

## Transvaginal Ultrasonographic Cervicometry as a Predictor for Successful Labor Induction

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**Abstract: Background:** Induction of labour refers to the process of initiation of uterine contractions by medical or surgical means before the onset of spontaneous labour. Bishop score, transvaginal ultrasound, and both together have been used for prediction of labour induction. **Objective:** This study was undertaken to assess the value and accuracy of pre-induction transvaginal ultrasonographic cervicometry in the prediction of successful labor induction. **Patients and Methods:** 60 pregnant women admitted to Al Hussein University Hospital with gestational age ranged from 37-42 weeks with a medical indication for labor induction. For cervical measurement, the patients were evaluated by transvaginal ultrasonography and Bishops score. Also, obstetric transabdominal Doppler device was used for assessing fetal heart rate, as well as the amniotic fluid index, and placenta as well as other measurements for the evaluation of fetal vitality. Labor was induced with misoprostol tablets and Oxytocin. **Results:** The TVUS parameters showed no significant difference with the Bishop score. Also, there was no significant correlation between the Bishop Score and TVUS parameters, however there was significantly negative correlation between the cervical length and the Bishop score. The higher cervical diameter and short cervical width were significantly associated with CS delivery. The combination of TVUS parameters and Bishop Score showed the highest sensitivity (83 & 80%) that was superior to cervical width, cervical length and cervical diameter separately. **Conclusion:** Although there are controversial results on the effects of cervical length and Bishop Score on induction to delivery interval and successful induction, transvaginal cervical measurement is a more objective method. Also, the combination of TVUS showed the best significant predictive value for successful induction. [Mohamed M. Elkholy, Mohamed E. Hamour, Mohamed Samir Fouad, Ismail Mohamed Abdelazeem Mera and Abou-Elwafa Zakaia Ibrahim. **Transvaginal Ultrasonographic Cervicometry as a Predictor for Successful Labor Induction.** *Nat Sci* 2017;15(3):60-66]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). <http://www.sciencepub.net/nature>.8. doi:10.7537/marsnsj150317.08.

**Keyword:** TVUS, Bishop Score, Vaginal Delivery, CS, Labour Induction.

### 1. Introduction

About 20% of pregnant women were subjected to labour induction around term not all inductions result in vaginal delivery, and some result in emergency cesarean sections (1).

Bishop Score was frequently established method for evaluation of cervical ripeness and shows a high inter-and intra-observer variability (2, 3). On the other hand, cervical length is a more objective method for assessing cervical status using transvaginal ultrasonographic measurement (4, 5).

The Bishop score is an index known to predict outcome of labor, but it does not provide satisfactory results, due to a low predictive value, especially in predicting cesarean section. Transvaginal ultrasonography is a known objective method for assessing cervical length. It is not too sophisticated a procedure to be done in obstetric units and clinics. Controversial results have been published, and not enough evidence is available to consider it as a strong alternative to the Bishop score (6-8). The aim of this study was to assess the value of pre-induction transvaginal ultrasonographic cervicometry in the prediction of successful labor induction.

### 2. Patients and Methods

After ethical approval from ethical committee of Obstetrics and Gynecology department and written approval from the subjects who were allocated in the study. Sixty (60) pregnant women with gestational age ranged from 37-42 weeks and admitted for induction conducted at Al Hussein University Hospital of delivery were enrolled in this prospective study.

Patients were subjected to clinical, physical and obstetric investigations. Inclusion criteria were a singleton pregnancy, postdate, accurate estimation of gestational age, pregnancy induced hypertension, diabetes mellitus (DM) and intrauterine growth restriction (IUGR). Exclusion criteria were labor pains having already started, uncertain gestational age, placenta previa, major fetal anomaly and other obstetric causes interfering with induction of labor.

Bishop Score was assessed by digital examination. Transvaginal examination of cervical length, width and diameter was by transvaginal sonography (MEDISON SONACE X-4-EXP, with abdominal probe 3.5 MHz and vaginal probe 7.5 MHz frequency).

**Primary outcome:**

- TVUS and Bishop Score for assessment of successful labour induction.

**Secondary outcomes:**

- The need for augmentation of 1st. stage of labor.
- Induction- delivery interval (IDI).
- Mode of delivery whether smooth vaginal delivery or C.S.
- Neonatal outcome including Apgar score of the newborn, fetal weight, admission to neonatal intensive care unit (NICU).

Statistical analysis of data was done by using SPSS version 16. The qualitative data were described as numbers and percentages and were analyzed by using the mean, standard Deviation, linear correlation coefficient, ROC-curve (Receiver Operating Characteristic curve analysis) and chi-square tests by SPSS v.20.P - Value 0.05 was considered significant.

**3. Results.**

Mean age ( $\pm$ SD) of the participants was 26.8 ( $\pm$ 4.8) years, the mean induction duration was 11.8 ( $\pm$ 2.4) and the mean of parity was 2.4 ( $\pm$ 1.1).

The indications for labour induction were DM in (35%), postdate (33.3%), IUGR (21.7%) and PIH (11.7%). The mode of delivery was vaginal in 65% of patients and CS delivery in 35%.

Mean Bishop Score was 3.5 ( $\pm$ 1.3), the mean of dilatation was 2.3 ( $\pm$ 0.6), the mean effacement was 34.5 ( $\pm$ 10.8) and the mean of station was -2 ( $\pm$ 0.6). Mean cervical length was 21.3 ( $\pm$ 3.4) mm, mean inner

diameter was 13.7 ( $\pm$ 6.3) mm and the mean cervical width was 30.2 ( $\pm$ 4.5).

The cervical width, cervical length and inner diameter showed no statistically significant difference regarding to the Bishop score either less than 5 or higher than 5 (Table. 1). Also, there was no significant correlation between the Bishop score and either cervical width or cervical diameter, however there was significantly negative correlation between the cervical length and the Bishop score (P-value <0.01) (Fig. 1).

As for the correlation between Bishop Score, TVS and demographic variables. The Bishop score was inversely correlated with the age with a statistically significant difference ( $p < 0.05$ ) however the parity showed no correlation with Bishop Score. Also, there was no statistically significant correlation between the TVS parameters with either age or parity (Table 2).

The Bishop score showed no significant relation with mode of delivery either VD or CS (Table 3). The cervical width  $\geq 30$  was significantly associated with VD however cervical width less than 30 was significantly associated with CS delivery (P-value = 0.01). The cervical length showed no significant association with mode of delivery. On the other hand, the cervical diameter higher than 20 mm was significantly associated with CS delivery and cervical diameter less than 20 was significantly related with VD (P-value = 0.017) (Table 4).

**Table (1): Comparison between Transvaginal US parameters versus bishop score**

Cervical width (mm)		Bishop score			
		$\geq 5$		$< 5$	
		N	%	N	%
• $\geq 30$		7	46.7	24	53.3
• $< 30$		11	73.3	21	46.7
Chi-square	X <sup>2</sup>	1.073			
	P-value	0.300			
Cervical length (mm)		Bishop score			
		$\geq 5$		$< 5$	
		N	%	N	%
• $\geq 25$		14	27.5	1	11.1
• $< 25$		37	72.5	8	88.9
Chi-square	X <sup>2</sup>	1.089			
	P-value	0.297			
Inner diameter (mm)		Bishop score			
		$\geq 5$		$< 5$	
		N	%	N	%
• $> 20$		22	43.1	3	33.3
• $< 20$		29	56.9	6	66.7
Chi-square	X <sup>2</sup>	0.303			
	P-value	0.582			

**Table (2): Correlations between TVUS parameters, Bishop Score and demographic variables:**

	Age		Parity	
	r	P-value	r	P-value
• Bishop Score	-0.284	<0.05	-0.040	>0.05
• Cervical width (mm)	0.078	>0.05	0.134	>0.05
• Cervical length (mm)	0.143	>0.05	-0.116	>0.05
• Inner diameter (mm)	0.067	>0.05	0.012	>0.05

**Table (3): Difference between the mode of delivery with Bishop Score:**

Bishop score		Mode of delivery			
		VD		CS	
		N	%	N	%
• $\geq 5$	10	22.2	5	33.3	
• $< 5$	35	77.8	10	66.7	
Chi-square	X <sup>2</sup>	0.741			
	P-value	0.389			

**Table (4): Difference between the mode of delivery with TVUS parameters:**

Cervical width (mm)		Mode of delivery			
		VD		CS	
		N	%	N	%
• $\geq 30$	30	78.9	7	31.8	
• $< 30$	16	42.1	15	68.2	
Chi-square	X <sup>2</sup>	6.693			
	P-value	0.010*			
Cervical length (mm)		Mode of delivery			
		VD		CS	
		N	%	N	%
• $\geq 25$	8	20.0	7	35.0	
• $< 25$	32	80.0	13	65.0	
Chi-square	X <sup>2</sup>	1.600			
	P-value	0.206			
Inner diameter (mm)		Mode of delivery			
		VD		CS	
		N	%	N	%
• $> 20$	22	42.3	7	87.5	
• $< 20$	30	57.7	1	12.5	
Chi-square	X <sup>2</sup>	5.670			
	P-value	0.017*			

**Table (5): Correlation between the Bishop Score, TVS with duration of delivery:**

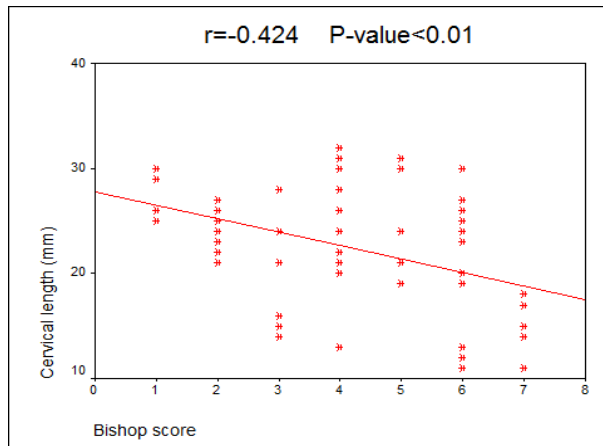
	Duration	
	r	P-value
• Cervical width (mm)	0.137	>0.05
• Cervical length (mm)	0.043	>0.05
• Inner diameter (mm)	0.182	>0.05
• Bishop score	0.253	>0.05

**Table (6): Accuracy of TVS and Bishop score in prediction of labour induction success:**

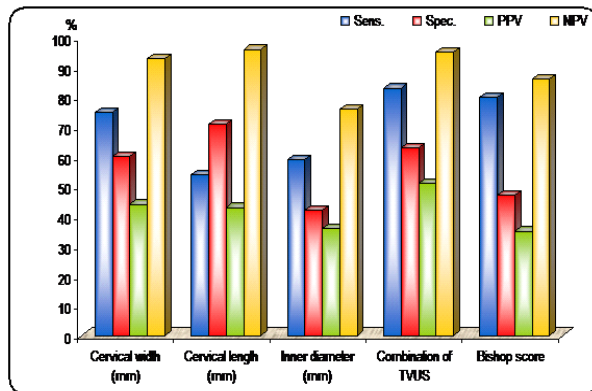
	Sens.	Spec.	PPV	NPV
• Cervical width (mm)	75	60	44	93
• Cervical length (mm)	54	71	43	96
• Inner diameter (mm)	59	42	36	76
• Combination of TVUS	83	63	51	95
Bishop score	80	47	35	86

Neither the TVS parameters nor the bishop score showed significant correlation with the duration of delivery (Table5).

The combination of TVUS parameters and Bishop Score showed the highest sensitivity (83 & 80%) that were superior to cervical width, cervical length and cervical diameter separately. Also, the negative predictive value was the least in case of cervical diameter. The combination of TVUS showed the highest specificity and positive predictive value (Table 6 & Fig. 2).



**Fig. (1): Correlation between Bishop Score and cervical length**



**Fig. (2): Accuracy of TVS and Bishop Score in prediction of labour induction success**

**4. Discussion:**

Using ultrasound in comparison with Bishop Score is a challenge for clinical prediction scores of successful induction (9, 10). In the present study, transvaginal cervical measurement by transvaginal ultrasonography was found to be a better predictor for successful labor than the Bishop score. Also, the combination of both TVUS and Bishop Score showed better results.

The TVS parameters including cervical length, width and diameter showed no significant difference to the Bishop score even higher or lower than 5 regarding to the successful induction. Also, there was no significant correlation between the Bishop score and either cervical width or cervical diameter, however there was significantly negative correlation between the cervical length and the Bishop score ( $P$ -value <0.01).

In consistence, there was a significant correlation between initial Bishop Score and cervical length ( $r = 0.72, P = 0.000000009$ ) (11). Also, the cervical length measured in both the supine and upright positions showed significant negative correlation with the Bishop score (12).

This study showed that the Bishop score was inversely correlated with the age with a statistically significant difference ( $p < 0.05$ ) however the parity showed no correlation with Bishop Score. However, there was no statistically significant correlation between the TVS parameters with either age or parity.

In accordance, the lower Bishop score levels were significantly associated with higher maternal age and thus increasing the risk of failed induction (13). Michelson et al. further maintained that the association between parity, hypertension, diabetes, older maternal age, and Bishop score influence the rate of CS, but not the induction of labor (14), and Osmundson et al. also agreed that labor induction does not result in a higher CS rate. Collectively, the above studies show that parity, cervical status (Bishop scores) and maternal age were significantly correlated (15).

In contrast study, the Bishop score showed a significant relationship to the parity in nulliparous women (1). Another conflicting study by Gonen et al. found a significant correlation between Bishop's scores and parity (16).

The Bishop score showed no significant relation with mode of delivery either VD or CS. The cervical width  $\geq 30$  was significantly associated with VD however cervical width less than 30 was significantly associated with CS delivery ( $P$ -value = 0.01). The cervical length showed no significant association with mode of delivery. On the other hand, the cervical diameter higher than 20 mm was significantly associated with CS delivery and cervical diameter less than 20 was significantly related with VD ( $P$ -value = 0.017).

In agreement, a sonographic cervical length of  $\leq 27$  mm was no longer for mode of delivery (6). However, most of our results were in contrast with the most prevalent literature related to the association between Bishop Score and TVS with the mode of delivery and this difference could be attributed to small population size. In contrast, successful vaginal

delivery within 24 h of induction occurred in 67% of the women and the pre-induction cervical length was significantly associated with the induction-to-delivery interval and the rate of vaginal delivery within 24 h (17). Also, the risk of cesarean section was 0% in women whose cervical length was <19 mm and 21.5% in those having >19 mm (8).

Conflict results showed that cervical length measured by TVS was significantly shorter in the patients delivered vaginally, compared with patients delivered by cesarean section (5).

As for the best predictor for successful induction, the combination of TVUS parameters and Bishop score showed the highest sensitivity (83 & 80%) that were superior to cervical width, cervical length and cervical diameter separately. Also, the negative predictive value was the least in case of cervical diameter. The combination of TVUS showed the highest specificity and positive predictive value.

Consistence study of Tan et al. concluded that TVS was significantly less painful than digital examination and both cervical length & modified Bishop's score were predictors of the success of induction with optimal cut off points of 20 mm for the cervical length and  $\leq 5$  for the modified Bishop's score, also, the cervical length measured by TVS had superior sensitivity (80% versus 64%) than the modified Bishop's score (18). Also, transvaginal ultrasound is thought to be less subjective compared with the Bishop score and the transvaginal ultrasound may be used successfully to make clinical decisions before induction of labor (11).

In addition, it was found that cervical length measurement, Bishop Score and posterior cervical angle have all provided significant independent prediction of cesarean section requirement (19). Both methods of cervical assessment (cervical length measured by TVS, and modified Bishop's score) were significantly associated with successful induction (5).

Furthermore, sonographic cervical length appears to be of better predictive value for failed induction of labor, whereas Bishop score is a better predictor for the outcome of labor induction, so it might be considered as complementary (7). A recent study demonstrates that translabial measurements can be a suitable alternative method to monitor labor progress with an admissible predictive value compared with Bishop Score. It is a non-invasive method which provides valuable objective measurements and can be better accepted by women when considering the painful process which is required in evaluating Bishop Score (20).

An additional study proposed the same idea as in women experiencing labour induction, transvaginal ultrasound score comprising of five different parameters indicated success of induction better than

Bishop Score (21). Other consistent results proposed the superior of TVS parameters (22-26).

In disagree with this study, a Bishop score of  $\geq 4$  and sonographic cervical length of  $\leq 29$  mm were no longer predictive of vaginal delivery as well as successful induction after adjustment (with the significance level set at  $P < 0.05$ ) (6). Also, ultrasonographic measurement of the uterine cervix was not a good predictor of evolution to vaginal delivery among patients with misoprostol-induced labor. Bishop score was a better predictor of vaginal delivery under these circumstances (27).

### Conclusion and Recommendations

The presently conducted prospective study showed that although there are controversial results on the effects of cervical length and Bishop Score on induction to delivery interval and successful induction, transvaginal cervical measurement is a more objective method. Also, the combination of TVUS showed the best significant predictive value for successful induction. Further evaluation of the accuracy and efficiency of TVUS in prediction of successful induction should be studied in large population studies.

### Ethics:

This study was approved from the Ethical Committee of Al Hussein University Hospital, and a written informed consent was obtained from subjects included in the study.

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### Disclosures:

We declare that we have no conflicts of interest.

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