

Original Research Article

# TVS SCORE: A NEW ASSESSMENT TOOL IN SUCCESSFUL OUTCOME OF INDUCTION OF LABOUR PREDICTION

DR. PRACHI SHUKLA<sup>1</sup> (ASSISTANT PROFESSOR), DR. MRINAL CHOUDHARY<sup>2</sup> (POST GRADUATE RESIDENT), DR. SIMRAN AGRAWAL<sup>3</sup> (M.B.B.S.) & DR. PAULRAJ RAHULRAJ<sup>4</sup> (M.B.B.S.)

DEPARTMENT OF RADIODIAGNOSIS, MGM MEDICAL COLLEGE, INDORE<sup>1&2</sup>  
Dr. D.Y. PATIL MEDICAL COLLEGE, KOLHAPUR, MAHARASHTRA<sup>3&4</sup>

CORRESPONDING AUTHOR – DR. MRINAL CHOUDHARY

## ABSTRACT:

**BACKGROUND:** Induction of labor (IOL) is one of the most common obstetric procedure in the world. However, the procedure is associated with an increase in the operative vaginal or caesarean delivery and many other complications. This study has been done to evaluate the role of TVS score in prediction of successful outcome of labour induction.

**METHODS :** The study has been performed in admitted patients in a tertiary care hospital. TVS score assessment was done for successful outcome of induction of labour prediction and compared with Bishop Score.

**RESULTS :** Sensitivity and specificity of TVS Score in predicting successful labour induction was 90.8% and 79.2% respectively and that for Bishop score was 68.4% and 70.8% respectively. Thus, TVS Score surpassed Bishop Score in predicting successful outcome of labour prediction. The association between TVS score and induction of labour was found to be statistically significant (p-value 0.001)

**CONCLUSION :** There is an increasing concern over induction of labour increasing operative risks and the deleterious effect that it may cause to fetus and mother as a consequence of its failure. Predicting successful outcome of labour induction is the need of the hour as not only it improves chance of fetal and maternal well being but also reduces healthcare cost. TVS Score has been found to be superior than Bishop Score and can act as an efficacious tool for predicting successful outcome of labour induction.

**KEY WORDS:** Transvaginal sonography. Bishop Score, Labour

## 1. INTRODUCTION

Labour induction is a lifesaving intervention aimed at preventing fetal and maternal complications which may arise in several conditions where further prolongation of pregnancy has become life threatening. Labor induction has become one of the most common interventions in clinical obstetrics, whose prevalence reaches upto 22% in India<sup>1</sup>. Labour induction is considered as a safe and effective mode of vaginal delivery but is often accompanied by various complications such as fetal heart rate abnormalities, operative vaginal delivery, uterine rupture, perinatal asphyxia and with increased risk of cesarean sections and NICU admissions. Indication for labour induction may be absolute in some patients. However, situations may arise in some patients where the indication is relative and

successful outcome of induction is not confirmed. Inappropriate selection of cases leads to induction failure significantly increasing maternal and fetal morbidity associated with these interventions<sup>2</sup>. Therefore, case selection prior to induction of labour is of utmost importance in order to predict the success of vaginal delivery for confirmation of the gestational age, pelvic adequacy, fetal presentation, cervical status, fetal lung maturity and fetal lie<sup>3</sup>.

Evaluation of pre-induction cervical status is of paramount importance in predicting success of induction of labour. As term approaches, the cervix prepares itself for spontaneous onset of labor by becoming softer and shorter, moving forward and starting to dilate. Bishop score, the conventional method used for prediction of successful labour induction, assesses the favorability of the cervix and the need for cervical ripening. It is calculated by evaluation of five parameters including cervical position, cervical consistency, cervical effacement, cervical dilation and station of the fetal presenting part<sup>4</sup>. However, Bishop score is accompanied by inter and intra-observer variability owing to the fact that it is a subjective criteria. Moreover, digital examination done for calculating Bishop Score, often leads to incorrect estimation of cervical length and fails to assess the supravaginal part of the cervix and estimate. Evaluation of cervical effacement is also problematic in closed cervix which adds to its disadvantage. Assessment of head station done by digital examination is often incorrect and inaccurate and not always reproducible by different examiners<sup>5</sup>. Thus, there is a need for an accurate and more objective method for predicting successful outcome of labour induction.

In such situation, transvaginal sonography of cervical assessment, being an objective and easily reproducible method can assess the supravaginal portion of the cervix causing only little discomfort and can be used even when cervix is closed. This study has been done based on five parameters i.e. cervical length, funnel width and length at the internal os, distance from the presenting part to the external os, and position of the cervix to predict successful labor induction, examined using trans-vaginal sonography. These ultrasound parameters have been selected to match the Bishop Score components. Cervical length was used to represent effacement of cervix. Another useful parameter for successful labor induction, distance of the presenting part to the external os was used to represent cervical station determined clinically by the head distance either above or below the ischial spine, which is determined through per vaginal examination. Cervical dilatation was assessed by measurement of width and length of the funnel whose presence may serve as an important predictor of successful induction as it may lead to reduction of delivery time<sup>6</sup>.

A number of studies have been done to compare accuracy of Bishop score with that of sonographic cervical length in predicting success of labour induction or otherwise. However, there is paucity of data on comparison of TVS Score and Bishop Score for prediction of successful labour induction. This study has been designed to determine the sensitivity and specificity of the TVS Score in predicting the fate of induction of labour and compare it with Bishop Score.

## 2. MATERIAL AND METHODS

An observational prospective study comprising of 118 obstetric patients who were admitted for labour induction was conducted in tertiary care hospital between July 2021 to July 2022. Good clinical care practices and guidelines as per declaration of Helsinki were followed. The study has been conducted after taking approval from the institutional ethics and scientific review committee.

Sample size was calculated based upon the following formulas given by Jones et al<sup>7</sup>:

Based on sensitivity

$$N = \{Z_{2 \cdot 1-\alpha/2} \times Sn \times (1-Sn)\} / \{L2 \times P\alpha\}$$

Based on specificity

$$N = \{Z_{2 \cdot 1-\alpha/2} \times Sp \times (1-Sp)\} / \{L2 \times P\beta\}$$

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

Sp = reported specificity

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).

$P\alpha$  =Prevalence of successful outcome

$P\beta$ =Prevalence of failed outcome

**Inclusion Criteria :** Patients with live single intra- uterine pregnancy with the fetus in vertex presentation and in those where vaginal delivery is not contra-indicated were included in the study

**Exclusion Criteria :** Patients who were in active phase of labour , suffering from genital infections or who had history of previously performed surgeries like LSCS, myomectomy were excluded from the study.

Modified Bishop Score assessment in all 118 patients who fulfilled the above mentioned criteria. However, cephalo-pelvic disproportion was encountered in 18 patients, so trans-vaginal sonography was performed in remaining 100 patients. The comparison between TVS Score and Modified Bishop Score (Burnett) was done among these 100 patients. TVS assessment for evaluation of TVS Score was performed by the person who was blinded with Modified Bishop Score (Burnett) findings. Thus, two different persons performed Bishop Score and TVS Score separately. The anatomical landmarks noted in TVS assessment of cervix done using 5-9 MHZ transducer were internal os, external os and endocervical canal. These landmarks were used to assess the five parameters, each scored between 0 to 10, as proposed by Bajpai et al (*Table 1*) (3) to calculate TVS Score. This procedure was repeated thrice and recording of the shortest measurement was done. Unfavourable cervix in this study was defined as score  $\leq 4$  on either Bishop score or TVS score. The TVS assessment of cervix was done within the hour prior to commencement of the induction of labour procedure. Following cervical assessment, induction procedure was performed within a time period of one hour. Intracervical instillation of Dinoprostone (PGE2) gel, 0.5 mg in 3 gm of gel was done in cases where cervix was found to be unfavourable. Even after 8 hours, if no cervical changes or regular uterine contractions are noted, induction is repeated upto maximum 3 inductions done over 24 hours. On Bishop Score assessment, if favourable outcome is noted then amniotomy was performed which was then 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). Labour was found to be active if regular uterine contractions occur at an interval of 2-3 minutes and cervical dilatation of 4 cm or more within 24 hours of induction which was considered the primary outcome of the study. Successful induction of labour was defined as vaginal delivery within 24 hours of induction of labour.

(*Table 1*)

All clinical and TVS imaging data were tabulated and comparisons were done using IBM Statistical Package for the Social Sciences (SPSS) software for Windows, Version 26.0. Armonk, NY: IBM Corp. The study was done using appropriate tests of significance and statistically significant association was stated when P- values were found to be less than 0.05.

### 3. RESULTS

The study population included the age range of 20 to 35 years. The mean age was 25.24 years [SD = 4.1]. Gestational age of the study population was found to be ranging from 37 to 42 weeks. The majority of the cases belonged to 39-40 weeks gestational age range (55%). Post-datism was found to be the most common indication for induction in the study seen in 69 % of the cases followed by pre-eclampsia seen in 11 % of cases. The other indications were GDM (9%), Oligohydramnios (6%), PROM (4%) and fetal distress occurring along with congenital anomaly in fetus which was incompatible with life(1%).

In 76% of cases, labour induction was found to be successful. Failed induction was seen in 24% of cases in this study. When Bishop score  $>4$  was taken, outcome was found to be successful in 68.4% of cases. Induction failure was seen in 70.8% cases with Bishop score  $\leq 4$ . The association between Bishop score and induction of labour was found to be statistically significant (p-value 0.001). Thus, sensitivity and specificity of Bishop Score in predicting successful labour induction was found to be 68.4 and 70.8% respectively. Thus, it can be seen that women with Bishop score more than 4 progressed well in labour and delivered successfully than those with score  $\leq 4$ . This means that Bishop score can differentiate those women with favourable cervix from those without with a sensitivity of 67.5%. (TABLE 2)

The cases in the study group had cervical lengths in the range of 1 to 4 cm. 88 cases had preinduction TVS cervical length of  $\leq 3$  & 12 cases had preinduction TVS cervical length of  $>3$ . The mean TVS cervical length of the study group was 2.12 cm. In our study, funneling was present in 85 cases and absent in 15 cases. Out of 85 cases where funneling was present, funnel lengths were in the range of 0 to 1.9 cm. 73 cases had preinduction TVS funnel length of  $\leq 1$  & 12 cases had preinduction TVS funnel length of  $>1$ . The mean TVS funnel length of the study group was 0.72cm. The cases in the study group had funnel widths in the range of 0 to 1.8 cm. 70 cases had preinduction TVS funnel width of  $\leq 1$  & 15 cases had preinduction TVS funnel width of  $>1$ . The mean TVS funnel width of the study group was 0.69 cm. In our study, the position of the cervix was evaluated. 65% of cases had a straight position of the cervix & 35% of cases had a curved position of the cervix. The distance of presenting part to external os was also evaluated. The distances were in the range of 1.4 to 4.9 cm. 60 cases had preinduction TVS distance of presenting part to the external os of  $\leq 3$  & 40 cases had preinduction TVS distance of presenting part to the external os of  $>3$ . The mean TVS distance of presenting part to the external os of the study group was 3 cm. Finally, the TVS score was assessed. The cases in the study group had TVS scores in the range of 1 to 10 (FIGURE 1). 74 cases were found to have TVS Score  $>4$  and 26 cases had TVS Score  $<4$ . With TVS Score  $>4$ , successful induction of labour was seen in 90.8% cases. Failed induction was seen in 79.2% cases with TVS Score  $\leq 4$ . It can be seen that women with TVS score more than 4 progressed well in labour and delivered successfully than those with score  $\leq 4$ . This means that TVS Score accurately differentiates those women with favourable cervix from those without (p- value 0.001). (TABLE 3)

Sensitivity and specificity of TVS Score in predicting successful labour induction was found to be 90.8% and 79.2% respectively. Thus, sensitivity and specificity of TVS score

was found to be better as compared to the Bishop score in the prediction of successful labour induction. (TABLE 4)

**Table 1: Modified Bishop Score (Burnett)**

Parameters	0	1	2
Cervical Length (cm)	>2	1-2	<1
Dilatation of cervix (cm)	< 1	1-2	>2
Consistency of cervix	Firm	Soft	Soft and stretchable
Position of the cervix	Posterior	Mid	Anterior
Station of head	≤-2	-1	≥ 0

*Bajpai et al. TVS Scoring System<sup>3</sup>*

Parameters	0	1	2
Cervical Length (cm)	>3	2-3	<2
Funnel length (cm)	Absent	≤ 0.5	>0.5
Funnel width (cm)	Absent	≤ 0.5	>0.5
Position of the cervix	Curved	-	Straight
Distance between presenting part to external os	>3	2-3	<2

**TABLE 2 : BISHOP SCORE FINDINGS AND RELATION BETWEEN BISHOP SCORE AND OUTCOME OF INDUCTION OF LABOUR**

CERVICAL LENGTH (CM)	>2	7
	≤2	93
DILATATION OF CERVIX (CM)	<1	20
	1-2	78
	>2	12
CONSISTENCY OF CERVIX(CM)	Firm	35
	Soft	53
	Soft and stretchable	12
POSITION OF CERVIX (CM)	Posterior	43
	Mid or Anterior	57
STATION OF HEAD	≤-2	41
	>-2	59

			INDUCTION		Total
			SUCCESS	FAILED	
BISHOP SCORE	>4	Count	52	7	59
		% within outcome	<b>68.4%</b>	29.2%	59.0%
	≤4	Count	24	17	41
		% within outcome	31.6%	<b>70.8%</b>	41.0%
Total		Count	76	24	100

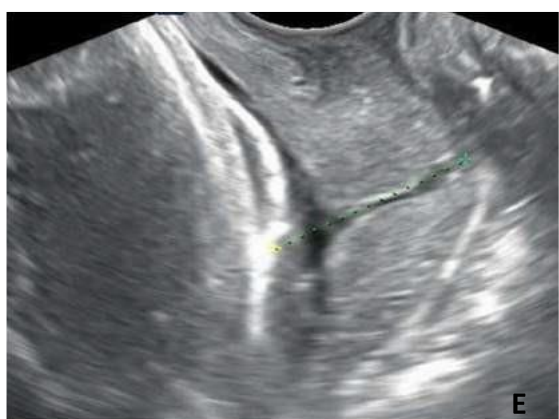
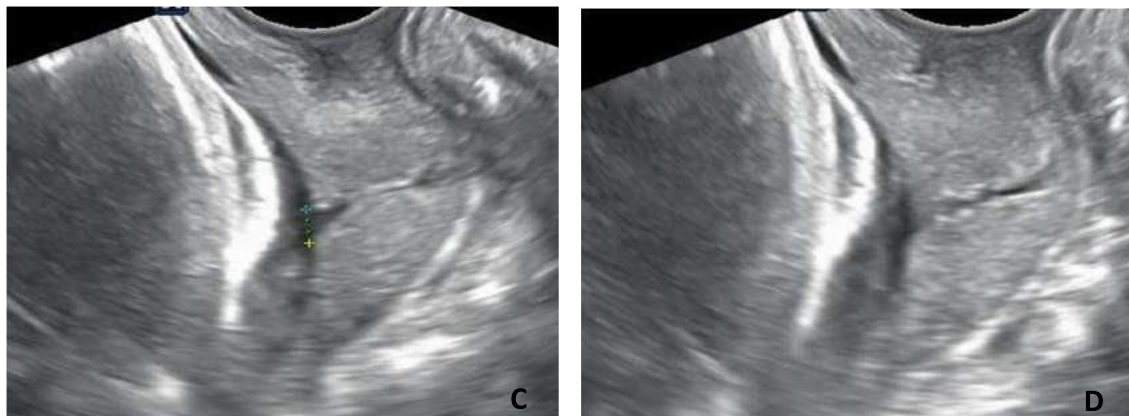
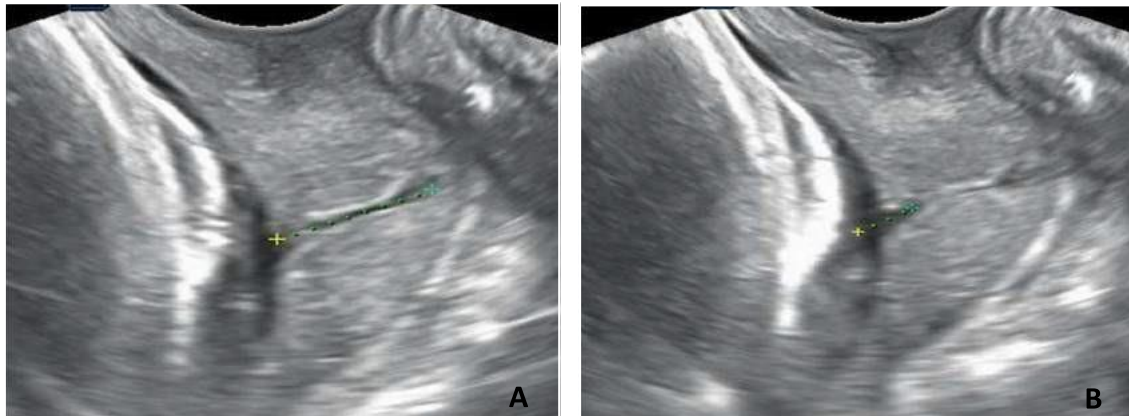
**TABLE 3 : ASSESSMENT OF TVS PARAMETERS**

TVS PARAMETERS	Criteria	Count
CERVICAL LENGTH (cm)	>3	12
	≤3	88
FUNNEL LENGTH (cm)	Absent	15
	≤1	73
	>1	12
FUNNELWIDTH (cm)	Absent	15
	≤1	70
	>1	15
POSITION OF CERVIX (cm)	CURVED	35
	STRAIGHT	65
DISTANCE OF PRESENTING PART TO EXTERNAL OS (cm)	>3	40
	≤3	60

**TABLE 4 : RELATION BETWEEN TVS SCORE AND OUTCOME OF INDUCTION OF LABOUR**

			(INDUCTION)		Total
			SUCCESS	FAILED	
TVS SCORE	>4	Count	69	5	74
		% within Outcome	<b>90.8%</b>	20.8%	74.0%
	≤4	Count	7	19	26
		% within Outcome	9.2%	<b>79.2%</b>	26.0%
Total		Count	76	24	100

FIGURE 1 - A 29 year old female with 36 weeks gestational age with Bishop score 3 was assessed by trans-vaginal sonography for calculating TVS Score. TVS Score was found to be 8 and the outcome of induction of labour was found to be successful.



TVS CERVICAL SCORE					
Parameters	0	1	2	Finding	score
A.Cervical length(cm)	>3	2-3	<2	1.4	2
B.Funnel length(cm)	absent	≤0.5	>0.5	0.6	2
C.Funnel width(cm)	absent	≤0.5	>0.5	0.4	1
D.Position of cervix	curved		straight	straight	2
E.Distance of presenting part to external os(cm)	>3	2-3	<2	2.4	1
Total TVS score=8/10					

Outcome of Induction – Successful.

#### 4. DISCUSSION

The mean age of the pregnant females in the studied population was 25.24 years. The mean age in our study was in concordance with the study conducted by Bastani et al<sup>2</sup> where the mean age of studied cases was 29.9 years.

37 to 42 weeks was the gestational age range of the study population. Similar findings were observed by Bajpai et al<sup>3</sup> and Bastani et al<sup>2</sup> where the gestational age ranged between 37 to 42 weeks

In 69% of cases, post-datism was the cause for induction of labour followed by pre-eclampsia in 11% of cases. The study done by Chawla et al<sup>9</sup> also observed similar causes for labour induction, the most common being postdatism (60%).

Successful labour induction was found in 76% of cases in our study and failure of induction was observed in 24% of cases. The results were in accordance with the results observed by Neha Bajpai et al<sup>3</sup> where induction of labour was found to be successful in 86.9% cases and induction failed in 13.1% of cases.

It was seen in our study that women with Bishop score more than 4 progressed well in labour as compared to those who had score less than 4, thus indicating that Bishop score can differentiate those women with favourable cervix from those with unfavourable cervix. The result was comparable with the study conducted by Finianty Raynelda et al<sup>10</sup> with a P-value<0.05 and Tan et al<sup>11</sup> with a p-value of 0.002.

Further on application of TVS Score, it was found that women with TVS score >4 showed better outcome of induction of labour as compared to the women with TVS Score < 4(p-value 0.001). The results were similar with the study conducted by Neha Bajpai<sup>3</sup> et al. (p-value 0.001).

Sensitivity and specificity of TVS Score was found to be 90.8% and 79.2% respectively and sensitivity and specificity of Bishop Score was found to be 68.4 % and 70.8 % respectively in predicting successful labour induction. The result was comparable with the study conducted by Neha Bajpai<sup>3</sup> et al. where sensitivity and specificity of TVS Score was found to be 77.4% and 92.8% respectively and sensitivity and specificity of Bishop Score was found to be 65% and 86% respectively. Thus, superiority of TVS Score over Bishop Score was established in predicting successful outcome of labour.

## 5. CONCLUSION

Induction of labour is performed after fetal viability is attained for a variety of maternal/fetal indications in order to improve the clinical course and outcome of the pregnancy. Appropriate selection of cases is crucial prior to induction of labour which depends largely on cervical characteristics and in turn can prevent a lot of hazardous complications such as fetal distress, meconium- stained liquor to the fetus and repetitive convulsions as in case of eclampsia, disseminated intravascular coagulation (DIC) to the mother. Bishop Score, the traditional method of predicting successful outcome of induction of labour, is subjective and has little reproducibility. TVS score was found to have sensitivity of 90.8 % and specificity of 79.2 % in predicting successful outcome of induction of labour prediction which was found to be higher than the sensitivity and specificity of Modified Bishop Score i.e. 68.4% and 70.8% respectively, encountered in this study. Thus, superiority of TVS Score over Bishop Score was well established in our study in predicting the response to induction . Therefore, implementation of transvaginal ultrasonography score can enable obstetricians to predict the outcome of labour induction more accurately & can prevent unnecessary cesarean sections which are associated with many hazardous complications.



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