Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

NLM ID: 101716117

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Indian Citation Index (ICI) Index Copernicus value = 91.86

(e) ISSN Online: 2321-9599;

(p) ISSN Print: 2348-6805

Original Research

Comparison of Bishop Score and cervical length measurement by transvaginal ultrasonography in predicting the outcome of induction of labor

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ABSTRACT:

Aim and objectives: The present study was done to compare the Bishop Score and cervical length measurement by transvaginal ultrasonography in predicting the outcome of induction of labor. Materials and method: This study was conducted in the Department of Obstetrics and Gynaecology Kamla Nehru State Hospital (KNSH) for Mother and Child, Shimla, Himachal Pradesh (H.P.). The study included 80 antenatal subjects attending the antenatal clinic at KNSH Shimla requiring IOL were admitted and enrolled for the study at a gestation 37-42 weeks. Obstetrical examination to assess the lie of the fetus, engagement of head, and per vaginum examination for the cervical Bishop Score (BS) and pelvic assessment was done followed by transvaginal sonography (TVS) measurement of cervical length (CL). Results: IAPI \geq 12 hrs was significantly more among subjects with Cervical Length (cm) – (USG TVS) > 2.5 cm (p-value 0.003). The IAPI \geq 12 hours was significantly more among subjects with Cervical Length (cm) – USG(TVS) > 2.5 cm compared to Bishop Score \leq 4 (p-value 0.001). Conclusion: Cervical length had more sensitivity, specificity and positive predictive value than Bishop Score in terms of induction to delivery interval < 24hours. Trans-vaginal cervical length was found to be a better predictor of successful induction of labor as compared to Bishop Score.

Keywords: Bishop Score, Cervical length, transvaginal sonography

Received: 22 June, 2022

Accepted: 26 July, 2022

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This article may be cited as: Chauhan S, Arora B, Rao R, Thakur R, Tenga TTT. Comparison of Bishop Score and cervical length measurement by transvaginal ultrasonography in predicting the outcome of induction of labor. J Adv Med Dent Scie Res 2022;10(8):62-70.

INTRODUCTION

Transvaginal ultrasonographic measurement of cervical length offers some advantages over the Bishop Score in its ability to properly access the cervical length and initial changes at the internal os (even when the cervix is closed) and its shortening, which is a better representative of cervical effacement and is more accurate.¹This is seen as the most important parameter to predict successful IOL after controlling for other confounders when using the Bishop Score. Various studies on this subject have reported on the usefulness of ultrasonographically measured cervical length in predicting the mode of delivery.

In recent years, cervical sonographic evaluation has been found more successful than Bishop Score in the prediction of successful labor. A prospective study on 80 patients by *Dimassi et al* revealed that the use of an ultrasound scoring system instead of Bishop Score for pre-induction cervical assessment was a useful tool in predicting labor outcome.¹⁻⁴

Tan et al reported that both Bishop Score and CL were significantly able to predict the need for caesarean section among the cohort of women they studied, but ultrasonographically measured CL prediction has a superior sensitivity but with a marginally better positive predictive value.⁵This effect was observed with CL of 0.2 cm or more and BS of 5 or less. This finding is in concordance with the reports by *Nitesh Kanwar et al* in India,⁶*Gokturk et al* in Turkey,⁷*Hale Bahadori et al* in Iran,⁸and *Pereira et al* in London.⁹

*Ben-Harush et al.*¹⁰ in a prospective study of 71 patients observed a statistically significant linear correlation between sonographic cervical lengths to IOL and laborduration. The cohort of women with CL of less than 28 mm significantly had a shorter induction to delivery time compared to patients with more than 28 mm length. In a similar study although with a different route of CL measurement, *Khazardoost et al* also showed that higher cervical length is significantly associated with a parturient being delivered abdominally.¹¹

Studies of *Chandra et al*¹², *Gonen et al*¹³, and *Rozenberg et al*¹⁴ showed no correlation between sonographic cervical length and induction to delivery interval, duration of labor, successful induction, or length of the latent phase of labor.

In various studies, there remains a conflict on which method is better in prediction of successful induction labor. Bishop Score or transvaginal of ultrasonography. Since a good number of women undergo induction of labor in our hospital and the outcome of IOL is affected by the ripeness of cervix, therefore we conducted a study to compare Bishop Score and cervical length measurement by transvaginal ultrasonography in predicting the outcome of induction of labor. Moreover, such a study had not been conducted earlier at Kamla Nehru State Hospital for Mother and Child, IGMC Shimla.

MATERIALS AND METHOD

The present study was done to compare the cervical length measured by transvaginal ultrasonography and Bishop Score in predicting response to induction of labor. This study was conducted in the Department of Obstetrics and GynaecologyKamla Nehru State Hospital (KNSH) for Mother and Child, Shimla, Himachal Pradesh (H.P.) after approval from Institutional Ethics Committee, IGMC Shimla.

The study included 80 antenatal subjects attending the antenatal clinic at KNSH Shimla requiring IOL were admitted and enrolled for the study at a gestation 37-42 weeks. The gestational age was determined by accurate dating methods (last menstrual period in women who are sure of dates and have regular menstrual cycles, a first trimester scan and crown rump length for others).

The study population was chosen as per the inclusion and exclusion criteria:

INCLUSION CRITERIA

- 1. 18-40 years old women with singleton pregnancy at 37-42 weeks of gestation, irrespective of parity.
- 2. Cephalic presentation.
- Pregnancy complication necessitating induction of labor (IOL) (gestational hypertension, preeclampsia, chronic hypertension, diabetes, cholestasis, chorioamnionitis, rupture of membranes, oligohydramnios, post-dated pregnancy, oligohydramnios, intra uterine

growth restriction, Rh alloimmunization and elective indications after 39 weeks)

EXCLUSION CRITERIA

- Age <18yrs and >40yrs
- BMI>35 kg/m²
- Gestation < 37 weeks and >42wks.
- Fetal malpresentation
- Multi fetal gestation
- Congenital anomalies of fetus
- Intrauterine death of fetus
- Previous caesarean delivery or other uterine surgery (myomectomy, hysterotomy, septoplasty, metroplasty, etc.)
- Previous surgery on cervix (encirclage, conisation, loop electrosurgical excision, Fothergill-Manchester operation).
- History of antepartum haemorrhage
- Cephalopelvic disproportion

• Any contraindication for vaginal delivery (VD)

The eligible subjects were enrolled in the study after obtaining an informed, written consent. Baseline characteristics such as age, parity, gestational age at induction and indication of induction were noted. A detailed history was taken from all the participants followed by general physical examination and systemic examination. Obstetrical examination to assess the lie of the fetus, engagement of head, and per vaginum examination for the cervical Bishop Score (BS) and pelvic assessment was done followed by transvaginal sonographic (TVS) measurement of cervical length (CL).

TVS was done by an expert radiologist blinded to the BS, using LOGIQ P6 (GE) ultrasound machine with an E8CS TVS probe. The vaginal probe was inserted under direct vision in lithotomy position. After visualization of urinary bladder, amniotic fluid and presenting part, midline sagittal plane of cervix was localised and vaginal probe was pulled back until lightest touch possible provided good image of cervical canal. Probe was slightly moved to get the best longitudinal axis of the cervix. The image was magnified so that it occupied $2/3^{rd}$ of the screen and external and internal os were well seen. Calipers were placed between the external os and the V-shaped indentation marking the internal os and the distance was measured as a straight line. Three separate readings of CL were taken and shortest CL in mm was reported.

STATISTICAL ANALYSIS

Sensitivity, specificity and predictive value of preinduction Bishop Score and cervical length measured by transvaginal scan were compared in terms of success and outcome of IOL in relation to the observed maternal, fetal and neonatal parameters.

RESULTS

Bishop Score, based on the pre-induction favorability of the cervix, has been traditionally used to predict whether an induced labor will result in successful vaginal delivery. Labor induction with a low cervical score has been associated with failure of induction, prolonged labor, and a high rate of caesarean deliveries. 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.

Measurement of transvaginal cervical length can be used to predict the success of induction of labor. Theoretically, transvaginal ultrasonographic measurement of the cervix could represent a more accurate and objective assessment of the cervix than digital examination, because the supra-vaginal portion of the cervix usually comprised about 50% of the cervical length is very difficult to assess digitally in a closed cervix. In addition, the assessment of the effacement, which starts at the internal os, is difficult to predict in a closed cervix. Also, sonographic measurement of the cervical length is quantitative and easily reproducible method of assessing the cervix, which can be achieved easily with minimal discomfort to the patient.

		Total Bi	p-value	
		≤4	> 4	
Induction to active	< 12 hours	7	45	< 0.001*
phase interval (hrs)		19.4%	70.3%	
	≥ 12 hours	29	19	
		80.6%	29.7%	
		Cervical Len	igth (cm) – USG	
		≤ 2.5	> 2.5	
Induction to active	< 12 hours	27	5	0.003*
phase interval (hrs)		71.1%	8.1%	
	≥ 12 hours	11	57	
		28.9%	91.9%	

Table 1: Induction to active phase interval in relation to BISHOP score

Chi-square test * Significant difference

The distribution of subjects in relation to induction to active phase interval (IAPI) < 12 hrs and \geq 12 hrs was compared between preinduction Bishop Score \leq 4 and > 4 using the chi-square test. IAPI \geq 12 hrs was significantly more among subjects with Bishop Score \leq 4 as compared to those with previous Bishop Score >4 (p-value <0.001)

The distribution of subjects in relation to induction to active phase interval (IAPI) < 12 hrs and \geq 12 hrs was compared between Cervical Length (cm) - (USG TVS) \leq 2.5 cm and > 2.5 cm using the chi-square test. IAPI \geq 12 hrs was significantly more among subjects with Cervical Length (cm) - (USG TVS) > 2.5 cm (p-value 0.003).

 Table 2: Comparison of cervical length and BISHOP score in relation to induction to active phase interval

Induction to active	Total Bishop	Cervical Length	p-value
phase interval (hrs)	Score ≤ 4	(cm) - USG > 2.5	
< 12 hours	7	5	
	19.4%	8.1%	0.001
≥ 12 hours	29	57	
	80.6%	91.9%	

Chi-square test * Significant difference

The distribution of subjects in relation to induction to active phase interval (IAPI) < 12 hrs and \geq 12 hrs was compared between Cervical Length (cm) – USG(TVS) > 2.5 cm and Bishop Score \leq 4 using the chi-square test. The IAPI \geq 12 hours was significantly more among subjects with Cervical Length (cm) – USG(TVS) > 2.5 cm compared to Bishop Score \leq 4 (p-value 0.001).

 Table 3: Comparison of BISHOP score and cervical length in relation to induction to active phase interval

	Induction to	Mean	Std.	t-test	p-value
	active phase		Deviation	value	
Total Bishop Score	< 12 hours	4.38	1.01	5.811	< 0.001*
	\geq 12 hours	3.21	1.01		
Cervical Length	< 12 hours	2.51	0.64	-3.586	0.001*
(cm) – USG	\geq 12 hours	2.98	0.65		

Unpaired t-test * Significant difference

The mean Bishop Score and Cervical Length (cm) – USG(TVS) was compared between induction to active phase interval (IAPI) < 12 hrs and \geq 12 hrs using the unpaired t-test. The mean Bishop Score was significantly more among those with IAPI < 12 hrs compared to those with IAPI \geq 12hrs (4.38±1.01

versus 3.21 ± 1.01 respectively, p-value-<0.001). The mean Cervical Length (cm) – USG(TVS) was significantly more among those with IAPI ≥ 12 hrs compared to those with IAPI <12hrs (2.98±0.65 cm versus 2.51 ± 0.64 cm respectively, p-value 0.001).

Table 4: Induction to delive	y interval in relation to BISHOP score
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Induction to Delivery	Bishop Score		Cervical Length (cm) - USG		
Interval (hrs)	≤ 4	>4	≤ 2.5	> 2.5	
< 24 hours	16	62	36	20	
	44.4%	96.9%	94.7%	32.3%	
≥24 hours	20	2	2	42	
	55.6%	3.1%	5.3%	67.7%	
χ2 value = 36.909, p-value < 0.001*			$\chi 2$ value = 10.00	5, p-value = 0.002*	

Chi-square test * Significant difference

The number of subjects with induction to delivery interval (IDI) < 24 hrs and \ge 24 hrs was compared between Bishop score ≤ 4 and > 4 using the chi-square test. IDI \ge 24 hrs was significantly more among subjects with Bishop Score ≤ 4 . (p-value <0.001)

The number of subjects in relation to induction to delivery interval (IDI) < 24 hrs and \ge 24 hrs was compared between Cervical Length (cm) - USG(TVS) \le 2.5 cm and > 2.5 cm using the chi-square test. IDI \ge 24 hrs was significantly more among subjects with Cervical Length (cm) - USG(TVS) > 2.5 cm (p-value 0.002).

Table 5: Comparison of induction to delivery interval between BISHOP Score and cervical length

Induction to Delivery Interval (hrs)	Cervical Length (cm) - USG > 2.5	Total Bishop Score ≤ 4	p-value
< 24 hours	20	16	
	32.3%	44.4%	
≥24 hours	42	20	< 0.001*
	67.7%	55.6%	

Chi-square test * Significant difference

The number of subjects with induction to delivery interval (IDI) < 24 hrs and \ge 24 hrs was compared between Cervical Length(cm) – USG(TVS) > 2.5 cm and Bishop Score \le 4 using the chi-square test. IDI \ge 24 hrs was significantly more among subjects with Cervical Length (cm) – USG(TVS) >2.5 cm compared to Bishop Score \le 4 (p-value <0.001).

Table 6: (Comparison of BISHOP	score and cervical leng	gth in relation to inducti	on to delivery interval
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Induction to		Mean	Std.	t-test value	p-value
	delivery interval		Deviation		
Bishop Score	< 24 hours	4.17	0.99	7.057	< 0.001*
	\geq 24 hours	2.52	0.95		
Cervical Length	< 24 hours	2.58	0.65	-5.103	< 0.001*
(cm) – USG	\geq 24 hours	3.35	0.57		

Unpaired t-test * Significant difference

The mean Bishop Score and Cervical Length(cm) – USG(TVS) was compared between induction to delivery interval (IDI) < 24 hrs and \ge 24 hrs using the unpaired t-test. The mean Bishop Score was significantly more among subjects with IDI < 24 hrs compared to subjects with IDI \ge 24hrs (4.17 \pm 0.99

versus 2.52 ± 0.95 respectively, p-value <0.001). The mean Cervical Length(cm) – USG(TVS) was significantly more among those with IDI ≥ 24 hrs compared to those with IDI<24hrs (3.35 ± 0.57 cm versus 2.58 ± 0.65 cm respectively, p-value <0.001).

 Table 7: Correlation of cervical length & BISHOP score in relation to induction to active phase interval

 & induction to delivery interval

		Cervical Length - USG	Total Bishop Score
Induction to active	Pearson Correlation	0.635	-0.401
phase interval (hrs)	p-value	< 0.001*	0.010*
Induction to Delivery	Pearson Correlation	0.683	-0.458
Interval (hrs)	p-value	< 0.001*	0.005*

There was a significantly positive and negative correlation of Cervical Length (cm) - USG(TVS) and Bishop Score respectively with induction to active phase interval and induction to delivery interval.

 Table 8: Comparative test value indices for success of induction of labour in relation to BISHOP score and cervical length

	BISHOP SCORE ≥ 4	TVS CERVICAL LENGTH ≤ 2.5
Sensitivity	60.3%	68.1%
Specificity	50.4%	95.5%
Positive predictive value	79.5%	92.0%
Negative predictive value	36.5%	58.5%
p-value	0.312	< 0.001*

Cervical length had more sensitivity, specificity and positive predictive value than Bishop Score in terms of induction to delivery interval < 24hrs. Significant predictive value was obtained for cervical length (pvalue <0.001) as compared to Bishop Score (p-value 0.312). Therefore, trans-vaginal cervical length was found to be a better predictor of successful induction of labor in terms of delivery within 24hrs as compared to Bishop Score.

DISCUSSION

Bishop Score is being universally used to assess cervical favorability for induction of labor. The cervix is divided into portiosupravaginalis and portio vaginalis depending upon the portion lying above or below the reflection of vagina.¹⁵Effacement which starts at the internal os has been reported to be difficult to assess by the digital examination in case of a closed cervix. To this, sonographic measurement of the cervical length is quantitative and can be performed easily with the advantage of the minimal or no discomfort to the patient.

In our study the mean Bishop Score and Cervical Length (cm) – USG(TVS) was compared between induction to active phase < 12 hours and \geq 12 hours using the unpaired t-test. The mean Bishop Score was significantly more among those with IAPI < 12 hours compared to those subjects with IAPI \geq 12 hrs (4.38±1.01 versus 3.21±1.01 respectively, p-value<0.001). The mean Cervical Length (cm) – USG(TVS) was significantly more among those with induction to active phase interval \geq 12 hours compared to those subjects with IAPI <12 hours

 Table 36: BISHOP score vs cervical length

 $(2.98\pm0.65 \text{ cm versus } 2.98\pm0.65 \text{ cm respectively, p-}$ value 0.001). On the contrary, Khandelwal et al.16 studied predictability of Bishop Score and cervical length for delivery within 12 hrs of induction of labor. Here also they observed that the median Bishop Score was significantly more (5) in subjects with IAPI<12hrs as compared to the median BS (4) in those with IAPI \geq 12hrs (p-value <0.0002). They also observed significantly less CL in those delivering within 12hrs of IOL (p-value 0.002). Independent t test was applied to get the p-value of mean cervical length (continuous variable) and Chisquare test for Bishop Score. It was found that Bishop Score is highly significant (P value <0.0002) in predicting induction-to-delivery interval. P-value for cervical length was 0.002, which is also significant.

In our study the distribution of subjects undergoing IOL in relation to induction to delivery interval < 24hours and ≥ 24 hours was compared between Bishop score > 4 and ≤ 4 using the chi-square test. Induction to delivery interval ≥ 24 hours was significantly more among subjects with Bishop Score \leq 4. The distribution of subjects in relation to induction to delivery interval < 24 hours and \geq 24 hours was compared between Cervical Length (cm) - (USG-TVS) ≤ 2.5 cm and > 2.5 cm using the chi-square test. Induction to delivery interval ≥ 24 hours was significantly more among subjects with Cervical Length (cm) (USG-TVS) > 2.5 cm. Similar results were found in a study conducted by Hafeez et al.¹⁷ who took a Bishop score cut off of<5 and transvaginal cervical length cut off >2.7cm.

Serial No.	Author		Sensitivity	Specificity	PPV	NPV
1	Pandis et al	Bishop Score	-	-	-	-
	$(2001)^{18}$	Cervical Length	87.0%	71.0%	-	-
2	Elghorori MR et al	Bishop Score	23.0%	88%	-	-
	$(2006)^{19}$	Cervical Length	62.0%	100%	-	-
3	Tan et al	Bishop Score	64.0%	-	27.0%	83.0%
	$(2007)^5$	Cervical Length	80.0%	-	30.0%	89.0%
4	Kaur et al	Bishop Score	69.0%	75.0%	-	-
	$(2017)^{20}$	Cervical Length	73.0%	81.0%	-	-
5	Khalifa et al	Bishop Score	46.15%	72.73%	-	-
	$(2018)^{21}$	Cervical Length	51.28%	81.82%	-	-
6	Hafeez et al	Bishop score	23%	88%	-	-

	(2019)17	Cervical length	62.0%	100.0%	-	-
7	Anikwe et al	Bishop score	58.0%	-	56.0%	53.0%
	$(2020)^{22}$	Cervical length	83.0%	-	75.0%	82.0%
8	Present Study	Bishop Score	60.3%	50.4%	79.5%	36.5%
	(2020)	Cervical Length	68.1%	95.5%	92.0%	58.5%

A standardized cervical scoring system was introduced by Bishop in 1964 and it took global acceptance by the name of Bishop's Score.⁷ Different researchers, using Bishop Score, have recorded different predictive values for the outcome of induction of labor.^{23,24}

In our study, we took a cut-off of 4 for Bishop Score and 2.5 cm for cervical length for correlating with induction to delivery interval (hrs) and induction to active phase interval (hrs) because the induction to active phase interval ≥ 12 hours and induction to delivery interval ≥ 24 hours was significantly more among subjects with Cervical Length (cm) -USG(TVS) > 2.5cm and Bishop Score $\leq 4cm$. Cervical length had more sensitivity (68.1%), specificity (95.5%) and positive predictive value (92%) than Bishop score (sensitivity: 60.3%, specificity: 50.4%, positive predictive value: 79.5%). Significant predictive value was obtained for cervical length (p-value<0.001) compared to Bishop Score (pvalue 0.312). Therefore, transvaginal cervical length was found to be a better predictor of successful induction of labor in terms of delivery within 24hrs when compared to Bishop Score.

Similarly, *Pandis et al.*¹⁸ demonstrated that cervical length performed better than Bishop Score in the prediction of vaginal delivery. They reported that even though both parameters successfully predicted vaginal delivery, the positive predictive value of ultrasonographically measured cervical length is 20% higher than that of Bishop Score.

*Parvin Bastani et al.*²⁵ also concluded that induction to delivery interval positively correlated with cervical length. They showed that ROC for cervical length was significantly better than Bishop Score and posterior cervical angle suggesting that cervical length is a better predictor for success of induction of labor than the Bishop Score.^{26,27}

TVS was noted as less painful by Tan and colleagues⁵ in comparison to digital examination. The authors also found that cervical length along with modified Bishop Score were predictors of the success of induction of labor with optimal cut off points of 20 mm for the cervical length and ≤ 5 for the modified Bishop Score. Similarly the subjects scheduled for IOL in present study did not complain of discomfort with USG(TVS) and the CL was found to be a better predictor although with slightly different cut-off values (2.5 cm for CL and 4 for BS). Support for this finding is also seen in other studies done in India5, Turkey6, Iran7, Netherlands,28 and London.⁹Ben-Harush et al.¹⁰ in a prospective study of 71 patients observed a statistically significant linear correlation between sonographically measured

cervical length prior to IOL and labor duration. The cohort of women with CL of less than 28mm significantly had a shorter induction to delivery time compared to patients with CL more than 28mm length. In a similar study although with a different route of CL measurement, *Khazardoost et al.*¹¹ also showed that higher cervical length is significantly associated with a parturient being delivered abdominally.

*Watson et al.*²⁹ evaluated the cervical consistency, position, effacement and dilatation and station of the fetal presenting part, maternal parity and cervical length measurement in a multiple regression model and showed that there was a significant relation between cervical length and effacement and both were not predictive for the length of latent phase labour. Other researchers have also predicted that the cervical length and Bishop Score were significant parameters in determining the induction to delivery interval and in predicting caesarean section risk; moreover, cervical length measurement had advantage over the Bishop Score.³⁰

Anikwe et al.²² showed that parturient with cervical length less than 19mm are less likely to remain undelivered than parturient with long cervical length. In terms of Bishop Score, the only significant contributor is the effacement, which is also an index of cervical length. This is consistent with the original work of Bishop in 1964 that showed that a score of 9 or more in multiparous women is associated with a high chance of successful delivery.³²

*Bartha et al.*²⁴ argued that short cervical length of less than 30mm is a better predictor of cervical ripeness and therefore less need for cervical ripening.They reported that using Bishop Score would lead to unnecessary use of prostaglandin to ripen the cervix. It is especially important in triaging for delivery when the indication for induction is "minor" or when there is urgent need to deliver the client with unfavorable Bishop Score.

*Paterson-Brown et al.*³³ could neither find a correlation of the induction to labor interval with cervical length and Bishop Score nor a correlation between cervical length and induction success. They found that there was a significant relation between the Bishop Score and successful vaginal delivery. However, they showed that the Bishop Score was not a good parameter for successful labor induction.

Although some studies inferred Bishop Score and cervical length to be independent predictors of successful labor induction,^{18,34}*Kaur et al*,²⁰ using the multivariate cox regression analysis found only cervical length to be an independent predictor.

Chandra et al,¹²*Gonen et al*,¹³and *Rozenberg et al*.¹⁴ showed no correlation between sonographically measured cervical length and induction to delivery interval, duration of labor, successful induction, or length of the latent phase of labor. *Gonen et al*.¹³ found that the Bishop Score and parity were significant for the induction to delivery interval and induction success, while cervical length was not.

In our study, there was a stronger correlation of cervical length with induction to active phase and induction to delivery interval. *Abdelazim et al.*³⁵ found similar predictability for prolonged induction to delivery interval.However, *Bahadori et al.*⁸ found stronger correlation of Bishop Score (0.001) than of cervical length (0.04) for predicting cervical ripening in 12 hours.

SENSITIVITY AND SPECIFICITY

In current study, the sensitivity, specificity, positive predictive value and negative predictive value of cervical length (68.1%, 95.5%, 92.0% and 58.5% respectively) was more than Bishop score (60.3%, 50.4%, 79.5% and 36.5% respectively). Tan et al.⁵ also found that cervical length recorded by TVS had superior sensitivity (80% versus 64%) than the modified Bishop's score. Khalifa et al.²¹ showed that the sonographically measured cervical length was better than the Bishop Score in predicting the likelihood of vaginal delivery within 24 hours of induction, with 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. Hafeez et al.¹⁷ also stated that the accuracy of cervical length assessment was higher than that of Bishop Score. Cervical length predicted sensitivity of 62% and specificity of 100% whereas Bishop Score forecasted vaginal delivery with a sensitivity of 23% and specificity of 88%. TVS was labelled better than Bishop Score in prediction of successful induction of labour. A study conducted by Elghorori MR & colleagues.¹⁹ found similar results.

Similar finding as in *Pandis et al.*¹⁸ was noted in our study. In this study, the positive predictive value of pre-induction cervical length predicting labor lasting less than six hours was 75%, which was 19% higher than the positive predictive value of Bishop Score. *Ware and Raynor.*³¹ also compared the two parameters and found cervical length to be a better predictor of successful induction of labor. In a similar study *Gabriel et al.*³⁰ reported that the use of cervical length measurement is more important in women with unfavorable Bishop Score. Their study showed that cervical length is predictive of the mode of delivery in a parturient with Bishop Score. ≤ 5 but not in women with favorable Bishop Score.

*Bahadori et al.*⁸ reported that cut-off for Bishop was <4 with a sensitivity of 57.9% and a specificity of 28.7% and for cervical length was <19 mm with a sensitivity of 66.7% and a specificity of 65%. Similar results were found by *Cengiz H et al.*³⁶Similarly, in

the present study, the cut-off for BS was 4 with a sensitivity and specificity of 60.3% and 50.4% respectively. The cut-off for CL was 2.5 cm with a sensitivity of 68.1% and specificity of 95.5%.

This finding could be explained by the dynamic changes that occur in the cervix before the onset of labor. Cervical shortening concerns primarily at the supravaginal segment of the cervix, which is not accessible by digital vaginal examination especially when the cervix is closed. Preinduction sonographic assessment of this segment of the cervix (supravaginal) becomes more important in women with unfavorable Bishop Score who seem to have undergone little cervical changes.²⁴

Ultrasound has specific advantages over digital examination. It can assess full cervical length and status of internal os without invading endocervical canal and hence is less invasive, and more objective.³⁷The ultrasound findings can be documented by taking pictures and are reproducible. co-existing findings like Other compound presentation and occult cord presentation if present can be documented, which can be easily missed by doing just a digital examination.³⁸

Although there are controversial results on the effects of cervical length and Bishop Score on induction to delivery interval and successful induction, transvaginal cervical length measurement is a more objective method. In this study, we found that cervical length was a better parameter compared to the Bishop Score.

CONCLUSION

Cervical length had more sensitivity, specificity and positive predictive value than Bishop Score in terms of induction to delivery interval < 24hrs. Transvaginal cervical length was found to be a better predictor of successful induction of labor as compared to Bishop Score. Therefore, we conclude that the sonologically measured cervical length is a better parameter to predict the outcome of induction of labor. As the Bishop Score is subjective and not reproducible cervical length measured on TVS is recommended as a betteralternative to Bishop Score for prediction of successful labor induction in the setting where the appropriate equipment and expertise are available.

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