCS group and 2 neonates from the vaginal delivery group required observation for 2 h. [Table 7]

Table 1: Demographic details

		Frequency (%)
Age in years	18 - 20	2 (1.6)
	21 - 25	94 (74.6)
	26 - 30	30 (25.4)
Indication for labour	Post-dated	69 (54.76)
	Gestational hypertension	30 (23.8)
	Gestational diabetes	28 (22.22)
Bishop score	1	7 (5.6)
	2	9 (7.1)
	3	21 (16.7)
	4	36 (28.6)
	5	53 (42.1)
Transcervical length	< 2.5 cm	76 (60.3)
	≥2.5 cm	50 (39.7)
Mode of delivery	Vaginal	107 (84.9)
	LSCS	19 (15.1)
Indication of LSCS	Foetal distress	6 (31.57)
	Non progression of labour even after induction	7 (36.84)
	Thick meconium	6 (31.57)

Table 2: Comparison of Bishop score and mode of delivery

Bishop score	Number of patients	Mode of delivery	
		Vaginal (%)	LSCS (%)
1	7	1 (14.3)	6 (85.6)
2	9	1 (11.1)	8 (88.9)
3	21	16 (81)	5 (19)
4	36	35 (97.2)	1 (2.8)
5	53	52 (98.1)	1 (1.9)

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Table 3: Assessment of transvaginal parameters

Parameters	Criteria	Frequency (%)
Cervical length in cm	≥ 2.5	50 (39.7)
	<2.5	76 (60.3)
Funnel length in cm	Absent	14 (11.1)
	≤1	94 (74.6)
	>1	18 (14.3)
Funnel width in cm	Absent	14 (11.1)
	≤ 1	94 (74.6)
	>1	18 (14.3)
Distance of presenting part from external os in cm	>3	50 (39.7)
	≤ 3	76 (60.3)

Table 4: Comparison between Bishop score, cervical length and outcome

		Vaginal delivery as successful induction	LSCS as failed induction	R and P value
Bishop score	≤ 3	2	14	r -8.3, p < 0.001
	> 3	105	5	
Cervical length in cm	≥ 2.5	32	18	r -8.3, p < 0.001
	< 2.5	75	1	

Table 5: Induction-delivery interval

Scoring system		Average duration	P value
Bishop score	≤ 3	20.3±1.8 hours	< 0.01
	> 3	17.24±2.1 hours	
Cervical length in cm	≤ 2.5	19.85±2.6 hours	< 0.01
	> 2.5	16.11±2.5 hours	

Table 6: Statistic parameters of the BISHOP score and cervical length

		Value	95% CI
Statistic parameters of the BISHOP score	Sensitivity	95.45%	89.71% to 98.51%
	Specificity	87.50%	61.65% to 98.45%
	Positive Predictive Value (PPV)	98.13%	93.49% to 99.48%
	Negative Predictive Value (NPV)	73.68%	53.83% to 87.05%
	Accuracy	94.44%	88.89% to 97.74%
Statistic parameters for cervical length	Sensitivity	98.68%	92.89% to 99.97%
	Specificity	86.00%	82.92% to 90.81%
	Positive Predictive Value (PPV)	94.74%	71.27% to 99.24%
	Negative Predictive Value (NPV)	70.09%	65.53% to 74.29%
	Accuracy	93.81%	89.8% to 95.64%

Table 7: Distribution of foetal parameters

Parameter	Vaginal delivery (n=107)	LSCS (n=19)
Average weight (kg)	2.9±0.8	3.1±0.5
APGAR < 7	Nil	Nil
APGAR ≥ 7 (%)	107 (100)	19 (100)
Cried immediately	107	19
Required ventilatory support	Nil	Nil
Required NICU admission	Nil	Nil
Required observation for 2 hours after delivery	2	5

DISCUSSION

Although many studies have suggested the induction of labour at or beyond 39 weeks, Middleton et al. have described that IOL at or beyond 37 weeks has better outcomes with a significant reduction in adverse foetal outcomes.[8] Hence, we included women with gestational age between 37 and 41 weeks and did not include any post-date pregnancies that could be an independent risk factor and might be a confounding factor. In addition, as maternal age < 18 and > 30 years were independent risk factors, we did not include such women.

In our study, the average Bishop score was 4.85±1.8. Similarly, 4.37±1.23 was the average Bishop score in Khandelwal et al.[9] The mean Bishop score in Khalifa et al. was 5.31±2.27 which is almost near to our observation.[10]

In our study, the average time taken for induction and delivery among the patients with cervical length ≤ 2.5 cm was 19.85±2.6 hours and those with cervical length > 2.5 cm were 16.11±2.3 hours with significant intra-group difference. Also, in Khalifa et al. the induction-delivery interval in women with cervical length < 25 mm was significantly shorter than those with cervical length ≥ 25 mm, 10.23±3.18 vs. 15.46±3.06 hours respectively with the p-value of 0.005. This observation was inconsistent with the present study just that we had categorized the patients into < 2 cm, 2.1 to 2.5 and > 2.5 cm but the outcome was similar to their findings.[10]

We found that 98.68% was sensitive for predicting the induction of transvaginal cervical length. The

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specificity, PPV, NPV, and accuracy of the cervical length in assessing normal vaginal delivery were 86%, 94.5%, 70.0%, and 93.0%, respectively. Similarly, the best cutoff value for cervical length to predict induction of labour within 6 h was less than or equal to 25 mm with a sensitivity of 51%, specificity of 70%, positive likelihood ratio of 1.71, and negative likelihood ratio of 0.70 in Khandelwal et al,[9] Unless these observations, Abdullah et al. stated that Bishop score and presence of funnelling were highly significant as independent predictors of success labour induction.[11]

In our analysis, both methods had similar outcomes, and hence both were better prognostic methods. Similar to the present study, the rate of induction was significantly higher among patients with Bishops > 5 and cervical length ≤ 2.5 cm in Khalifa et al. Although the bishop > 5 is a comparatively higher value suggested than our study, as they had divided their patients into > 5 and < 5 only, we can consider it as a similar outcome.[10]

Their study reported that predicting the likelihood of vaginal delivery within 24 hours of induction, with a sensitivity of 51.28%, specificity of 81.82%, and accuracy of 58% compared to 46.15%, 72.73%, and 52.0%, respectively, for the Bishop Score, which was much less compared to the present study but was almost similar to Khandelwal et al,[9] Similar to our observations, Tan et al,[12] one of the older trials reported that both cervical length and Bishop Score were useful predictors of LSCS in IOL with an optimal cut-off point of > 20 mm for the cervical length and Bishop's < 5. Another clinical study by Keepanasseril et al. found that neither Bishop nor cervical length was accurate in predicting the outcome of IOL, as per their observation, the posterior cervical angle was the most accurate.[13]

Raynelda et al. was also aimed at comparing the outcome of Bishop versus cervical length by transvaginal scan and they had reported that Bishop's had better outcome than the transvaginal cervical length in predicting the success of IOL.[14]

Another statement given by the prospective trail Park et al. was that the measurement of cervical length by using transvaginal ultrasound reduces the use of prostaglandins by 50% among the pregnant women with Bishop score of ≤ 4 and a cervical length of ≥ 28 mm but they had not analysed the sensitivity and specificity of the two methods.[15]

Whereas the clinical observation by Banu et al. and Cubal et al. was almost similar with our findings in which they too had observed that both Bishop's and transvaginal scan yield better prediction in assessing the outcome of induction of labour.[7,16]

CONCLUSION

The average gestational age of the women included in our study was 39.32±1.5 weeks. A post-dated pregnancy is a major indication for induction. According to our observations, women with a Bishop score of ≥ 3 and cervical length ≤ 2.5 cm had a significant chance of vaginal delivery and a significantly shorter duration of induction to delivery. We observed that the Bishop score and transvaginal cervical length scan both had similar sensitivity, specificity, and accuracy in predicting the outcome of labour induction. Hence, TVS for cervical length measurement need not be completely replaced by the Bishop score, but can be used as an additional tool for better predictability of induction with respect to duration of labour.

Strengths

All 126 patients participated in our study, providing a substantial dataset compared with other studies. However, oligohydramnios, which is a significant independent risk factor, was not included in this study.

Limitations

Neonatal outcome was not the aim of our study, and the association of other factors, such as maternal weight and maternal age, was not considered. This can be an independent predictor of successful labour induction.

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