

Cervical length measurement by transvaginal ultrasonography versus Bishop score to predict successful labour induction in term pregnancies

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Abstract: Background: Induction of labor is indicated when benefits to the mother or the fetus outweigh those of continuing the pregnancy. Induction of labor is performed in about 20% of all pregnancies and successful induction is reported to be related to cervical characteristics, or 'ripeness'. The Bishop score, since its description in 1964, remains the gold standard for assessing favorability for induction of 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. **Objectives:** to assess the effectiveness of transvaginal ultrasound assessment of cervix versus bishop score prior to induction of labor in prediction of successful induction. **Patient Methods:** this prospective observational study was conducted in 120 pregnant women at 37-42 weeks gestational age undergoing induction of labor for various indications. Induction of labor was done using 25µg misoprostol vaginally. The dose was repeated at 6 hours interval for maximum 24 hours. Before labor induction, we performed the cervical evaluation by transvaginal ultrasonography for length and calculated the value for the Bishop score by pelvic examination. **Results:** Successful induction of labor correlated significantly with gestational age ($p = 0.761$), indication of induction (p value: 0.044), the Bishop score ($p < 0.001$) and ultrasonographic cervical length ($p < 0.018$). As for assessment of the cervix by Bishop Score, Bishop Score of value ≤ 5 showed sensitivity for prediction of successful induction of labor of 76.2% and specificity of 58.97%. As for assessment of the cervix by transvaginal ultrasound, the sensitivity for prediction of successful induction of labor was 30.6% at cervical length value >29 mm and specificity up to 96.2%. **Conclusion:** Bishop Score and cervical length were both sensitive and specific but the Bishop score is more sensitive for the prediction of successful labor induction.

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Keywords: Bishop score, cervical length, induction of labor, Induction of labor, transvaginal ultrasound,

1. Introduction

The cervix is integral to conception, the maintenance of pregnancy, and timely delivery of the baby. Throughout gestation the cervix must remain closed despite multiple forces acting upon it (Nott, Bonney et al. 2016).

In general, about 20 percent of pregnant women are requiring induction of labor to terminate pregnancy, Induction of labor usually associated with an increased risk of cesarean delivery, especially when the cervix is not ready for induction. (Nikbakht and Hemadi 2016)

Since 1964, Bishop score has been successfully used as the standard, is the current method to assess cervical ripening for induction of labor. Bishop's score based on dilation, effacement and position of the cervix is graded to predict the success of labor induction. (Nikbakht and Hemadi 2016)

A number of studies have reported that cervical length measured by transvaginal ultrasonography (TVS) compared with Bishop's score is better able to predict pregnancy termination. Some studies also have

claimed that TVS is less painful than digital assessment for Bishop score. However, this finding has not been reported by all investigators. Instance, a recent metaanalysis concluded that TVS has not been observed to be reliable to Bishop's score and calls for further research. (Nikbakht and Hemadi 2016)

Aim of the Work

This study aimed to examine:

The relationship between pre induction *sonographically measured cervical length* and *the bishop score* and to compare the two measurement in prediction of successful vaginal delivery.

2. Patient and Methods

This prospective study will be performed to determine the role of transvaginal ultrasound measurements (cervical length and posterior cervical angle) compared to the Bishop score in assessment of the cervix before induction of labor.

This study will be performed at EL Glala Maternity hospital between January 2017 and February 2017. One hundred and twenty women are

included in this study; their ages ranged from 18 to 32 years and gestational ages ranged from 37-42 weeks. All patients have medical indications for labor induction.

Inclusion criteria:

1. Written consent always preceded inclusion.
2. Every pregnant lady must have an accurate estimation of gestational age.
3. Women with singleton pregnancies, vertex presentation and intact membrane.
4. Indications for labor induction were:
 - a. Pregnancy induced hypertension (PIH).
 - b. Diabetes mellitus (DM).
 - c. Postdate.
 - d. IUGR.
 - e. Other medical conditions (ex: renal disease, Cardiac disease).

Exclusion criteria:

1. When in labor.
2. Patient whose gestational age was uncertain.
3. Presence of obstetric causes interfering with induction of labor as mal-presentation.
4. Placenta previa.
5. Major fetal anomaly as hydrocephalus.
6. Prior classic cesarean delivery or previous major uterine surgery.
7. Cephalo-pelvic disproportion.

Methods:

I- Initial evaluation (Pre-induction):

A) Thorough medical history:

- a. Personal history (name, age, occupation, residence and special habits).
- b. Obstetric history (parity, first day of last menstrual period and history of contraceptive method).
- c. Past history (history of DM, hypertensive disorders, cardiac problems, renal diseases, chest disease, bleeding tendency or blood disorders).
- d. Past history of laparotomies or other operations.
- e. History of the present pregnancy.

B) General examination:

Assessment of vital data (blood pressure, pulse, respiratory rate and temperature).

C) Abdominal examination:

- a. Fundal level - Fundal grip - Umbilical grip.
- b. First pelvic grip.
- c. Fetal heart rate.
- d. Presence of scar of previous operations.

D) Local vaginal examination:

- a. Pelvic capacity.
- b. The presenting part.
- c. Presence of intact or rupture membranes.

E) Bishop score:

Cervical assessment including cervical dilatation (cm), effacement (%), station of presenting part, consistency and position.

Table (1): Bishop Scoring system used for assessment of inducibility (Cunningham et al., 2010 (2)):

Score	Dilatation (cm)	Effacement (%)	Station (-3 to +3)	Cervical consistency	Cervical position
0	Closed	0-30	-3	Firm	Posterior
1	1-2	40-50	-2	Medium	Midposition
2	3-4	60-70	-1	Soft	Anterior
3	≥5	>80	+1,+2	-	-

(F) Ultrasound

1. Transabdominal:

Complete real time trans-abdominal ultrasonographic examination including confirmation of gestational age, fetal number, viability, presentation, estimated fetal weight, position and grade of placenta, amount of liquor.

2. Transvaginal

Transvaginal ultrasonography will be performed for all patients involved in the study (after declaring the purpose of the approach and its advantages to each patient) by using 6-MHZ endovaginal probe.

Technique of transvaginalsonography:

Preparation and precautions:

- The patient had fully voided.
- The patient will be asked to lie in the lithotomy position with flexion of her thighs and knees

to enable free movement of the probe in the horizontal plane.

- The probe tip will be covered with a digit disposable glove in which gel is placed with removal of all air bubbles.
- The probe will also lubricated into gel.

Procedure:

The transvaginal ultrasonography probe will be introduced into the vagina and manipulated in coronal and sagittal planes, anteriorly and posteriorly relative to the structures to be examined.

The standard anatomical landmarks (bladder, fetal presentation, cervical canal, internal and external cervical os, and vagina) should be clearly and firstly determined.

These principal items requiring setting will presented: adjustment of the gain, the image zoom and the focal zone at the cervical canal.

The four criteria defining a high-quality measurement are stated and explained.

(1) A strict sagittal plane of the cervix that makes it possible to image the entire length of the cervical canal.

(2) Cervical canal placed in the middle with the probe placed in the anterior fornix.

(3) Absence of excess pressure on the probe with thickness of the anterior lip of the cervix equivalent to the posterior. Once the cervical canal was identified, the probe was withdrawn slightly.

(4) Cursors placed in precise contact with the closing points of the internal and the external os:

i. The external os will be identified more precisely by following the distal contour of the posterior cervical lip.

ii. The internal os will often be identified by a small triangle-the cursor should be placed at its summit. The head can be gently pushed away by a hand above the pubis to separate-the internal os from the fetal head if necessary.

The posterior cervical angle is the angle between the cervical canal and the posterior uterine wall which was measured using the trace function of the ultrasound machine.

Labor induction:

Induction of labor will be done according to standard guidelines for induction of labor as follows:-

1) Prostaglandin E1 (misoprostol):

- Initial dose 25 microgram vaginal misoprostol tablet (*vagiprost@25 microgram* each tablet, manufactured by ADWIA CO. S.A.E Egypt).

- Full reassessment 6 hours after initial dose unless clinical condition indicates earlier assessment.

- Second dose 25 micrograms in cases with unfavorable cervix.

- Reassessment 6 hours later.

- Failure of cervical ripening: the 3rd dose of misoprostol was given.

If no cervical ripening after 4 doses of misoprostol, the procedure will considered a failure and the patient will be delivered by Caesarean section.

(Hofmeyr et al., 2003).

- If there is cervical ripening we move to the next step.

2) Oxytocin and/or Amniotomy:

- Oxytocin infusion will be started by 5 units in 500 ml of normal saline or "Ringer's solution" following the last dose of misoprostol starting with a rate of 10-15 drops/minute.

- Infusion rate will increase (by doubling drops/minute) at intervals of 30 minutes, until there are 3 good contractions in 10 minutes obtained.

(ACOG, 1999).

During the period of induction, the fetal heart rate will be monitored continuously, by means of electronic fetal heart rate monitoring (Cardiotocography). Also, maternal monitoring will done including:

- Blood pressure measurements every 2 hours and frequent clinical evaluation (according to the condition).

3. Results

Table (2): Mode of delivery distribution of the study group.

Mode of delivery	No.	%
NVD	78	65.00
CS	42	35.00
Total	120	100.00

This table shows that the NVD (65%) and CS (35%) of mode of delivery.

Table (3): Relation between mode of delivery according to CX by TVS and BISHOB score.

	Mode of delivery		t/z#	p-value
	NVD	CS		
Cx by TVS (mm)				
Mean±SD	19.29±6.77	22.62±8.08	5.734	0.018
Range	8-31	8-38		
Cx by Bishop score				
Median (IQR)	6 (4)	3.5 (4.25)	4.595#	<0.001
Range	2-8	0-8		

IQR: Interquartile range

This table shows statistically significant difference between NVD and CS according to TVS and BISHOB score.

Table (4): Relation between mode of delivery according to maternal outcome.

Maternal outcome	Mode of delivery		Chi-square test	
	NVD	CS	x ²	p-value
Cervical tear	9 (11.5%)	0 (0.0%)	20.483	<0.001
Normal	38 (48.7%)	35 (83.3%)		
PPHGE	12 (15.4%)	7 (16.7%)		
Vaginal laceration	8 (10.3%)	0 (0.0%)		
Vaginal tear	11 (14.1%)	0 (0.0%)		
Total	78 (100%)	42 (100%)		

This table shows highly statistically significant difference between NVD and CS according to maternal outcome.

Table (5): Correlation between CX TVS and BISHOB score with Age, GA and no of doses of the study group.

	Cx by TVS (mm)		Cx by Bishop score	
	R	p-value	R	p-value
Age (years)	0.395	<0.001	-0.321	<0.001
G.A (wks)	0.060	0.513	-0.131	0.153
No of Doses	0.033	0.719	-0.120	0.191

Positive correlation and significant between CX by TVS (mm) and age (years), while Age and BISHOB score significant and negative correlation.

Table (6): Diagnostic Performance of Cx by TVS (mm) in Discrimination of CS and NVD.

CX	Cut-off	Sen.	Spe.	PPV	NPV	Accuracy	p-value
BISHOB score	<5	76.2%	58.97%	50%	82.1%	73.1%	<0.001
TVS (mm)	>29	30.6%	96.2%	81.3%	72.1%	63.4%	0.018

Receiver operating characteristics (ROC) curve was used to define the best cut off value of:

- Cx by BISHOB score which was <5, with sensitivity of 76.2% specificity of 58.97% positive predictive value of 50%, negative predictive value of 82.1% with diagnostic accuracy of 73.1%.

- TVS (mm) which was >29, with sensitivity of 30.6% specificity of 96.2% positive predictive value of 81.3%, negative predictive value of 72.1% with diagnostic accuracy of 63.4%.

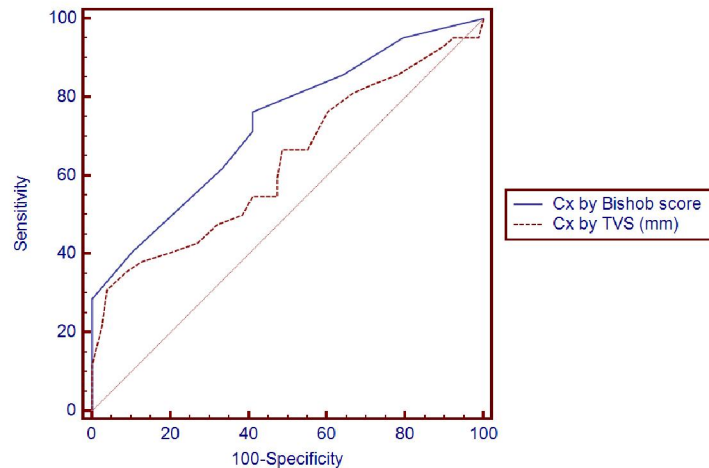


Fig. (3): ROC curve, sensitivity and specificity diagnostic Performance of Cx by TVS (mm) in Discrimination of CS and NVD.

4. Discussion

In this study 120 women was admitted in el glaa teaching hospital for induction of labour 59 (49.17 %) were primi gravid and 61(50.83%) were multipara like (**Garcia - Simon, Oros et al. 2015**) 57 were nullipara and 63 were multi para and (**Meijer-Hoogveen et al. 2009**) were 102 women admitted for labour induction 68 (67 %) were nullipara and 34 (33%) were multipara and against (**Khazardoost, Ghotbizadeh et al. 2016**) 100 nullipara women and (**Gouri, Jyothirmayi et al. 2015**) hundred primi gravid women.

In present study the about 65 %(78) of patient delivered by ceserian section and 35% (42) delivered by normal vaginal delivery the indication for ceserian section were failed induction, fetal distress and cervical dystocia which is with (**Khazardoost, Ghotbizadeh et al. 2016**) about 57 % delivered vaginally and 43 % delivered by ceserian section, (**Bansiwal, Rao et al. 2016**) About 78 % of patient delivered normally and 22% delivered by ceserian section, (**Gouri, Jyothirmayi et al. 2015**) about 67 % (67 women) deliverd vaginally with in 24 hours and 33% deliverd by ceserian section, (**Garcia - Simon, Oros et al. 2015**) about 82 patient deliverd vaginally (67 of them deliverd spontaneous vaginal delivery and 15 by instrumental delivery) and 38 delivered by ceserian section and (**Meijer-Hoogveen et al. 2009**) 85 % of patient (87 women) deliverd by normal vaginal delivery and 15 % (15 women) delivered by cesrian section either due to failure of progress or fetal distress.

In this study about (85 %) of babies are delivered with no complication with APGAR score ranged from 7 to 10, (6.67 %) of them were admitted in incubator due to prematurity and severe respiratory distress upto grade III, (5.83 %) of them were complaining of respiratory distressand (2.5 %) were thick meconuim aspirationas which is with (**Bansiwal, Rao et al. 2016**) Admissions to NICU were also comparable in both the groups but the number was more as we keep more babies for observations if initial Apgar score <6 and baby weight >3 kg.

In present study cervix was considered unribbed when bishob score <5 and cervical length <29 mm which agree with (**Khazardoost, Ghotbizadeh et al. 2016**) The cut-off points of cervical length measured by transvaginal ultrasound and Bishop score were 16 and 5, respectively, (**Bansiwal, Rao et al. 2016**) the cervix was considered unripe when bishob score < 6 and transvaginal ultrasound measurement of cervical wedging was < 30% and (**Gouri, Jyothirmayi et al. 2015**) bishob score < 5 was taken as unfavourable score and cervical length by transvaginal ultrasound of < 2.8 centimeters was taken as unfavourable cervix.

This study shows statistically significant difference between NVD and CS according to

indication of induction as patient with PIH 18 (42.9 %), PAST DATE 15 (35.7 %) and GDM 9 (21.4 %) of them delivered by cesrian section in comparison with 31(39.7 %), 21(26.9%) and 13 (16.7 %) patient delivered normally only patient with IUGR babies 13 (16.7%) all of them delivered normally on the other hand (**Bansiwal, Rao et al. 2016**) showed that there no statistically significant difference between mode of delivery and indication of induction.

This study shows statistically significant difference between NVD and CS according to TVS and BISHOB score as there is a higher rate of ceserian section delivery in assessing cervix by transvaginal ultrasound in comparison with BISHOB score assessment which agree with (**Khazardoost, Ghotbizadeh et al. 2016**) as ceserian section rate was higher with transvaginal ultrasound measurement of cervical length than bishob score, with a bishob score p value (.030) in comparison to transvaginal ultrasound measurement of cervical length (0.041) and against (**Bansiwal, Rao et al. 2016**) which show no significant difference between cervical length measured by transvaginal ultrasound and bishob score according to mode of delivery and (**Meijer-Hoogveen et al. 2009**) cervical length measured in the upright position was a significant predictor of the need for a Cesarean section. An increase of 1 mm in cervical length was associated with a 14% increase in the odds of a Cesarean section for failure to progress.

In present study Receiver operating characteristics (ROC) curve was used to define the best cut off value of:

- Cx by BISHOB score which was <5, with sensitivity of 76.2% specificity of 58.97% positive predictive value of 50%, negative predictive value of 82.1% with diagnostic accuracy of 73.1%.
- TVS (mm) which was >29, with sensitivity of 30.6% specificity of 96.2% positive predictive value of 81.3%, negative predictive value of 72.1% with diagnostic accuracy of 63.4%. which agree with (**Khazardoost, Ghotbizadeh et al. 2016**) Cx by BISHOB score which was 5.5, with sensitivity of 84 % specificity of 70 %.
- TVS (mm) which was 16, with sensitivity of 85 % specificity of 67 %.

Our study suggested that Bishop score and cervical length were both sensitive and specific but the Bishop score is more sensitive for the prediction of successful labor induction which agree with (**Gouri, Jyothirmayi et al. 2015**) Bishop score when complimented with cervical length by transvaginal ultrasound could predict the success of induction of labour better compared with assessment by Bishop score alone and disagree with (**Khazardoost, Ghotbizadeh et al. 2016**) Cervical length is a good predictor of successful IOL. Considering the painful

process of digital exam, implementing trans-vaginal ultrasound is preferred, **(Bansiwali, Rao et al. 2016)** With the suggested cut-off values of a Bishop score <6 and wedging <30%, the use of transvaginal ultrasound instead of Bishop score for preinduction cervical assessment to choose induction agent significantly reduces the need for intracervical prostaglandin treatment without adversely affecting the success of induction. **(Garcia - Simon, Oros et al. 2015)** Bishop score and ultrasound cervical length examination for the management of labor induction are accurate and easy to learn by inexperienced first-year residents. However, cervical length showed higher reliability than the Bishop score and **(Meijer-Hoogeveen et al. 2009)** Cervical length measured using TVS in both the supine and upright positions was a better predictor of a failed induction than was the Bishop score.

Conclusion and recommendation

Our results suggested that bishob score and cervical length were both sensitive and specific but the bishob score is more sensitive for prediction of succful labour induction. because of the relatively small sample size in this study the results need gto be confirmed in al larger and more homogenous population.

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