Original Article

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Manipal Cervical Scoring System by Transvaginal Ultrasound in Predicting Successful Labour Induction

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Induction of labour (IOL) nowadays is a common procedure in obstetric practice. The success of IOL largely depends upon "favourability" or "readiness" cervix which is traditionally assessed by manual examination and Scored as Bishop Score. However, this method is limited by subjectivity and reproducibility and though done in all the patients prior to IOL, several studies have demonstrated poor correlation between Bishop Score and outcome of labour.

Objective: To evaluate the role of preinduction transvaginal ultrasonographic (TVS) cervical assessment in predicting labour outcome and to compare its performance against Bishop Score in patients undergoing induction of labour (IOL).

Setting: A tertiary medical college hospital in Southern India.

Design: Prospective observational and investigational study.

Materials and Methods: Transvaginal ultrasound was performed in 131 patients who underwent labour induction at term with intact membranes and live fetus. Bishop Score was assessed by pervaginal examination and was compared with preinduction TVS cervical Score (parameters being cervical length, funneling, position of cervix and distance of presenting part from external os). Labour was induced within one hour of cervical assessment. The labour induction was considered successful if patient could get into active labour i.e., onset of regular uterine contractions (at interval of 2-3 minutes) and cervical dilatation of 4 cm or greater within 24 hours of induction.

Results: Labour induction was successful in 86.9% of patients. At cut off Scores of ≥ 4, TVS cervical Score performed better than Bishop Score (Sensitivity 77% vs. 65%, Specificity 93% vs. 86%). ROC analysis indicated that Area Under Curve (AUC) was more for TVS Score (0.90, 95% CI 0.84 – 0.95), compared to Bishop Score. It was found that an increase in cervical length and distance from the os by 1 mm from their means were associated with an increase in odds for failure of induction and there by caesarean delivery by 6.5% and 11% respectively.

Conclusion: In women experiencing labour induction, transvaginal ultrasound score comprising of five different parameters indicated success of induction better than Bishop Score. Further, two of its components (longer cervical length and increased distance of presenting part from external os) demonstrated significant and independent prediction of the likelihood of failure of induction and risk of operative delivery.

Keywords: Bishop score, Cervical length, Funnel length, Funnel width, Head to internal os distance, Position of cervix

INTRODUCTION

In obstetrical practice induction of labour (IOL) is aimed at stimulation of uterine contractions after period of viability before the onset of spontaneous labour irrespective of status of membranes [1]. Presently, IOL is done for approximately 20% of pregnancies for various maternal and fetal indications [2,3] and nearly 20% of labour inductions end up in caesarean deliveries [4]. Successful induction depends largely on cervical characteristics or simply referred to as "readiness of cervix or cervical ripening" and Bishop Score is the gold standard traditional method of assessing favourability of the cervix in predicting whether an induced labour will result in successful vaginal delivery [5]. However, this assessment is subjective, biased by inter observer variations and studies have shown poor predictive value [6-8]. Digital examination may not measure the length of the cervix very precisely [9]. Other parameters of the score, such as consistency and position of the cervix are to some extent subjective and imprecise [10]. Effacement of the cervix is highly subjective and varies considerably among examiners [11]. Assessment of cervix digitally is also reported to be associated with fear of examination, pain, anxiety and discomfort [12]. Supravaginal portion of cervix comprises about half the length of cervix which is difficult to assess digitally and this is highly variable among subjects [13]. Transvaginal ultrasound (TVS) is an objective and well tolerated method not only to assess cervical length but also to detect changes at the internal os [14]. TVS can represent more accurate measurement of cervical length (including supravaginal portion), and these measurements are quantitative and easily reproducible hence can remove interobserver variations [15]. Evaluation of cervixby TVS can be useful in predicting successful labour induction i.e., initiation of active labour represented by cervical dilatation >4 cm in the presence of uterine contractions [16]. The purpose of present work is to study the sonographic equivalent components of Bishop Score and to formulate an ultrasound (TVS) scoring system and compare its performance with Bishop Score in predicting successful labour induction.

MATERIALS AND METHODS

This was a prospective observational study of pregnant women who underwent labour induction between August 2009 to July 2012 in a university hospital setting. Sample size was determined according to the method described in the next paragraph. Written and informed consent was taken from all patients who were included in the study. All patients with singleton gestation at 37 completed weeks up to 42 weeks with vertex presentation, longitudinal lie, live fetus, intact membranes and no vaginal bleeding were included in the study. Patients with previous cesarean delivery, antepartum haemorrhage and cephalopelvic disproportion were excluded and finally a total of 107 subjects were available for analysis. The study received approval of the Ethics committee of the hospital. Patients were asked to empty bladder. Cervical assessment by TVS was done by using TOSHIBA Nemo machine (TVS probe-5 Hz). The probe was gently placed in the vagina just below the cervix avoiding undue pressure which otherwise would distort the cervical configuration. All the measurements were taken in sagittal view which included

presence of both internal and external os, cervical canal and its gland area. Following parameters were assessed: length of the cervix from the internal to external os, presence or absence of funneling and if present width and length of funnelling at internal os were measured. Distance between presenting part to external os was measured and position of the cervix i.e. whether curved or straight was also noted. For measuring cervical length and distance between presenting part to external os, minimum of three measurements were taken and the shortest and technically appropriate measurements were recorded. Following the TVS examination, digital examination was done to by the person who was blinded to the TVS findings. We have used Burnett modified bishop Score [Table/Fig-1] with a scale of zero to maximum ten [17]. These parameters were carefully selected to match the components of modified Bishop Score, like cervical length was comparable to effacement of cervix. Funneling depicted by ultrasound was comparable to cervical dilatation and distance between presenting part to external os was the counterpart of station in Bishop Score. Ultrasound (TVS) scoring system was formulated with the above mentioned parameters [Table/Fig-2]. Each parameter was Scored from 0-2, maximum TVS Score was 10.

Score	0	1	2
Dilatation of cervix	< 1 cm	1- 2 cm	>1 cm
Cervical length	>2 cm	1- 2 cm	< 1 cm
Position of cervix	Posterior	Mid	Anterior
Consistency of cervix	Firm	Soft	Soft and stretchable
Station of Head	≥ -2	-1	≥0

[Table/Fig-1]: Modified Bishop Score (Burnett)
(Score range: minimum 0, maximum 10)

Score	0	1	2
Cervical length	>3 cm	2-3 cm	< 2 cm
Funnel length	Absent	≤ 0.5 cm	>0.5 cm
Funnel width	Absent	≤ 0.5 cm	>0.5 cm
Position of cervix	Curved	-	Straight
Distance of presenting part to external os	>3 cm	2-3 cm	< 2cm

[Table/Fig-2]: Transvaginal Ultrasound (TVS) cervical Score.
(Score range: minimum 0, maximum 10)

Sample Size Calculation

Radeka et al conducted a prospective, blind, observational study on Bishop Score to evaluate successful induction of with endovaginal prostaglandins. Induction was successful in 74% and unsuccessful in 26% [18]. They found that Bishop Score has sensitivity of 65.5%, specificity of 95%. Based on this information, we calculated minimum required sample size according to method described by Jone et al., [19].

Sample size based on sensitivity

$N = \{Z^2_{1-\alpha/2} \times Sn \times (1-Sn)\} / \{L^2 \times P^\alpha\}$

Sample size based on specificity

$N = \{Z^2_{1-\alpha/2} \times Sp \times (1-Sp)\} / \{L^2 \times P^\beta\}$

wherein

N = number of patients

$Z_{1-\alpha/2}$ = 1.96 (standard normal deviate value that divides the central 95% of z distribution from 5% in the tails)

Sn = reported sensitivity (65.5%, i.e., 0.655),

Sp = reported specificity (95%, i.e., 0.95)

L = absolute precision desired on either side (half width of the confidence interval of the confidence interval) of sensitivity/specificity (10% i.e., 0.1)

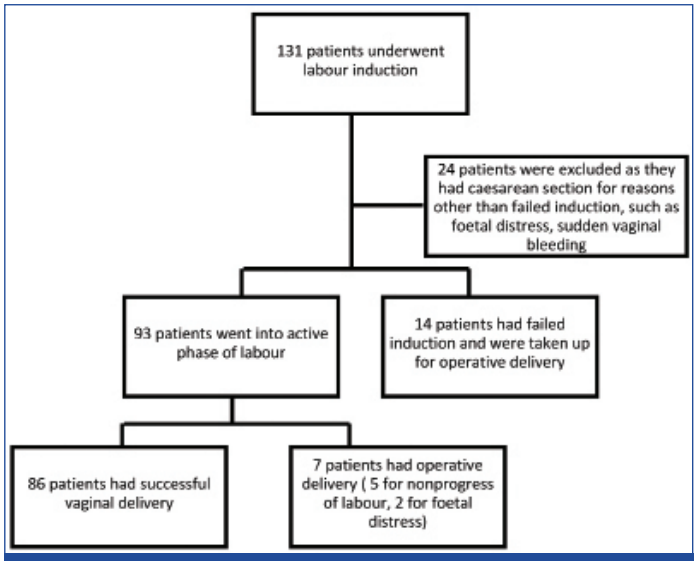
P^α = Prevalence of successful induction (74%, i.e., 0.74),

P^β = Prevalence of failure of induction (26%, i.e., 0.26)

The sample size calculation based on sensitivity was 114 and based on specificity was 76. Thus any sample size above 114 is more than adequate with respect to both required sensitivity and specificity.

Induction was carried out within one hour of cervical assessment, as per protocol of labour ward. In case of unfavourable cervix, labour induction was done by intracervical instillation of Dinoprostone (PGE2) gel, 0.5 mg in 3 gm of gel, if the patient did not exhibit regular uterine contractions and cervical changes after eight hours, induction was repeated. Maximum of three inductions were done over 24 hours. If the Bishop Score was found to be favourable, amniotomy was done followed by 2 units of intravenous oxytocin at the rate of 2mIU/min (8 drops/min) and gradually increased exponentially till maximum of 16mIU/ min (60 drops/min). Primary outcome of this study was the onset of active labour i.e. onset of regular uterine contractions (at interval of 2-3 minutes) and cervical dilatation of 4 cm or greater within 24 hours of induction.

There were 131 patients who were initially enrolled in the study. The mean age of the patients was 26.4 years (SD 3.55, range 21-35). The BMI (kg/m^2) ranged from 17.8 to 34.6 (Mean 23.9 ± SD 3.6). The majority of patients were primigravidae (89 ie, 67.6%). All 131 patients underwent induction of labour as per said protocol. Twenty four of them could not continue in the study they were taken up for operative delivery (foetal distress 21, appearance of vaginal bleeding 3). The remaining 107 patients (these patients represent the actual research population of present study) could complete the induction protocol and 14 of them did not respond to induction and were taken up for operative delivery with the indication as "failed induction". Of remaining 93 patients, 86 delivered vaginally and of them went into active phase of labour. The 86 of them delivered vaginally successfully and 7 of them had caesarean delivery for indications which occurred in active phase of labour (non progress of labour, foetal distress) [Table/Fig-3]. Non progress of labour in active phase was defined according to modified WHO partograph (all our patients had partographic management of labour and foetal heart was monitored by cardiotocography in all patients) and included any of following conditions; protracted active phase of labour (cervical dilatation crossing alert line), secondary arrest of cervical dilatation (< 1cm / hour) and absence of descent of fetal head despite good uterine contractions. Consortium statement is given pictorially.



[Table/Fig-3]: Study enrollment

STATISTICAL ANALYSIS

The values of various variables were entered into computer software (SPSS software, version 16, Chicago Il, USA). The various means

and standard deviations were calculated using descriptive statistics. Kolmogorov-Smirnov test was used to test the normality of observed measurements. Categorical variables were analysed using cross tabulation feature of the software and to determine the statistical significance. Pearson Chi-Square test (with Yate's correction) was applied. The best cut off values for Bishop Score and ultrasound Score were computed using Receiver Operator Characteristic (ROC) analysis. The diagnostic characteristics of these cut off points were assessed using sensitivity, specificity, positive and negative likelihood ratio with their 95% confidence intervals and area under the curve (AUC) reflected the true abilities of these two Scores. Logistic regression analysis was used to determine the relationship between success of induction and various components of Bishop Score and Ultrasound Score. Kaplan-Meier analysis was done to study the relationship between duration of labour at two cut offs of these two Scores as determined by ROC analysis. Log Rank (Mantel-Cox) test was used to find statistical differences in mean duration of labour in these groups. The hazard ratios were calculated for various covariates using the Cox proportional hazards model. The results were considered significant at two tailed p-value less than 0.05.

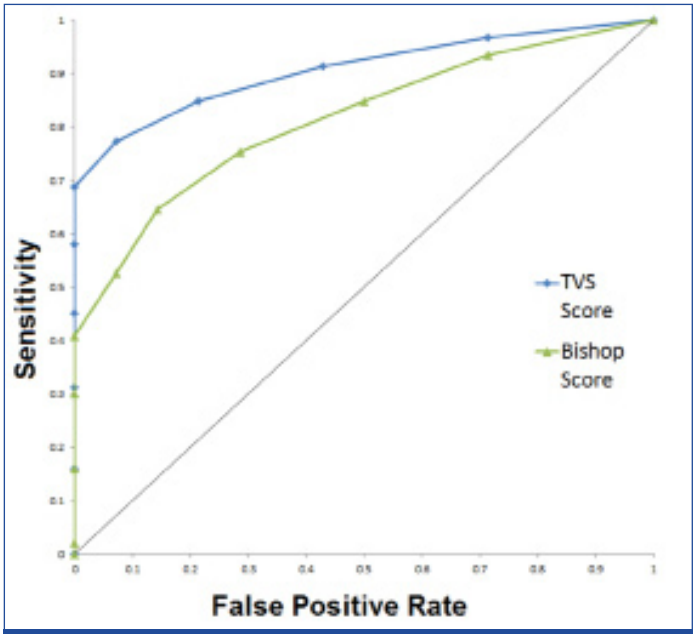
RESULTS

The maternal characteristics of 107 patients who completed the induction protocol are given in the [Table/Fig-4]. Increasing maternal age (>30 years) and higher BMI (≥30) appeared to be significantly associated with higher percentage of failed induction. Though failed induction rates were more in primigravida (16% vs. 6.3%), the difference was not statistically significant.

Parameters	Women who had active labour n (%)	Women who had failed inductions n (%)	p-value (Pearson Chi-Square)
Age (years)			
20-25	44 (93.6)	3 (6.4)	0.039
26- 30	38 (86.4)	6 (13.6)	
31-35	11 (68.7)	5 (31.3)	
Parity			
Primi	63 (84)	12 (16)	0.17
Multi	30 (93.7)	2 (6.3)	
BMI (kg/m^2)			
< 18.5	2 (66.7)	1 (33.3)	0.032
18.5- 24.9	60 (93.7)	4 (6.3)	
25- 29.9	26 (81.3)	6 (18.7)	
≥30	5 (62.5)	3 (37.5)	

[Table/Fig-4]: Demographic characteristics of 107 patients who completed induction protocol

[Table/Fig-5] represents sensitivity, specificity and other diagnostic parameters as indicated by ROC analysis. We have truncated wide range of cut points to few cut off values for Bishop Score and Ultrasound Score (three each) which have shown acceptable sensitivity and specificity. It is well known that in ROC analysis, with incremental increase in cut off value, the sensitivity and specificity values show reciprocal relationship and the best cutoff value would be one that produces a combination of maximum sensitivity and specificity. From [Table/Fig-5] it can be seen that at cut of values of Score of ≥ 4 produces best of the combinations for both Bishop Score and Ultrasound Score, and among the two ultrasound Score performs better than Bishop Score in all aspects. [Table/Fig-6] shows comparison of AUC for these two methods of cervical assessment to predict successful active phase of labour. The correct classification rate {CCR, i.e., (True Positives + True Negatives)/N} was 67.3% for Bishop Score and 79.4% for Ultrasound Score.



[Table/Fig-6]: Comparison of ROC curves for TVS and Bishop Scores

We performed multiple logistic regression analysis to examine the relationship between successful induction of labour and various components of two scoring systems. The five variables of Bishop Score and Ultrasound Score were entered in SPSS program as predictor variables and the outcome of induction (success or failure) as outcome variables and stepwise regression analysis was carried out to find the association between individual components of these two scoring methods and successful induction. The strength of the association was determined by p-value for the odd's ratio [Table/Fig-7]. Odd's ratio of more than one, indicates positive correlation (increase in the value of parameter results in higher success), whereas ratio less than one indicates negative correlation (increased measurement results in lower success). It was found that dilatation of the cervix was the single most predictor of successful induction with respect to Bishop Score, whereas cervical length and distance from presenting part to external os predicted success in ultrasound Score. Statistical derivations showed that an increase of 1 mm in cervical length (from mean cervical length of 2.54 cm) increased the odds of failure of induction by 6.5% and similarly 1 mm increase in head distance from external os (from mean distance of 2.79 mm) increased the odd of failure by 11%.

Scoring methods	Cut off Scores	Sensitivity (95% CI)	Specificity (95% CI)	Positive Likelihood ratio (95% CI)	Negative Likelihood ratio (95% CI)	AUC (95% CI)	p-value
Bishop Score	≥ 2	84.95 (76.0 - 91.5)	50 (23.1 - 76.9)	1.7 (1.0 - 2.9)	0.3 (0.1 - 0.6)	0.815 (0.728 - 0.883)	0.0001
	≥ 3	75.27 (65.2 - 83.6)	71.43 (41.9 - 91.4)	2.63 (1.9 - 3.7)	0.35 (0.1 - 0.9)		
	≥ 4	64.52 (53.9 - 74.2)	85.71 (57.2 - 97.8)	4.52 (3.5 - 5.9)	0.41 (0.1 - 1.5)		
Ultrasound Score	≥ 2	91.4 (83.7 - 96.2)	57.14 (28.9 - 82.2)	2.13 (1.3 - 3.4)	0.15 (0.06 - 0.4)	0.907 (0.835 - 0.955)	0.0001
	≥ 3	84.95 (76.0 - 91.5)	78.57 (49.2 - 95.1)	3.96 (3.0 - 5.3)	0.19 (0.06 - 0.6)		
	≥ 4	77.42 (67.6 - 85.4)	92.86 (66.1 - 98.8)	10.84 (9.0 - 13.0)	0.24 (0.04 - 1.7)		

[Table/Fig-5]: Diagnostic characteristics of Bishop Score and Ultrasound Score in predicting successful active phase of labour

	Odd's Ratio	95% CI for odd's ratio	p-value
Bishop Score			
Dilatation of cervix	7.6398	2.205 to 26.467	0.0013
Cervical length	0.9768	0.337 to 2.832	0.9656
Station of head	0.31405	0.082 to 1.203	0.0949
Manipal USG Score			
Cervical length	0.1448	0.044 to 0.472	0.0014
Funnel length	1.1529	0.861 to 1.543	0.3391
Funnel width	0.9033	0.653 to 1.250	0.5398
Distance of presenting part to external os	0.0226	0.002 to 0.217	0.0012

[Table/Fig- 7]: Relationship between successful active phase and various components of Bishop and USG Scores according to multiple logistic regression analysis.
2 components from Bishop Score (consistency and position) and one from USG Score (direction of cervical canal) were not analysed as they represented ordinal variables

[Table/Fig-8] explains the survival curves (Kaplan Meier) for Bishop Score and USG Score at two cut off values (<4 & ≥ 4). We have defined "vaginal delivery" as desired "event" (instrumental deliveries also included). Women experiencing caesarean deliveries (for various indications as mentioned in [Table/Fig-3]) were censored. It can be seen that women with USG Score ≥ 4 progressed well in labour and delivered in a shorter time than those with Score <4 (mean duration of labour 14.07 hours vs. 18.45 hours) and this was statistically significant (p<0.0001, Mantel-Cox log rank test). [Table/Fig-9] explains the statistical results related to survival analysis. The life table analysis further indicated that at the end of 16 hours of labour, only 10% of women with USG Score ≥ 4, whereas more than 90% of women with USG Score < 4 had not yet delivered. This means that ultrasound not only differentiates those women with favourable cervix from those without and also shorter duration of labour, though this phenomenon may be attributed to the fact that women with good Score would have already achieved significant amount of progress with regard to initial dilatation and foetal head descent.

We have used Cox proportional regression model for calculating hazard ratio [Table/Fig-10] for Bishop Score and Ultrasound Score. We defined occurrence of vaginal delivery as completion of the event and this was technically considered as hazard, meaning parameter having higher hazard ratio (HR) literally meant achieving successful vaginal birth. Ultrasound scoring of cervix was significantly associated with higher hazard function for Score ≥ 4 (6.96, p<0.001) compared to Bishop Score ≥ 4 (1.32, p=0.23, N.S. - statistically not significant), indicating faster progression to vaginal delivery. Again further statistical analysis (not shown) indicated that transvaginally measured cervical length and foetal head distance were significantly contributing to hazard ratio in USG Score group.

	Mean	95% CI	Log Rank (Mantel-Cox) chi square value	p-value
Bishop Score			3.83	0.005
< 4	15.45	14.7 - 16.2		
≥ 4	14.74	14.03 - 15.45		
Manipal USG Score			56.93	<0.0001
< 4	18.45	18 - 18.9		
≥ 4	14.07	13.63 - 14.52		

[Table/Fig-9]: Kaplan – Meier Survival analysis showing mean duration of labour, 95% Confidential intervals for the mean and significance.
*Life tables are not shown, as they are lengthy and usually software generated lists

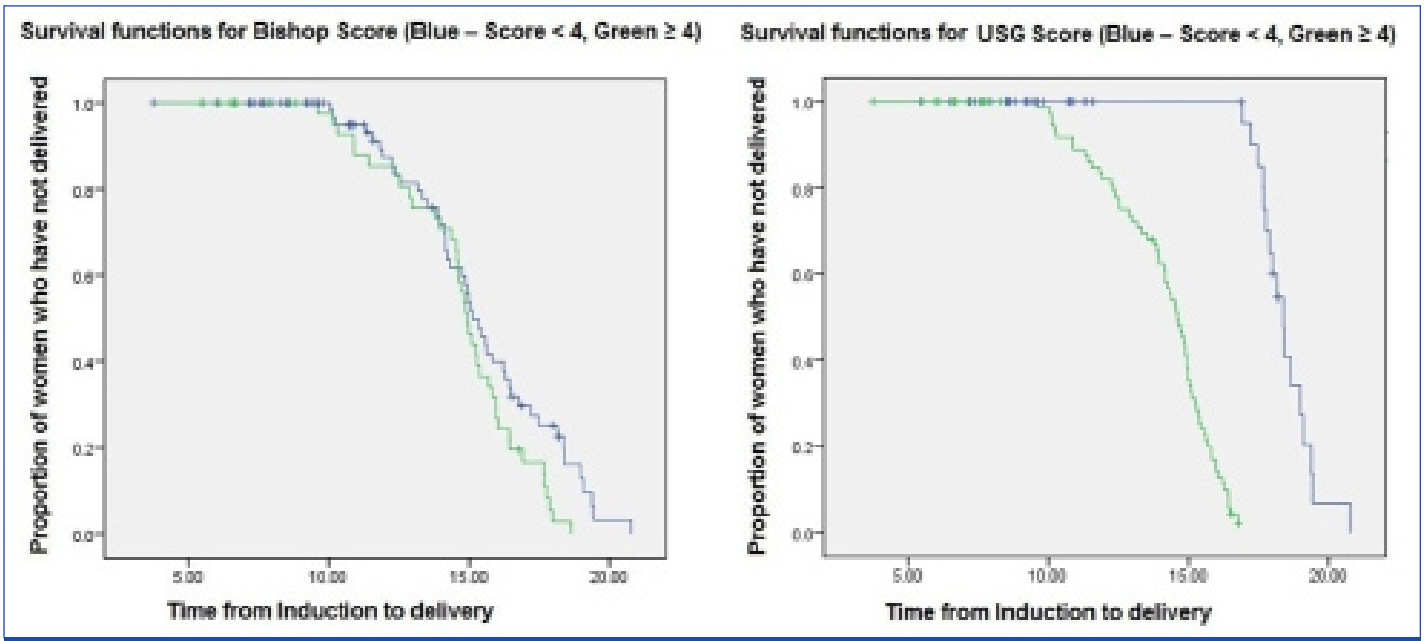
	HR	95% CI	Chi square value	p-value
Bishop Score		-		
< 4	1	Reference	1.45	0.23
≥ 4	1.32	0.84 - 2.06		
Manipal USG Score			52.55	<0.0001
< 4	1	Reference		
≥ 4	6.96	4.12to 11.77		

[Table/Fig-10]: Hazard Ratio (HR) for vaginal delivery after induction of labour according to Bishop Score and USG Score using Cox proportional hazard model

In our series, there were no complications (for example uterine hyper stimulation, amniotic fluid embolism etc.) related to intracervical PGE2 instillation. We had three cases of sudden vaginal bleeding and were immediately taken up for caesarean section. There were no maternal and perinatal mortality in our study.

DISCUSSION

In modern obstetrical practice induction of labour has been tried in one of every five deliveries for various maternal and/or fetal indications and incidence is gradually rising [3]. In appropriate



[Table/Fig-8]: Kaplan – Meir survival analysis for Bishop Score and USG Score

selection of cases results in failure of induction and raised rates of intrapartum caesarean sections, there by significantly increasing maternal and fetal morbidity associated with these interventions. Hence, pre-induction counseling and explaining the chances of successful inductions is of paramount importance and any tool that helps the physician in estimating favourable outcome will be indispensable. Few studies have indicated that inductions solely based upon bishop Scores have resulted in increased number of prostaglandin inductions and incorporating ultrasound in decision making have significantly reduced the need for prostaglandin usage from 75% to 36% [20].

Several studies in the past have evaluated the efficacy of ultrasound in prediction of successful labour induction and have reached some conclusion that ultrasound performs better than Bishop Score. However, these studies have focused mainly upon transvaginal measurement of cervical length and not on other equivalent ultrasound representatives of Bishop Score components. In this direction, the present study is the one of its kind to formulate a composite USG (TVS) scoring system that can be used to predict successful labour induction. The following table [Table/Fig-11] shows how ultrasound parameters were matched to components of Bishop Score.

Bishop Score parameter	USG (TVS) parameter
Effacement	Cervical length
Cervical dilatation	Funneling at internal os
Station	Distance of presenting part to external os
Position of cervix	Position (curved / straight)
Consistency	Not evaluated

[Table/Fig-11]: Comparing individual ultrasound parameters to Bishop Score

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 [9]. The ultrasound findings can be documented by taking pictures and is reproducible. Other co-existing findings like compound presentation and occult cord presentation if present can be documented, which can be easily missed by doing just a digital examination.

Earlier it was thought that there are certain advantages of Bishop Score over ultrasound assessment, for example, parameters such as cervical consistency and position could only be measured by pervaginal examination [4]. The results of this study shows that other parameters of Bishop Score such as cervical length, effacement and station of the head can be measured more accurately and objectively and one can add other parameters such as cervical canal configuration and funnel length to construct an ultrasound scoring system which can perform better than digital scoring.

In the past, many studies that have compared cervical length with Bishop Score have shown variable results [14]. GK Pandis et al., from Harris Birthright Research Centre for Fetal Medicine, London carried out a multicenter study on 240 women with singleton pregnancies at 37-42 weeks period of gestation and they found that cervical length alone appeared to be a better indicator of successful vaginal delivery within 24 hours compared to Bishop Score [21]. R Gabriel et al., from France too had similar observations and in their series of 179 patients, they observed that in women with poor Bishop Score, a cervical length of <26 mm, the caesarean rates were less and labour was not prolonged [6]. SM Rane et al., have too opined that cervical length estimation is better than Bishop Score in their series of 382 prolonged pregnancies [22]. Soon Ha Yang et al., from Seoul, South Korea, concluded that cervical length <3.1 cm by TVS was a better predictor of active phase of labour than Bishop Score of >4 [23]. In 2007 Ana M Gomez et al., also found that cervical length <2.4 cm by TVS was a better predictor of successful vaginal delivery than Bishop Score> 4 [24]. A meta-analysis published concluded that cervical length by USG was not an effective predictor of successful labour induction [25]. However, some studies have reported that ultrasound is no more than better than Bishop Score. In a study done by H Roman et al., concluded that Bishop Score is a better predictor than cervical length by USG in predicting successful labour induction [26].

JL Bartha et al., have opined that a combination of Bishop Score and ultrasonically measured cervical length and wedging predicts high success rates for induction of labour [27]. In their series of 85 patients they found that if Bishop Score <6, cervical length >3 cm and weding <30%, used as criterial for labour induction instead of Bishop Score alone, the need for intracervical prostaglandins reduced significantly by 35%. Studies from 2006 onwards have focussed on combinations of several other parameters such as history, clinical examination details and ultrasound findings. HP Dietz et al., from University of Sydney, Australia conducted a prospective observational study on 202 patients between 36 to 40 weeks of gestation [28]. They assessed maternal age, parity, previous operative delivery, Bishop Score and translabial ultrasound assessment of cervial length, bladder position on Valsalva and fetal head engagement. Multivariate logistic regression analysis indicaed that a model comprising of maternal age, BMI, previous operative delivery, Bishop Score, sonographic cervical length, bladder position and head engagement had the best discriminatory power to predict successful vaginal delivery. However a Dutch study which included above parameters reported only a moderate predictive capacity and they concluded that such prediction models should be used with caution in clinical practice [29]. Eggebo et al., from Norway constructed a validation model including three ultrasound parameters viz, tranperineally measured foetal head distance, transvaginally measured posterior cervical angle (angle between cervical canal and posterior uterine wall) and cervical length along with digitally measured cervical dilation on a 8 point scale, which could predict successful induction of labour as high as 71% of patients planned for delivery (95% CI 61-80%, p<0.01) [9]. The ultrasound scoring in our study is based upon 0 – 10 point scale and does not include any clinical examination parameter and we assume that such a scoring system can be highly objective, authentically documented and easily reproducible.

TVS was well tolerated by all patients in our study, so we propose that this scoring system can be used in clinical practice to evaluate and follow up the cervical Score in term patients once pelvis has been assessed by digital examination, this will help to reduce frequent digital examinations of cervix which can be associated with premature rupture of membranes. Other co-existing findings like compound presentation and occult cord presentation if present can be documented, which can be easily missed by doing just a digital examination.

LIMITATIONS OF STUDY

Recently many other parameters such as transperineal head distance, cervical gland area, posterior cervical angle and angle of head progression have been studied to determine successful labour. Further studies are required to know whether incorporation of these parameters in ultrasound scoring system improve the efficacy of intrapartum sonography in predicting successful induction.

CONCLUSION

The results of present study indicate that the use of Manipal ultrasound scoring system instead of Bishop Score for pre-induction cervical assessment is a useful tool in predicting labour outcome. Ultrasound Score of ≥ 4 demonstrates significantly higher diagnostic indices compared to Bishop Score of same magnitude.

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