

A COMPARATIVE STUDY ON PREINDUCTION CERVICAL ASSESSMENT BY TRANSVAGINAL SONOGRAPHY AND BISHOP SCORE IN PREDICTING SUCCESSFUL LABOUR INDUCTION

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Abstract

Background: Induction of labour presently is a common procedure in obstetric practice. This study is meant to compare the efficacy of transvaginal sonographic cervical assessment with Bishop's score before induction of labour in predicting the success of labour induction in pregnant women. The aim is to compare the predictive value of the Bishop score and transvaginal ultrasonography in successful labour induction. **Materials and Methods:** 100 pregnant women, admitted in Modern Government Maternity Hospital, Petlaburz, Hyderabad, who underwent induction of labour, as per inclusion criteria, were selected during June, 2018 to May, 2020. Data related to the objectives of the study were collected. **Result:** Majority of pregnant women with singleton pregnancy with live fetus in vertex presentation with gestational age 37 to 42 weeks with postdated pregnancy (gestational age >40 weeks), uncontrolled preeclampsia undergoing induction of labour assessed by both by TVS cervical assessment and Bishop score at regular interval till delivery showed that pre induction cervical assessment by TVS is better than Bishop score in predicting successful labour induction. The TransVaginal Sonographic cervical length ≤ 2.6 cm is good predictor for successful labour induction. **Conclusion:** Bishop score and sonographic transvaginal cervical length both are good predictors of successful induction of labour. Sonographic Transvaginal cervical length provides a better prediction of the likelihood of vaginal delivery within 24 hrs of induction. The Transvaginal Sonographic cervical length ≤ 2.6 cm is good predictor for successful labour induction. TVS cervical length could be used as a better alternative to Bishop Score for successful labour induction in the setting where the appropriate equipment and expertise are available.

INTRODUCTION

Induction of labour is a process where uterine contractions are initiated by medical or surgical means before the spontaneous onset of labour and is carried out in approximately 20% of pregnancies.^[1] The commonest indication for induction is prolonged pregnancy, and several studies have shown that induction, compared to expectant management, is associated with a substantial reduction in perinatal mortality.^[2] Predicting whether an induced labour will result in successful vaginal delivery is based on the pre-induction favorability of the cervix as assessed by the Bishop score is the traditional method. 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. Transvaginal ultrasonography has gained increasing application in obstetrics in the area of induction of

labour. Transvaginal cervical length measurement has primarily focused on detecting cervical changes in women at risk for preterm delivery. Theoretically, transvaginal ultrasonographic measurement of the cervix could represent a more accurate assessment of the cervix than digital examination, because the supravaginal portion of the cervix usually comprising 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 will be difficult to predict in a closed cervix. In contrast transvaginal 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.^[3]

This study was done to determine if transvaginal ultrasound, with its ability to objectively measure the cervical length, could predict the outcome of induction better than clinical assessment obtain 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 add yet another dimension of information in the field of successful induction of labour.

MATERIALS AND METHODS

Study Design: Prospective Observational study

Sample Size and Source of Data: 100 pregnant women with gestational age ranging between 37-42 weeks who are admitted for labour induction under Obstetrics and Gynecology in Modern Maternity Government Hospital, Petlaburz, Hyderabad, TS.

A minimum sample size of 100 is planned from June 2018 to May 2020.

Inclusion Criteria

Nulliparous and multiparous women with gestational age of 37 to 42 weeks, Singleton pregnancy, Vertex presentation, Women with postdated pregnancy and Pregnant women with PIH and uncontrolled pre eclampsia.

Exclusion Criteria

IUD (Intra Uterine Death), Pre term deliveries, Pregnancy with congenital anomalies, Severe oligohydraminos cases and Polyhydraminos cases.

All patients who are willing to participate in this study will be included in the study. Baseline characters such as age, gestational age at induction & indication for induction are noted. After informed consent is obtained, Transvaginal ultrasonographic measurement of cervical length is performed with the standard longitudinal view of the cervix while the patient's bladder is empty. GE VOLUSON 730 PRO TVS Probe IC5-9 H instruments with 5-9 MHz is using to measure the cervical length. Cervical length is measured by keeping the probe 3cm away from the posterior fornix. The cervical length is defined as the length between the internal os and external os. After sonography the Bishop Score is determine by the digital examination by the resident physician responsible for the induction. Physicians were masked to the cervical length measurement. Induction of labour is carried out according to the standard protocol of our hospital. Prostaglandin E2 gel is inserted into the cervical canal within 1 hour of cervical assessment. The patient is reassessed after 12 hours. If she did not exhibit regular uterine contractions and cervical change, a second dose of PG E2 is administrate intracervically. Maximum of 3 doses can be repeated. Subsequent dose is withheld if;

- The patient is in active labour
- Rapture of membrane
- If cervical effacement > 60% and OS \geq 3 cm.

- Regular uterine contractions 2-3 in 10 minutes.

Augmentation of labour is done as per labour room protocol.

Active phase of labour is diagnosed as 3-4 contractions in every 10 minutes, each lasting for 45 to 60 seconds. And the cervix is dilated \geq 3cm and the effacement of cervix is 80% or greater. Successful induction of labour is defined as active labour occurring at the end of induction protocol (12 hrs from the last dose). Failed induction is defined as an inability to achieve the active phase of labour corresponding to cervical dilatation of \geq 3 cm within 12 hours from the last dose of PG E2.

Failure to progress is defined as no cervical dilation during the active phase of labour for the last 2 hours or no descent of the fetus' head during the second stage of labour for at least 1 hour despite adequate uterine contractions. This is considered as an indication for cesarean delivery for failure to progress. Outcome measures assessed are Induction to delivery interval < 24 hrs, Induction – Active phase interval < 12hrs and number of vaginal deliveries <48 hrs.

Statistical Analysis

Descriptive and Inferential statistical analysis has been carried out in the present study using computer software (SPSS Trial version 23 and primer). The qualitative data were expressed in proportion and percentages, and the quantitative data expressed as mean and standard deviations. The difference in proportion was analysed by using chi square test. The difference in means among the groups was analyzed using the ANOVA. To find out the relation between quantitative data correlation coefficient was used. Significance level for tests were determined as 95% (P< 0.05).

RESULTS

Eighty-five nulliparous, fifteen multiparous women with gestational age between 37-42 wks who are admitted for induction of labour were enrolled in the study. Demographic variables (age distribution, gestational age & indication for induction) are summarized.

Women with transvaginal cervical length <2cm were 12%, 31% of women were with cervical length between 2.1- 2.5cm and 67% were with cervical length of \geq 2.6cm. Vaginal delivery occurred in 85% of women and in 74% of these, delivery was within 24hrs of induction. There were 15% deliveries by caesarean section. patients 85 delivered vaginally, and 15 underwent LSCS. Out of 15 eight were for fetal distress and 6 were for non progression of labour (40%).

Table 1: Demographic distribution of women

Age in years	Number (%)
15-20	33 (33%)
21-25	49 (49%)
26-30	17 (17%)

31-35	1	(1%)
TOTAL	100	(100%)
Indication		
Postdatism	66	(66%)
PIH (Uncontrolled pre eclampsia)	34	(34 %)
Bishop Score		
1	4	(4%)
2	7	(7%)
3	17	(17%)
4	20	(20%)
5	26	(26%)
TVS cervical length In cm		
<2 cm	12	(12%)
2.1- 2.5 cm	31	(31%)
≥ 2.6 cm	67	(67%)
Mode of delivery		
vaginal	85	(85%)
caesarean	15	(15%)
Indication		
fetal distress	8	(53%)
non progression of labour	6	(40%)
thick MSL	1	(7%)
Total	15	

Table 2: Disribution of gestational age

Study Parameter	Gestational Age in days Mean ± Sd	Independent T Test
GESTATIONAL AGE BY LMP	273.28± 8.172 (250- 290)	t= 7.981*
GESTATIONAL AGE BY USG	262.50 ±10.755(238- 287)	

P<0.001

Gestational age by LMP & gestational age by USG was significantly different.

Table 3: Fetal Outcome

Variable	MEAN±SD
BIRTH WEIGHT	2.87± 0.3629(2.01-3.8kg)
APGAR @ 5 MINUTE	8.90 ± 0.414 (6 – 9)
NICU Admission	7 (7%)

7% of neonates required NICU admission, 6 for respiratory distress and 1 with congenital malformation.

Table 4: Primary Outcome Measure

Group Statistics						
	Induction to delivery interval	N	Mean	Std. Deviation	Std. Error Mean	Independent t-test
Bishop score	≥ 24.00	11	4.1818	1.16775	0.35209	0.926
	< 24.00	74	4.5676	1.30417	0.15161	
Cervical Length	≥ 24.00	11	3.4545	0.31101	0.09377	7.778*
	< 24.00	74	2.5162	0.38107	0.04430	

*p<0.001

Cervical length shows that there is significant difference in induction delivery interval The above table depicts that, Bishop score was not significantly different for the woman whose delivery interval was less than 24 hr or more than 24 hrs, but TVS cervical (within 24 />24 hrs).i.e if cervical length is more means period of delivery will be increased.

Table 5: Comparison of number of women undelivered at 24hrs

			Bishop Score		Total
			<4	≥4	
Induction to delivery interval <24	<24 hrs	Count	16	58	74
		% within bishop score	22%	78%	100%
	>24 hrs	Count	3	8	11
		% within bishop score	27%	73%	100%
Total		Count	19	66	85
		% within bishop score	22%	78%	100.0%

Chi square = 0.176 p= 0.675 non-significant

Table 6: Crosstab delivery interval and cervical length

			CV		Total
			≤2.6	>2.6	
Day	<24 hrs	Count	50	24	74
		% within day	67.6%	32.4%	100.0%
	>24 hrs	Count	0	11	11

		% within day	0.0%	100.0%	100.0%
Total	Count		50	35	85
	% within day		58.8%	41.2%	100.0%

Chi square = 18.05* $p < 0.01$ significant

Table 7: Comparison of number of women undelivered at 24hrs

Variable	No. of deliveries within 24hrs	No. Undelivered at 24hrs	Total
BISHOP SCORE ≥ 4	68 (90%)	6 (10%)	74
TVS Length ≤ 2.6	74 (100%)	0 (0%)	74

Further comparing the prediction of women who remained undelivered at 24hrs, we found that 10% of women with Bishop Score ≥ 4 remained undelivered when compared to none with a TVS cervical length of ≤ 2.6 cm. This proves that TVS cervical length is a better predictive of successful labour induction compared to Bishop Score.

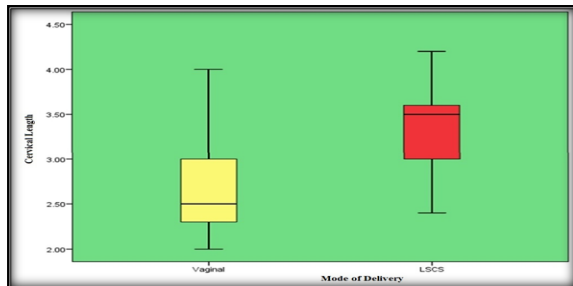


Figure 1: Comparison of Cervical Length for Mode of delivery

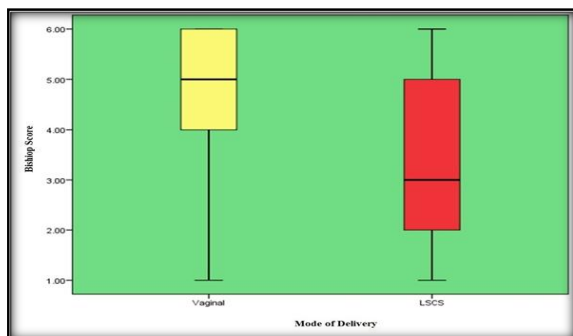


Figure 2: Comparison of Bishop score for Mode of delivery

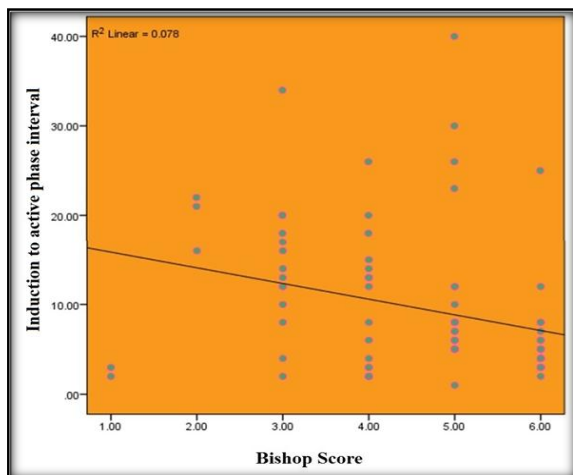


Figure 3: Comparison of Bishop score and the induction to delivery interval

There was a significant negative correlation between the Bishop score and the induction to delivery interval ($p < 0.0001$). $R^2 = 0.078$ which means that only 7.8 % variation was explained by the Bishop score for induction to active phase delivery.

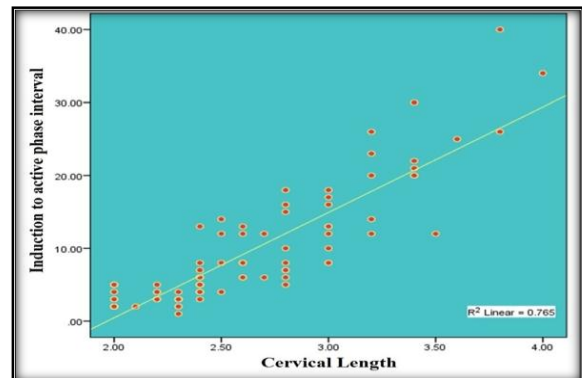


Figure 4: The mean Trans vaginal cervical length.

There was a significant positive correlation $r = 0.875$ between cervical length and the Induction to delivery interval ($p < 0.0001$) and $R^2 = 0.765$ which means that 75.5 % variation was explained by the cervical length.

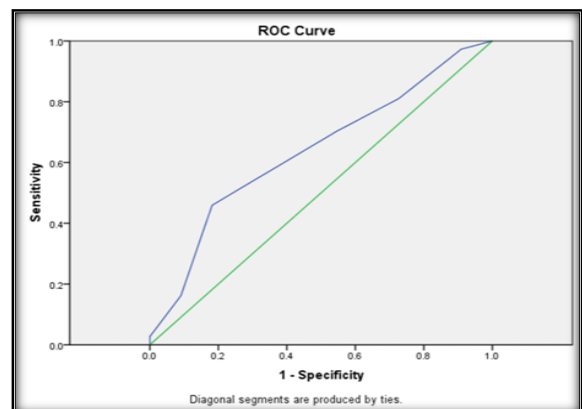


Figure 5: Receiver – operating characteristic curves for the correlation of bishop score and Induction to delivery interval <24 hrs

Area under the curve is 0.638*

DISCUSSION

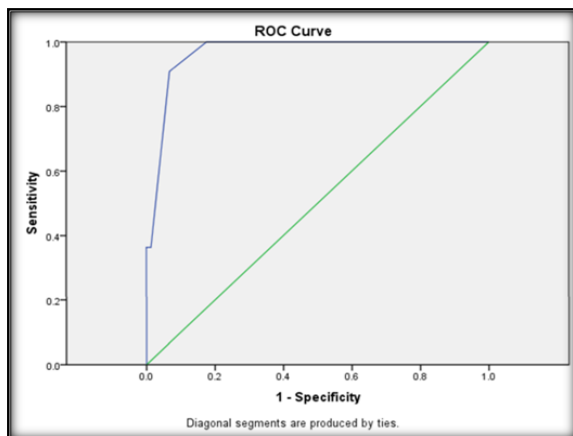


Figure 6: Receiver – operating characteristic curves for the correlation of transvaginal cervical length and induction to delivery interval

The area under the curve is 0.967* ($p < 0.05$)

However, cervical length appears to be a better predictor than the Bishop Score with a sensitivity of 0.703 and a specificity of 0.82 compared to 0.9 and 0.94 respectively

In the receiver operating characteristic curves, the best cut-off point for the prediction of successful induction was 2.6 cm cervical length and 4 for the bishop score.

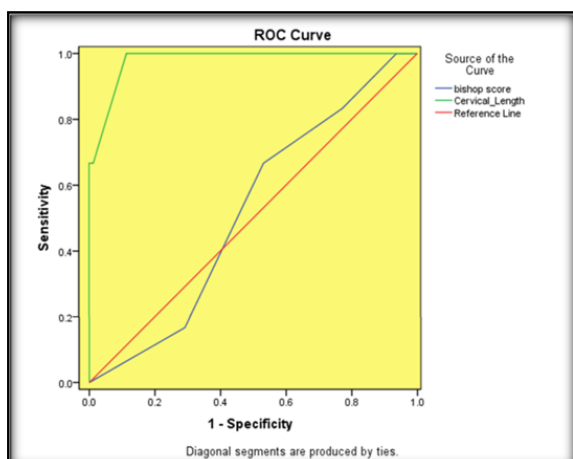


Figure 7: Receiver – operating characteristic curves for the correlation of transvaginal cervical length and Bishop score

Bishop score around 4 and transvaginal cervical length around 2.6 are found to be best cut-off values for the pre induction cervical condition. Taking Bishop Score 4 and Cervical length 2.6 as the cut off and taking successful induction of labour as delivery within 24hrs.

Though Bishop score has more sensitivity than cervical length, specificity and positive predictive value of the trans vaginal cervical length is 100%. Significant predictive value is obtained for cervical length < 0.001 . P value for Bishop Score is 0.296. So transvaginal cervical length found to be better predictor of successful induction of labour in terms of delivery within 24hrs when compared to Bishop Score.

This study has demonstrated that, in primi singleton pregnancies undergoing induction of labour with dinoprostone gel at 37-42 wks, successful vaginal delivery within 24hrs of induction occurred in approximately 74%. The study has also demonstrated that induction to delivery interval is significantly associated with both the preinduction Bishop score and the sonographically measured cervical length, higher the Bishop score and lesser the cervical length better the likelihood of vaginal delivery. TVS cervical length was a better predictor of successful labour induction in terms of delivery within 24hrs of induction.

Previous studies on the value of pre-induction sonographic measurement of cervical length have reported conflicting results. Paterson Brown et al,^[4] examined 50 pregnancies before induction and reported that, although the Bishop Score correlated significantly with successful vaginal delivery, the score fell well short of being a satisfactory predictor of successful induction. In addition they found that sonographically measured cervical length was not significantly associated with either the Bishop Score or the induction to delivery interval. Boozarjomehri et al.^[5] Examined 53 women before induction and reported that, although sonographically measured cervical length was correlated with the duration of the latent phase of the labour, there was no significant association with the induction to delivery interval or to cervical effacement measured by digital examination.

Watson et al,^[6] Examined 109 women before induction and reported a significant association between sonographically measured cervical length and clinical assessment of cervical effacement; however, neither of the two provided a useful prediction of the length of the latent phase of labour. Gonen et al,^[7] examined 86 women before induction and reported significant association between both the Bishop Score and sonographically measured cervical length with successful induction and induction to delivery interval. Ware and Raynor⁸ examined 77 women before induction and found that both sonographically measured cervical length and Bishop score predicted induction-to-delivery interval and likelihood of vaginal delivery. In a logistic regression model, only cervical length and parity were independent predictors of vaginal delivery.^[8]

Pandis et al,^[9] Conducted a study on 240 women with singleton pregnancies at 37-42wks of gestation Vaginal delivery occurred in 194(80.8%) women and in 142(73.2%) of these delivered within 24hrs of induction. In our study 85% delivered vaginally and 74% delivered within 24hrs. Table 15 shows the comparison of the primary outcome measures in our study with the other study.

In our study we defined successful induction of labour as vaginal delivery occurring within 24 hrs. This end point has been traditionally used in several

studies to examine the efficacy of an inducing method. P Rozenberg et al¹⁰ compared the Bishop score and sonographically assessed cervical length for the prediction of successful induction as delivery within 24 hrs of induction. Pandis et al,⁹ also demonstrated that cervical length by ultrasound performed better than Bishop Score to predict vaginal delivery within 24hrs of induction.

Both sonographic cervical assessment and the Bishop Score successfully predicted vaginal delivery within 24 hrs. As the cervical length increases the likelihood of delivering within 24hrs decreases whilst, as Bishop score increase, the likelihood of delivering within 24hrs increases. However, the receiver operating characteristic curves for the two variables showed that, the sensitivity of sonologically measured cervical length in predicting successful induction of labour was higher than that for the Bishop Score. ROC curves were constructed to determine appropriate cut off for bishop score and transvaginal cervical length in predicting the labour induction, shown 4 is the best cut off for Bishop Score and 2.6 is for transvaginal cervical length.

Sujata et al,¹¹ Conducted study on 122 patients and their ROC curves failed to identify an appropriate cut off for continuous variables relating to sonographic cervical measurements. These variables were, therefore, analyzed as continuous variables in the regression model. Independent predictors of vaginal delivery included Bishop Score, cervical position, and maternal age. In their study transvaginal ultrasound does not predict successful labour induction as well as digital cervical examination.

In our study though the sensitivity of the Bishop Score in predicting the successful labour induction is higher (70.3%) compared with that of cervical length measured trans vaginally (58.1%) the specificity and positive predictive value for the cervical length was 100% compared with the Bishop Score (45.5% and 89.7% are respectively)

Two larger studies have been published, which compared Bishop Score and transvaginal ultrasound in preinduction cervical assessment. In a study of 109 women, Watson et al⁶. Used regression modelling to determine factors associated with successful induction. They determined that only cervical dilatation, as assessed by clinical examination, was a predictor of induction success. Likewise, Gonen et al,⁷ Prospectively evaluated 86 study subjects and found that only Bishop Score and parity were independent predictors of vaginal delivery in induced labour.

Interestingly, a recent randomised study comparing use of transvaginal sonographic assessment and Bishop Score to guide preinduction cervical ripening with prostaglandins has shown a reduction in prostaglandin use without affecting successful labour induction with transvaginal ultrasonography. The survival analysis demonstrated better discriminatory results in favour of cervical length without any women in short cervix (0- 1.8cm) remaining undelivered after 24 hrs compared to 10% of women

in the high Bishop Score group (5-8). 67% of the long cervix group (3.2-5cm) remained undelivered after 24 hrs compared to 33% of women in the low Bishop Score group. These findings suggest that sonographic cervical length is a better test than the Bishop Score for predicting successful induction of labour.

But the limitations for obtain TVS cervical length are that the expensive equipment and also the technical expertise in measuring the cervical length in standard and reproducible manner is required, so as to avoid the errors in the measurement. It is also an expensive test. In the setting where Transvaginal sonographic measurement of cervical length can be achieved easily, correctly and with minimal discomfort to the patient, it provides a useful prediction of the likelihood of vaginal delivery within 24 hrs of induction and of the induction to delivery interval. It helps in counseling the women regarding the outcome of labour induction.

Women with a cervical length of less than 2.6 cm can be counseled that delivery will possibly occur within 24 hrs of induction, whereas those with cervical length of 3cm can be advised that they have an approximately 67% chance of remaining undelivered after this interval. Bishop score still remains a useful test in the setting where the equipment and experts are not available as it is a simple, inexpensive test and does not required technical expert.

CONCLUSION

Bishop score and transvaginal cervical length both are good predictors of successful induction of labour. Transvaginal cervical length provides a better prediction of the likelihood of vaginal delivery within 24 hrs of induction. The Transvaginal Sonographic cervical length ≤ 2.6 cm is good predictor for successful labour induction. TVS cervical length could be used as a better alternative to Bishop Score for successful labour induction in the setting where the appropriate equipment and expertise are available.

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