Role of TransvaginalSonography Cervical Length in Prediction of Successful Labor Induction

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Abstract

Background:Induction of labour is a common obstetric practice which refers to the process where the uterine contractions are initiated by medical and surgical means before the onset of spontaneous labour.The aim of this work was to evaluate the role of Preinduction transvaginal ultrasonographic measurement of cervical length as an indicator of a successful induction of labor.Methods:A cross-sectional study was carried out in Zagazig University Maternity Hospital during the period from May 2017 till November 2018. Included 171 pregnant women admitted for induction of labour.40 women delivered by Cesarean section (positive group) and 131 women delivered vaginally (negative group). All patients had vaginal examination for assessing the Bishop score before induction of labourand transvaginal ultrasound for assessment of cervical length.Results:Our study showed that the cervical length was significantly higher (31 ± 5.93 mm versus 22.61 ±3.67, p-value =0.00) and the Bishop Score significantly lower (5.95 ± 1.13 versus 7.87 ± 1, p-value = 0.00, respectively) in patients undergoing cesarean delivery compared with those delivering vaginally.Conclusions:Transvaginal ultrasonography proved to be better in predicting the success of induction of labor by having higher sensitivity, specificity, higher predictive value and better tolerability and less inter and intra observer variation.

Key words:Transvaginal Ultrasound, Cervical Length, Induction of Labor

I. INTRODUCTION

Induction of labour is a common Obstetric practice which refers to the process where the uterine contractions are initiated by medical and surgical means before the onset of spontaneous labour[1].

Induction of labour is indicated in about 20% of term pregnancies and is associated with a caesarean delivery rate of about 20% [2].

Elective induction is not convenient when routine delays at the hospital postpone the starting time of the induction. It is not convenient when an induction does not work and the pregnant woman is sent home to try

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another day. And it certainly is not convenient when induction leads to a cesarean surgery. After a cesarean surgery, a new mother has to recover from major abdominal surgery and is at increased risk for complications such as infection and Post-Partum Hemorrhage[3].

The commonly cited indications for induction of labour are premature rupture of membranes before onset of labour, diseases as diabetes mellitus or hypertension with pregnancy, intrauterine growth restriction or pregnancy passing 41 weeks, which is most common indication[4].

Today, Bishop Score remains the standard method to predict the duration and outcome of induced labor. However, the preinduction 'favorability' of the cervix as assessed by the Bishop score is very subjective and several studies have demonstrated a poor predictive value for the outcome of induction especially in women with a low Bishop score[5].

In women undergoing induction of labor, pre-induction sonographic assessment of cervical length and occipital position is superior to the Bishop score in the prediction of outcome of labor[6].

In women undergoing induction of labor, significant prediction of the likelihood of vaginal delivery within 24 hours and the likelihood of caesarean section are provided by pre-induction cervical length, posterior cervical angle and maternal characteristics. Sonographic parameters were superior to the Bishop score in the prediction of the outcome of induction[7].

Transvaginalultrasonographic imaging measuring the cervical length is a good method for cervical assessment i.e. if the cervical length >30 mm and funneling (wedging) is < 30 percent of total cervical length this indicates an unripe cervix[8].

Transvaginalsonographic measurement of cervical length is a good predictor of successful labor induction at term in nulliparas[9]. Theoretically, Transvaginalsonographic measurements could represent a more accurate assessment of the cervix than digital examination because the supravaginal portion comprises about 50% of cervical length but this is highly variable among individuals. This portion is difficult to assess digitally. In addition, effacement is subjective and can vary considerably among examiners, and is difficult to determine in the closed cervix [10].In contrast transvaginalultrasonographic cervical measurement is quantitative and easily reproducible [11].

Transvaginalsonography for cervical length measurement is better tolerated than digital examination for Bishop Score assessment. Both cervical length and Bishop Score are useful predictors of the need for Cesarean delivery following labor induction. A cervical length >20 mm at labor induction at term is an independent predictor of Cesarean delivery [12].We aimed toevaluate the role of Preinduction transvaginal ultrasonographic measurement of cervical length as an indicator of a successful induction of labor.

II.   METHODS:

After obtaining approval of the ethics committee, a cross-sectional study was carried out in Zagazig University Maternity Hospital during the period from May 2017 till November 2018. Included 171 pregnant women admitted for induction of labour.40 women delivered by Cesarean section (CS) (positive group) and 131 women delivered vaginally (negative group).

Inclusion criteria: Age (18-35) years,Singleton pregnancy,37-42 weeks gestation,Living fetus,Cephalic presentation, Absence of active labor,No contraindication to vaginal delivery,Average amount of clear liquor,No history of uterine scar (myomectomy or previous C.S), Reassuring NST before induction.Written informed consent was obtained from all participants, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University.**Exclusion criteria**: Malpresentation,Major fetal congenital anomalies as hydrocephalous,Patient received any pre induction ripping methods for example: (Acetic Acid-Prostaglandins),Assessment meconium staining to liquor or any evidence of chorioamnionitis,Previous uterine surgery,Multiple gestations,Women with allergy to prostaglandins,Women with vaginal bleeding (antepartum hge)

All patients were subjected to full history taking, general, abdominal and pelvic examinations and investigations (including Complete blood count (CBC), Rh, transvaginal ultrasound and non-stress test). All patients had vaginal examination for assessing the Bishop score before induction of labour and transvaginal ultrasound for assessment of cervical length.

Protocol of transvaginal ultrasound:

Patient was asked to void Urinery bladder (UB).Vaginal probe was inserted using direct visualization with K-Y gel.Identification of bladder, amniotic fluid and fetal presenting part.Identification of abnormal findings as placenta pervia .Identification of midline sagittal plane of the cervix and looking in the proximal one third of the image for the internal os then pulling back the probe until the lightest touch provides good image of the cervical canal and moving the probe slightly to get the best long axis of the cervix then measuring the cervical length by placing the calibers appropriately and recording the distance between internal and external OS.After sonography the Bishop Score was determined by the digital examination by the resident physician responsible for the induction. Physicians were masked to the cervical length measurement.All ultrasound measurements were performed by using MEDISON SONACE X-4-EXP, ultra-sound machine equipped with a 3.5-MHz convex transabdominal probe and 7.5-MHz vaginal probe. Ultrasound examinations were done by a single operator to avoid interobserver variability.Induction of labor was done according to hospital protocol using intravaginal misoprostol (25 microgram) (vagiprost-Produced by Adweya co.) then digital examination was made 6 h after the first intravaginal administration; if necessary, 3 doses were given at 6 hours interval. External Cardiotocography was regularly performed to monitor the condition of the fetus.Continuous Cardiotocography was used when uterine contraction started in all cases. If necessary, amniotomy was performed. Intravenous oxytocin administration was started when there is an arrest of dilatation, starting at 1 mIU/ min and increasing 1 mIU every 30 min as necessary. For analgesia, intramuscular pethidine was offered.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 ≥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 (24 hrs from the last dose)Failed induction is defined as an inability to achieve the active phase of labour corresponding to cervical dilatation of ≥3 cm within 24 hours from the last dose of PG E2**[13].**

Cesarean delivery was done when:

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. Pathological fetal heart rate trace which is according to R-cog.

Statistical Analysis:

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis. According to the type of data qualitative represent as number and percentage , quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance;. difference and association of qualitative variable by Chi square test (X^2) , agreement by Kappa. Differences between quantitative independent groups by t test or Mann Whitney, , correlation by Pearson's correlation or Spearman's . P value was set at <0.05 for significant results &<0.001 for high significant result.

III.   RESULTS:

Table 1: Comparison between success and failure cases

	CS	Success	t	P
Age	28.72±4.29	25.81±4.62	3.536	0.001**
HB	11.37±1.11	11.73±1.04	-1.467	0.112
WBCs	7.25±0.8	6.98±1.49	1.078	0.282
BISHOP_SCORE	5.95±1.13	7.87±1.0	-10.342	0.00**
CERVICAL_LENGTH	31.52±5.93	22.61±3.67	11.457	0.00**
FUNNEL percentage	28.47±6.25	38.03±5.34	-9.503	0.00**

Table 1, showed that Cesarean section (CS)cases sig higher in age and cervical length as they were distributed between failedand success as 28.72±4.29 and 25.81±4.62, 31.52±5.93 and 22.61±3.67 respectively but significantly lower regard Bishop and funnel as they were distributed as 5.95±1.13 and 7.87±1.0, 28.47±6.25 and 38.03±5.34 respectively . Figure (1)

Figure (1): ROC Curve for detection of cervical length cutoff regard failure
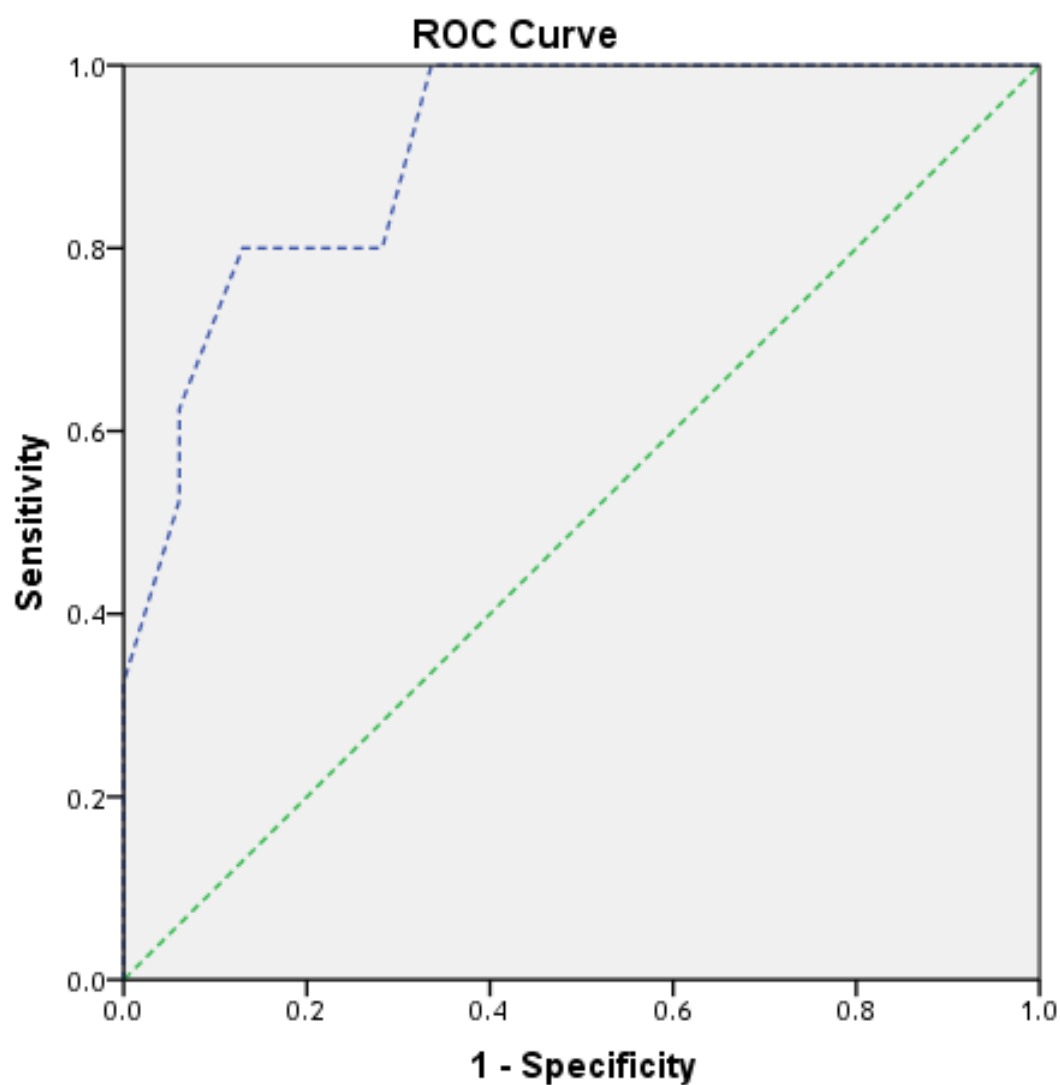
Diagonal segments are produced by ties.

Figure (2), showed that Significant area under curve with cutoff >27.5

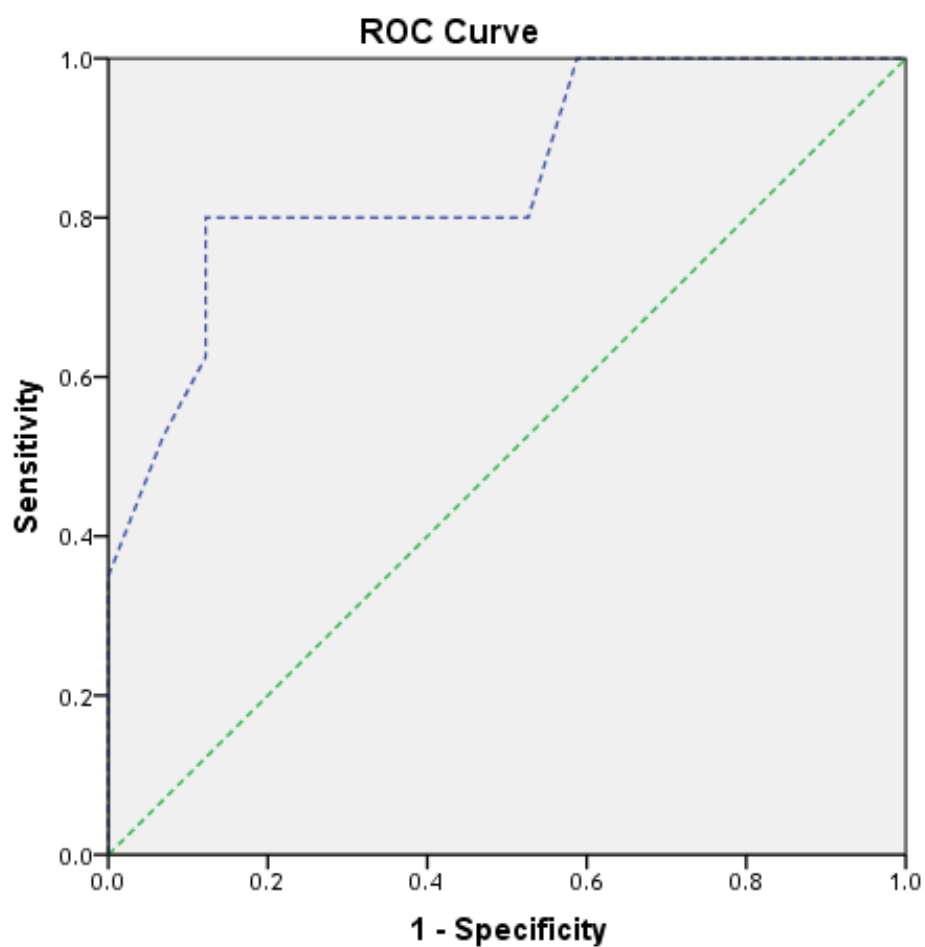**Figure (2): ROC Curve for detection of cervical funnel percentage cutoff regard failure**

Diagonal segments are produced by ties.

Table 2: Area under curve and suggested cutoff regard funnel percentage

Area	Cutoff	P	95% Confidence Interval	
			Lower Bound	Upper Bound
0.852	<30.5	0.00**	0.781	0.923

Table (2), showed that Significant area under curve with cutoff <30.5

Table 3: Association and agreement between success and suggested cutoffs

			OUTCOME		Total	X^2	P	Kappa agreement
			Success	CS				
Bishop	>8	N	93	13	106	19.26	0.00**	0.38
		%	71.0%	32.5%	62.0%			
	<8	N	38	27	65			
		%	29.0%	67.5%	38.0%			
Cervical length	<27.5	N	114	8	122	67.33	0.00**	0.68
		%	87.0%	20.0%	71.3%			
	>27.5	N	17	32	49			
		%	13.0%	80.0%	28.7%			
Funnel	>30.5%	N	115	11	126	57.43	0.00**	0.59
		%	87.8%	27.5%	73.7%			
	<30.5%	N	16	29	45			
		%	12.2%	72.5%	26.3%			
Total		N	131	40	171			
		%	100.0%	100.0%	100.0%			

Table (3), showed thatSignificant association and agreement between parameters of success prediction and success highest was cervical length then Funnel then Bishop

Table 4: Validity of cutoffs

	Sensitivity	Specificity	+VE Predictive	-VE Predictive	Accuracy
Bishop	67.5%	71.0%	41.5%	87.7%	70.1%

Cervical length	80.0%	87.0%	65.3%	93.4%	85.3%
Cervical funnel	72.5%	87.8%	64.4%	91.2%	84.2%

Table (4), showed thatHighest was cervical length then Funnel then Bishop

IV.   DISCUSSION

Present study showed that sonographic assessment of cervical length successfully predicted cervical maturation. Ultrasound has specific advantages over bishop score. It causes less discomfort for the patient. It can assess full cervical length and status of internal os without invading endocervical canal and hence is less invasive, it is more objective, and findings can be documented by taking a picture, also the findings are reproducible other coexisting finding like compound presentation and occult chord presentation if present can be documented which can be easily missed by doing just a digital examination.

In present study, the best cut off points for successful induction were 27.5 mm for the cervical length measured by TVS. In **Gómez et al.**[14] found that the best cut off points for predicting successful induction were 24mm for cervical length measured by TVS and 4 for the modified Bishop score.

Transvaginal ultrasound measurement of cervical length was found to be a superior method of measurement by **Gibreilet al.**[15], which corroborated our study. They had reiterated that cervical length could not be measured accurately by transabdominal ultrasound and transvaginal ultrasound measurement was a superior method.

Although cervical ripeness can be established with the Bishop score, this frequently used method shows a high inter-and intra-observer variability [16]. Alternatively, transvaginalultrasonographic measurement of cervical length may be a more objective method for assessing cervical status [17]**.**

Groeneveld et al. [18] compared the value of transvaginalultrasonographic measurement of the cervical length versus the Bishop score, prior to induction of labour, in predicting the mode of delivery within four days. The study population included 110 at term women of whom 66 were nulliparous and 44 multiparous. Vaginal delivery within 96 h was achieved in 48 (73%) nulliparous and in 40 (91%) multiparous women; i.e. in 80% of the total group. The overall rate of caesarean delivery was 17%. There was a significant difference in age, cervical length, Bishop score and successful induction between nulliparous and multiparous women.

Theoretically the advantage of the Bishop score is that it can evaluate parameters such as consistency or station that may influence the outcome that can hardly be assessed by TVS also the Bishop score does not require any special equipment, however its evaluation remains a matter of controversy depending on the differences in the clinical senses of the examiners. So cervical length by TVS is considered as a complementary tool to Bishop Score to assess the risk of cesarean delivery before induction of labor.

On the other hand, TVS is thought to be less subjective compared with the Bishop score and this study demonstrates that TVS may be used successfully to make clinical decisions before induction of labor however it

may also depend on the availability of ultrasound machine in the emergency delivery room which might be not available in developing countries as Egypt.

V.   CONCLUSIONS

Transvaginal ultrasonography proved to be better in predicting the success of induction of labor by having higher sensitivity, specificity, higher predictive value and better tolerability and less inter and intra observer variation. Bishop score is also good in predicting the success of induction of labour but it is having comparatively less significant relation with vaginal delivery because of many variables and person to person variability in assessment. Cervical length by transvaginal ultrasonography could be used as a better alternative to Bishop Score for predicting successful labour induction in the setting where the appropriate equipment and expertise are available.

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