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Original Research Article

Comparison of Bishop's score with transvaginal sonographic cervical assessment to predict success of induction of labor

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ABSTRACT

Background: Induction of labor for medical or obstetric indications is a common practice in modern obstetrics. Evaluation of the cervix by Bishop's score is universally used to predict the success of induction of labor. But it is a subjective method and many studies have shown that it is not a good indicator of success of induction.

Aim: To compare Bishop's scoring system and trans-vaginal sonographic assessment of cervix in predicting the successful outcome of induction of labor.

Materials and Methods: This was an observational study conducted in a tertiary care center. 120 patients who met the selection criteria were included. Prior to the induction of labor the Bishop's score and the sonographic scoring was assigned. Successful induction was defined as the patient entering the active phase of labor.

Results: 84% of participating women entered the active phase of labor. While 72.6% women had a normal vaginal delivery, 67.8% women delivered vaginally within 24 hours of induction. The TVS score (MGPICSS) of ≥2 predicted the successful induction with a specificity of 100% and sensitivity of 39.3% and AUC 0.74. In comparison, the Bishop score of ≥4 had a specificity of 75% and sensitivity of 44% and AUC 0.56. The prediction of delivery within 24 hours at the MGPICSS of ≥2 had a specificity of 100% and sensitivity of 42.9% and AUC 0.76. For the same, the Bishop's score of ≥4 had specificity of 83.3% and sensitivity of 45.5% and AUC 0.71.

Conclusion: TVS assessment of cervix is a better predictor of successful labor induction in comparison to Bishop's score.

1. Introduction

Induction of labor refers to stimulation of uterine contractions after the period of viability, before spontaneous onset of labor, in cases where the ongoing pregnancy may affect the mother or the fetus adversely, with the aim of vaginal delivery.[1] The most common indications for induction of labor are post dated pregnancy, hypertensive disorders of pregnancy, oligohydramnios, PROM, etc.[1]

It is a common practice in modern obstetrics in view of various obstetrical or medical indications.[2] Usually, the decision to induce labor is made after considering the risk and benefits of prolonging the pregnancy.[3] Successful induction results in vaginal delivery. However, the process is not completely seamless. Failure of induction can lead to cesarean section and the associated risks.[3,4] It is therefore important to predict the chances of success of induction.

Efforts have been made to predict the rate of success of induction. Currently the most popular and widely used method is the Bishop's score. It is a quantifiable but

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subjective method. Hence assessment is likely to vary from observer to observer. So the search for better predictors continues.[5]

Trans-vaginal sonography (TVS) is an alternative but objective method emerging for assessing the cervix to predict the success of induction of labor by reducing inter-observer variations.[6] TVS measurements are quantitative and easy to reproduce, with minimal discomfort to the patient.[7] It also allows a better evaluation of cervical length, since the supra-vaginal part of cervix is difficult to measure digitally.[8] It also provides access to internal os, which cannot be reached in a closed cervix and where the effacement begins.[9] Various parameters that can be used for cervical evaluation using TVS are cervical length, cervical funneling, cervical position, posterior cervical angle, distance of presenting part from external os, uterocervical angle, etc.[10–14]

Although many studies have been conducted to compare the Bishop's score with TVS cervical evaluation, the superiority of one method over the other has not been clearly defined. In addition, there is a lack of definite and established cut offs to use TVS assessment in defining the success of induction. Some researchers have attempted to develop cut offs and scores to use the TVS assessment.[6,15] However, these scores are not widely used at present. This might be because they used the parameters that are not easy to measure.

The aim of this study was to compare the two methods: Bishop's score and MGM pre induction cervical scoring system (MGPICSS), and to develop an easy to use system for using TVS assessment to predict the successful induction of labor.

2. Materials and Methods

This was an observational study conducted at the Department of Obstetrics and Gynaecology, Mahatma Gandhi Medical College and Research Institute with the approval of ethics committee. Pregnant women who underwent induction of labor during the study period, i.e., from February 2020 to February 2021, were included in this study.

Assuming that 74% of women who undergo induction will deliver vaginally, the calculation for sample size was done using the following formula:

$$N = \left(Z^2_{1-\frac{\alpha}{2}} X Sn X (1 - Sn)\right\} / (L^2 X P)$$

Where,

N = number of patients

$Z^2_{1-\frac{\alpha}{2}}$ = 1.96 (standard normal deviate)

Sn = reported sensitivity,

L = absolute precision desired of sensitivity (10% i.e., 0.1)

P = Prevalence of successful induction (74%, i.e., 0.74),[15]

As per Bajpai et al. sensitivity of Bishop's Score was 65% and that of TVS cervical assessment was 77%.[15] Therefore the sample size of this study was calculated as 120.

Inclusion criteria were patients over 18 years of age, primigravida, full term live singleton gestation with intact membranes, who were planned for induction of labor with PGE2.

Patients were counseled about the study and informed consent was taken. After emptying the bladder, digital cervical evaluation was performed and a score was assigned according to the Bishop's scoring system. This was followed by a Transvaginal ultrasound (GE Logiq P5 TVS probe 4-10 Mhz). TVS probe was inserted into the vagina and placed just below the cervix. Undue pressure was avoided as it can cause the distortion of the cervix.[15] TVS was performed to measure the length of the cervix and check for presence or absence of funneling of the cervix, and score was assigned as per MGPICSS. Ultrasound evaluations were performed by the researcher herself, thus minimizing inter-observer bias.

Cervical length was taken as the length between internal and external os.[10,15] Funneling was defined as the protrusion of the membranes into the internal os.[11]

The proposed scoring system for TVS cervical assessment was as follows (Table 1).

Table 1: MGPICSS for the TVS assessment of the cervix

Parameters	**2**	**1**	**0**
Cervical length	0-2 cm	>2-4 cm	>4 cm
Funneling		Present	Absent

Cervical lengths of 0 – 2 cm, 2 – 4 cm and more than 4cm were scored as 2 points, 1 point and 0 point respectively. The presence of the cervical funneling was scored as 1 point and absence of funneling scored as 0 point. The maximum score that could be obtained was 3.

MGPICSS score of 3 and Bishop's scoring of 6 were considered favorable for induction. Induction was done using similar method for all the women with intra cervical PGE2 gel. Primary outcome of the study was decided to be the onset of the active phase of labor. Active labor was defined as regular and adequate contractions with progressive dilataion of the cervix within 24 hours after induction. Up to 3 doses of PGE2 gel was used in 24 hours.

If the patient did not enter active labor despite 3 doses of intracervical prostaglandin E2 gel, labor induction was considered unsuccessful.

Patients who underwent LSCS for reasons other than failure of induction, (e.g., fetal distress, secondary arrest of cervical dilatation and non descent of fetal head despite good uterine contractions) were excluded from the study.

2.1. Statistical analysis

Data were entered into Microsoft Excel. Statistical analysis was performed using SPSS software version 17.0. Univariate analysis was performed using the Mann – Whitney test. The receiver-operating characteristic (ROC) curve was drawn for the Bishop's score and the MGPICSS. The ROC curves were used to determine which score better predicts the successful outcome. The results were considered to statistically significant at $p< 0.05$.

3. Results

The median age of the subjects was 25 years (range 18 – 37 years), median BMI was 27 kg/m^2 (range 18 – 43 kg/m^2) and median gestational age was 39.2 weeks (range 37 – 40.6 weeks).

Out of 120 women recruited in the study, twenty women (17%) underwent cesarean section before completing the full course of PGE2, due to indications such as fetal distress, abruption and maternal request.

Among the 100 women who completed the entire course of induction, 84 entered the active phase i.e., had successful induction. Sixteen women were taken up for section due to failed induction (87.5%), fetal distress (6.25%) or maternal request (6.25%).

Of the 84 women who entered active phase, 61 had normal vaginal delivery (72.6%) and 23 had LSCS (27.4%). Fifty seven women (67.8%) delivered within 24 hours of induction.

In the present study the AUC of MGPICSS was 0.74. The lower limit of AUC was 0.66. Women with an MGM score of 2 or higher had a 100% likelihood of entering active stage of labor. The AUC for Bishop's score was 0.56 with the lower limit being 0.42. So, women with Bishop's score of >4 had only a 75% chance of entering active phase of labor. (Table 2) (Figure 1)

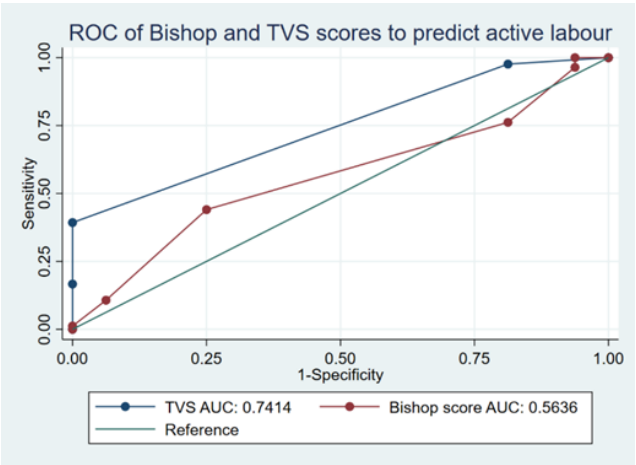

Figure 1: ROC of Bishop's score and MGPICSS for predicting active labor

The lower limit for AUC for MGPICSS is 0.63 and the AUC in this study is 0.71. Therefore, with MGM score of 2 or more 100% of women are likely to give birth within 24 hours of the induction. The lower AUC limit of the Bishop's score is 0.84 and the AUC for this study is 0.57. So, at a score of four or more only 75% women are likely to deliver within 24 hours. (Table 3) (Figure 2)

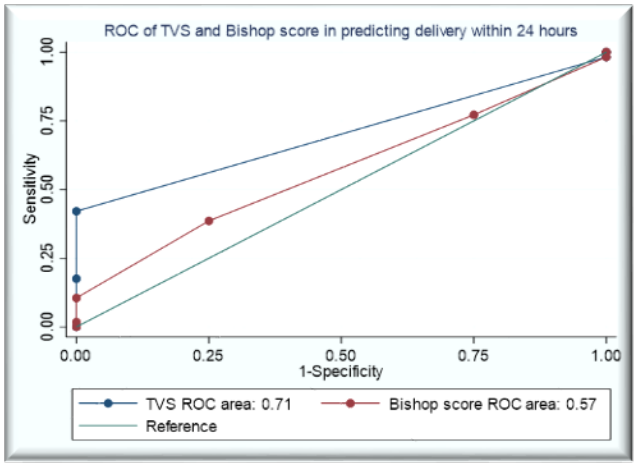

Figure 2: ROC of Bishop's score and MGPICSS to predict delivery within 24 hours

4. Discussion

This study compared the Bishop's score with the TVS assessment of cervix to predict the success of induction. It was concluded that the MGPICSS better predicted the successful induction of labor and also the delivery within 24 hours of the induction. TVS examination also causes less discomfort to the patients than digital examination.

Most of the studies have evaluated sonographic parameters individually.[9,16,17] These studies have shown that ultrasound parameters are better than Bishop's score at predicting the mode of delivery (vaginal or cesarean section) as well as the probability of delivery within 24 hours of induction. Some authors have studied a single sonographic parameter, others have studied multiple. Only a few studies have attempted to use these parameters to create an objective scoring system for day to day practice.[6,15]

Alalfy et al., Shreya et al. and Mohamed El Bishry et al. concluded in their studies that sonographic evaluation of the cervix was better than Bishop's score in predicting outcome of the induction.[7,10,18]

On the other hand, Khandelwal et al and Chandra et al. concluded that Bishop's score was superior to the sonographic parameters.[19,20] The differences may be due to the fact that all the above mentioned studies included women with post dated pregnancy. Additionally, in the study done by Khandelwal et al. not only the sample size (62) was much smaller than the other studies, they also used multiple

Table 2: Comparison of MGPICSS and Bishop's scores in predicting successful active phase of labor (N=100)

Scoring methods	Cut off	Sensitivity (95% CI)	Specificity (95% CI)	PLR (95% CI)	NLR (95% CI)	AUC (95% CI)	p value
MGPICSS	≥1	97.6 (91.7-99.7)	18.8 (4.0-45.6)	1.2 (0.95-1.52)	0.13 (0.02-0.70)	0.74 (0.66-0.81)	<0.001
	≥2	39.3 (28.8-50.5)	100.0 (79.4-100)	-	0.61 (0.51-0.72)		
	≥3	16.7 (9.4-26.4)	100 (79.4-100)	-	0.83 (0.76-0.92)		
Bishop's	≥2	96.4 (89.9-99.3)	6.3 (0.2-30.2)	1.03 (0.9-1.17)	0.57 (0.06-5.15)	0.56 (0.42-0.70)	0.36
	≥3	76.2 (65.7-84.8)	18.8 (4.0-45.6)	0.94 (0.72-1.22)	1.27 (0.43-3.77)		
	≥4	44 (33.2-55.3)	75.0 (47.6-92.7)	1.76 (0.73-4.26)	0.75 (0.53-1.05)		

Table 3: Comparison of MGPICSS and Bishop's scores in predicting delivery in 24 hours

Scoring methods	Cut off	Sensitivity (95% CI)	Specificity (95% CI)	PLR (95% CI)	NLR (95% CI)	AUC (95% CI)	P value
MGPICSS	≥1	98.2 (90.6-100.0)	0 (0-60.2)	0.98 (0.95-1.02)	-	0.71 (0.63-0.77)	<0.001
	≥2	42.1 (29.1-55.9)	100 (39.8-100)	-	0.58 (0.46-0.72)		
	≥3	17.5 (8.7-29.9)	100 (39.8-100)	-	0.82 (0.73-0.93)		
Bishop's	2	98.2 (90.6-100.0)	0 (0-60.2)	0.98 (0.95-1.02)	-	0.57 (0.30-0.84)	0.604
	3	77.2 (64.2-87.3)	25.0 (0.6-80.6)	1.03 (0.57-1.8)	0.91 (0.16-5.32)		
	≥4	38.6 (26.0-52.4)	75.0 (19.4-99.4)	1.5 (0.27-8.7)	0.82 (0.45-1.49)		

methods of induction simultaneously to achieve entry into active labor within a span of 6 hours.[19] Uzun et al. also concluded that AUC for the Bishop's score was greater than the AUC for the sonographic parameters, but the difference was not statistically significant.[21]

Bajpai et al used cervical length, cervical position, length and width of funnel and distance of presenting part to external os to develop the Manipal cervical scoring system. A score of 4 or higher resulted in a sensitivity of 77% and specificity of 93% and AUC of the ROC curve was 0.907 for predicting successful active phase of labor. Bishop's score had sensitivity of 65%, specificity of 86% and AUC was 0.815.[15] Keepanasseril et al used TVS parameters of cervical length and posterior cervical angle along with parity to establish a score. At a score of 6 or more the score had 95.5% sensitivity and 84.6% specificity to predict the vaginal delivery. Comparatively the Bishop's score of 5 had sensitivity of 65.3% and specificity of 80.8%.[6] Hence among the above mentioned studies TVS was found to be performing better than the Bishop's score to predict the outcome of the induction. Differences in sensitivity and specificity might be due to the use of different parameters and the parity of patients.

In the present study TVS parameters of cervical length and funneling (presence or absence) was used to create an objective scoring system. Other TVS parameters such as length and width of the cervical funnel, position of the cervix, posterior cervical angle, distance of the presenting part to the os, cervical gland area have also been shown to be useful.[6,10,13,15,22] Inclusion of a few of these other parameters would have made the score more objective and refined. But the sonographic parameters used for cervical assessment in the present study can be easily evaluated without the need for advanced training in sonography.

The present study included only nulliparous women to avoid selection bias. Such selection of only nulliparous women led to a population with a similar pre induction Bishop's score. But demographic characteristics influence the success of induction. So, an addition of the maternal demographic parameters to the TVS score might increase the sensitivity of the score.

5. Conclusion

TVS assessment of cervix is a better predictor of success of induction in comparison to Bishop's score. According to the present study, MGPICSS of ≥2 can predict the successful outcome with specificity of 100% and sensitivity of 39.3%. Also a score of ≥2 can predict the chances of delivery within 24 hours with a specificity of 100% and sensitivity of 42.9%. MGPICSS is doable even by the beginners and has reduced interobserver variations.

6. Clinical Significance

Trans vaginal sonography is a better tool to predict the success of the induction of labor, and subsequently reduces the morbidity associated with failed inductions.

7. List of Abbreviations

PROM: Pre-labor rupture of membranes; TVS: Transvaginal sonography; MGPICSS: MGM pre induction cervical scoring system; LSCS: Lower segment cesarean section; ROC: Receiver-operating characteristic; BMI: Body mass index; PGE2: Prostaglandin E2

8. Source of Funding

None.

9. Conflict of Interest

None.

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