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ORIGINAL ARTICLE

Transvaginal Ultrasound Cervical Length as an Indicator for Successful Induction of Labor

[(1)] Anwar Ezzat Esmail,[(1)] Mohammed Sabry Mahdy,[(1)] Mohammed El-Hussieny Radwan and [(1)] Ahmed Mohammed Ibrahim El-Sheikh[*]

[(1)] Department of Obstetrics and Gynecology, Faculty of Medicine, Zagazig University, Egypt.

***Corresponding Author:**
Ahmed Mohammed Ibrahim El-Sheikh
E-mail :
Drshe2o87@gmail.com

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ABSTRACT

Background: Labor induction is a traditional obstetric procedure that refers to the process of inducing uterine contractions before the start of spontaneous labour through medical and surgical means. 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 were subjected to full history taking, general, abdominal and pelvic examinations and investigations (including 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.

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

INTRODUCTION

Labor induction is a common obstetric practise which refers to a process in which uterine contractions are triggered by medical and surgical means before spontaneous labour[1]**.** Labor induction is reported in about 20 per cent of term pregnancy and is associated with a caesarean delivery rate of about 20 per cent. [2]**.** Elective induction is not easy when regular hospital delays postpone the start time of the induction. It's not easy if the induction doesn't work and the pregnant woman is sent home to try another day. And it is definitely not easy when induction leads to caesarean surgery. After caesarean surgery, a new mother needs to recover from major abdominal surgery and is at elevated risk for complications such as infection and postpartum haemorrhage [3]**.** Commonly cited signs for labour induction include premature rupture of membranes before the start of work, diseases such as diabetes mellitus or pregnancy hypertension, intrauterine restriction of development, or pregnancy of 41 weeks, which is the most common indication[4] **.** Today, Bishop Score remains the traditional formula for estimating the duration and outcome of induced labour. However, the pre-induction 'favorability' of the cervix as measured by the Bishop score is very subjective and several studies have shown poor predictive value for the induction outcome, particularly in women with a low Bishop score[5]**.** In women undergoing labour induction, the pre-

induction sonographic assessment of cervical length and occipital location is higher than the Bishop's score in predicting labour outcome[6].

In women undergoing labour induction, pre-induction cervical length, posterior cervical angle and maternal characteristics provide important estimates of the probability of vaginal delivery within 24 hours and the probability of caesarean section. Sonographic parameters were higher than the Bishop score when estimating the outcome of the induction[7]. Transvaginal ultrasound imaging measuring the cervical length is a successful tool for cervical assessment, i.e. if the cervical length is > 30 mm and the wedge is < 30 percent of the total cervical length, this suggests the unripe cervix[8].

Transvaginal sonographic assessment of cervical length is a strong indicator of active labour induction in nulliparas over time[9]. Theoretically, transvaginal sonographic measurements could reflect a more reliable cervical assessment than a digital one, since the supravaginal portion is around 50 percent of cervical length, but this is highly variable among individuals. This portion is difficult to test digitally. In addition, the effacement is subjective and can differ considerably between examiners, and it is difficult to evaluate in the closed cervix[10]. In comparison, transvaginal ultrasound cervical measurement is objective and easily reproducible[11]. Transvaginal sonography for cervical length estimation is better tolerated than the optical scan for the Bishop Score assessment. Both cervical length and Bishop Score are useful predictors of the need for Cesarean delivery after labour induction. The cervical length > 20 mm at the term of labour induction is an independent indicator of Cesarean delivery [12]. We aimed to evaluate the role of Preinduction transvaginal ultrasonographic measurement of cervical length as an indicator of a successful induction of labor.

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 foetus, Cephalic appearance, Absence of active labour, No contraindication to vaginal delivery, Average volume of clear liquor, No history of uterine scarring (myomectomy or previous C.S).

Exclusion criteria: Malpresentation, Major foetal congenital abnormalities such as hydrocephalus, Patient got some pre-induction ripping methods such as: (Acetic Acid-Prostaglandins), Liquor staining evaluation of meconium or some signs of chorioamnionitis, Prior uterine operation, Multiple pregnancy, Women with prostaglandin allergy, Women with vaginal bleeding (antepartum hge) Written informed consent was obtained from all participants and the study was accepted by the Research Ethics Committee of the Faculty of Medicine, Zagazig University. Study has been carried out on experiments involving human subjects in compliance with the Code of Ethics of the World Medical Association (Declaration Helsinki).

All patients underwent comprehensive history of general, abdominal and pelvic exams and investigations (including complete blood count (CBC), Rh, transvaginal ultrasound and non-stress tests). Both patients had a vaginal examination to measure the Bishop score before labour induction and a transvaginal ultrasound to determine cervical duration.

Protocol of transvaginal ultrasound: Patients were required to give up the Urinery bladder (UB). Vaginal probe was implanted using K-Y gel guided visualisation. Identification of the portion of the bladder, amniotic fluid and foetal. Identification of irregular results as a pervian placenta. Identification of the midline sagittal plane of the cervix and looking at the proximal one third of the image for the internal os, then pushing the probe back until the lightest contact gives a clear 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 positioning the calibres correctly and recording the distance between the cervix (Figure 1,2).

Following sonography, Bishop Score was determined by a digital test by the resident physician responsible for the induction. Physicians were masked to assess cervical length. Both ultrasound measurements were performed using MEDISON SONACE X-4-EXP, an ultrasound system fitted with a 3.5-MHz transabdominal convex probe and a 7.5-MHz vaginal probe. Ultrasound measurements were conducted by a single operator to prevent inter-observer variability.Induction of labor was done according to hospital protocol using intravaginal misoprostol (25 microgram) (vagiprost-Produced by Adweya co.) After the first intravaginal administration, the digital test was performed 6 h; if necessary, 3 doses were administered at 6 hours interval. External cardiotocography was conducted routinely to track the state of the foetus. Continuous Cardiotocography was used when uterine contraction began in all cases. If required, amniotomy has been performed. Intravenous oxytocin administration began when dilation was

stopped, beginning at 1 mIU/min and-1 mIU every 30 minutes as required. Intramuscular pethidine was given for analgesia.

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 characterised as an inability to achieve an active phase of labour corresponding to cervical dilation of ≥3 cm within 24 hours of the last dose of PG E2**[13] .Cesarean delivery was done when:**

Failure to progress is characterised as no cervical dilation during the active period of labour for the last 2 hours or no descent of the foetus head during the second stage of labour for at least 1 hour despite adequate uterine contractions. Pathological foetal heart rate trace, according to R-cog (Royal College of Obstetricians and Gynecologists) guidelines of labour induction. Scientifc paper no.34 published 2015

STATISTICAL ANALYSIS

Data collected over the course of the history, basic clinical evaluation, laboratory investigations and outcome measures are coded, entered and analysed using Microsoft Excel software. Data was then imported into the Analysis Software Statistical Package for Social Sciences (SPSS version 20.0) (Statistics Package for Social Sciences). Depending on the form of qualitative data represented by number and percentage, the quantitative continuous category represented by mean ± SD; The following measures were used to assess variations of significance; Difference and correlation of the qualitative variable with the Chi square test (X^2) agreement of Kappa. Differences between quantitative independent groups by t or Mann Whitney, Pearson's correlation or Spearman 's correlation. The P value was set at < 0.05 for significant results and < 0.001 for high significant results.

RESULTS

Table 1, showed that Cesarean section (CS) cases sig higher in age and cervical length as they were distributed between failed and 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 (2), showed that Significant area under curve with cutoff >27.5

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

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

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

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 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 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%			

			OUTCOME		Total	X^2	P	Kappa agreement
			Success	CS				
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 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%

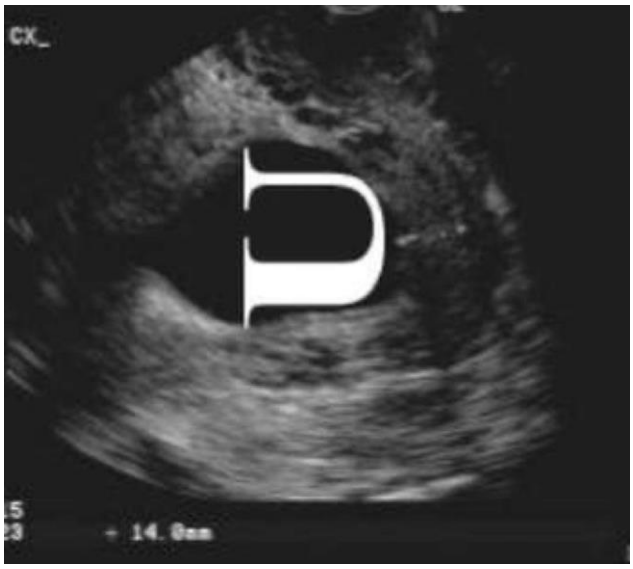

Figure (1): Cervical Funneling

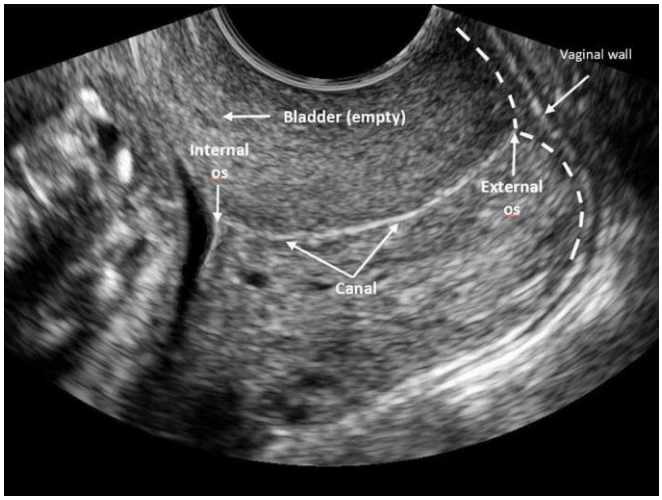

Figure (2): Measurments of cervical length by TVS

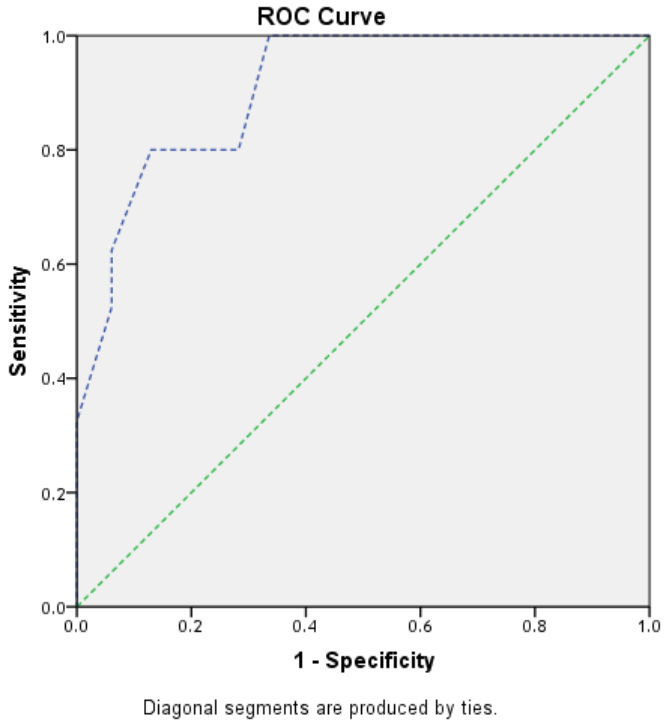

Figure (1): ROC Curve for detection of cervical length cutoff regard failure

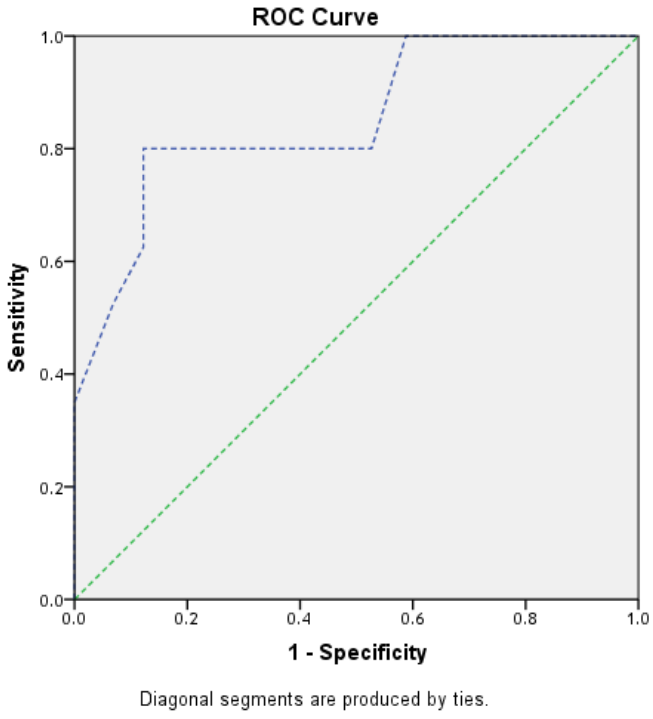

Figure (2): ROC Curve for detection of cervical funnel percentage cutoff regard failure

DISCUSSION

Present research has shown that sonographic measurement of cervical length has successfully predicted cervical maturation. Ultrasound has particular advantages over the Bishop ranking. It causes less pain to the patient. It can measure the full cervical length and status of the internal os without invasive endocervical canal and is thus less invasive, more objective, and can be captured by taking a picture, other coexisting observations, such as compound presentation and occult chord presentation, are also reproducible if they can be recorded which can easily be overlooked by merely conducting a digital review.In the present research , the best cut-off points for successful induction were 27.5 mm for cervical length measured by TVS. In **Gómez et al.[14]** it was found that the best cut-off points for predicting good induction were 24 mm for cervical length measured by TVS and 4 for changed Bishop score. Transvaginal ultrasound

measurement of cervical length was found to be a superior method of measurement by **Gibreil et al.[15],** which confirmed our research. They affirmed that cervical length could not be determined precisely by transabdominal ultrasound, and that transvaginal ultrasound measurement was a superior process.While cervical maturity can be defined with the Bishop score, this frequently used method shows a high inter-and intra-observer variability[16]. Alternatively, transvaginal ultrasound assessment of cervical length may be a more objective approach for determining cervical status[17].

Groeneveld et al. [18] Compared the importance of the transvaginal ultrasonographic measurement of the cervical duration to the Bishop score, prior to labour induction, in predicting the mode of delivery within four days. The study population included 110 women in terms of length, 66 of whom were nulliparous and 44 were multiparous. Vaginal delivery within 96 h was achieved in 48 (73 per cent) nulliparous and 40 (91 per cent) multiparous women, i.e. 80 per cent of the total group. The average rate of caesarean delivery was 17%. There has been a substantial difference in age, cervical length, Bishop score and active induction between nulliparous and multiparous women. Theoretically, the advantage of the Bishop's score is that it can determine criteria such as accuracy or station that can affect the result that can hardly be measured by TVS, and the Bishop's score does not require any special equipment, although its assessment remains a matter of debate depending on the discrepancies in the clinical context of the examiners. Thus, TVS cervical length is considered as an external method for Bishop Score to determine the likelihood of caesarean delivery prior to labour induction. On the other hand, TVS is thought to be less arbitrary than the Bishop score and this study indicates that TVS may be used effectively to make clinical decisions before labour induction, but it can also rely on the availability of an ultrasound machine in an emergency delivery room that may not be available in developing countries such as Egypt.

CONCLUSIONS

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 by having higher sensitivity, specificity, higher predictive value , and less inter and intra observer variation.

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