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Sonographic assessment of the cervical length before induction of labor

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ABSTRACT

Objective: To compare the cervical length measured by TVS with modified Bishop′s score for cervical assessment before induction of labor. **Methods:** One hundred and twenty women in their first pregnancy were admitted for induction of labor. Digital vaginal examination was done to record the modified Bishop′s score, followed by TVS to detect the cervical length. The method of induction of labor was decided after the initial vaginal examination, when the modified Bishop′s score was evaluated. Dinoprostone pessary was used for labor induction if the Bishop score was < 5 (unfavourable cervix), and amniotomy was usually performed when the cervix was 3 cm dilated, and the presenting part was low (0 station). **Results:** The cervical length measured by TVS was significantly shorter in the patients delivered vaginally, compared with the patients delivered by cesarean section (24.7±6.9) versus (26.5±8.2) mm; respectively. A total of 72 (78.3%) of the patients delivered vaginally, and 10 (35.7%) of the patients delivered by cesarean section had cervical length < 25 mm. The modified Bishop′s score was significantly high in the patients delivered vaginally, compared with the patients delivered by cesarean section (6.0±2.7) versus (5.9±8.7) respectively. Moreover, 77 (83.7%) of the patients delivered vaginally, and 11 (39.3%) of the patients delivered by cesarean section had modified Bishop′s score > 5. **Conclusions:** Both methods of cervical assessment (cervical length measured by TVS, and modified Bishop′s score) were significantly associated with successful induction.

1. Introduction

Induction of labor is a process where the uterine contractions are initiated by medical or surgical means before the spontaneous onset of labor, and the most common indications for induction of labor are prolonged pregnancy or PROM or medical disorders with pregnancy[1,2].

Considering that 18% of the patients having induction of labor need a cesarean section for delivery, the need for more objective criteria for the prediction of successful induction of labor can be better understood[3,4]. One of the most common labor ward problems is the difference of digital assessment of the cervix between members of the medical team. The mean reason behind this conflict is the subjective nature of digital examination of the cervix, especially the assessment of the cervical length[5].

The main purpose of cervical evaluation before induction of labor is the choice of induction agent, which may influence the duration of labor and the outcome[6]. Various scoring systems for cervical assessment have been introduced, in 1964; Bishop developed a standardized cervical scoring system called the Bishop′s score[7]. The Bishop′s score has a poor predictive value for the outcome of induction of labor due to the controversy in the assessment of the cervical condition by different examiners[8,9].

Transvaginal ultrasound allows visualization of the cervix beyond a closed external os and measures the cervical length accurately, without much inter−observers′ variation, especially in cases of non−palpable cervix on digital examination[5,10,11]. It may accurately reflect the cervical anatomy and it is considered a well tolerated examination than painful pelvic examination[12,13]. Gomez *et al.*

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concluded that the cervical length measured by TVS was a better predictor of successful induction than the modified Bishop's score[14]. So, this study was designed to compare the cervical length measured by TVS with modified Bishop's score for cervical assessment before induction of labor.

2. Patients and methods

2.1. Patients

This comparative study was done in Ahmadi Hospital, Kuwait over two year from February 2010 till February 2012. One hundred and twenty (120) women in their first pregnancy were admitted to the hospital for induction of labor after informed consent and approval of the study protocol by institute ethical committee. Women with non vertex presentation or multiple pregnancies or previous cesarean delivery or oversized baby or abnormal bony pelvis or any contraindication to vaginal delivery were excluded from this study. After careful history and general examination, digital vaginal examination was done to evaluate the cervix and to record the modified Bishop's score, followed by TVS to record the cervical length in mm for each patient.

2.2. Procedure of TVS

The vaginal probe was inserted under direct visualization, after evacuation of the bladder. Identification of the bladder, amniotic fluid, presenting part or any abnormalities was done. The midline sagittal plane of the cervix was localized, and then the probe was pulled back until the lightest touch provided a good image of the cervical canal with fixation of the internal os in the proximal one third of the image. The probe was then moved slightly to get the best longitudinal axis of the cervix.

When the following criteria were fulfilled, measurement of the cervical length was accurate[15]. (i) Sagittal plane of the cervix that allows imaging the entire length of the cervical canal. (ii) Placement of the cervical plane in the middle with screen as horizontal as possible. (iii) Absence of excess pressure on the probe cursors, which was placed in precise contact with the closing points of the internal and external os.

All TVS examinations were done by an experienced sonographer, who was blinded to the patient's clinical data, using Philips HD9 with 2D convex probe 4–9 MHz (Philips international; Amsterdam; Netherlands); the standard anatomical landmark during the examination was the presenting fetal part, the urinary bladder, internal, external os and the cervical canal. Cervical length was considered the hyperechoic line extending from the internal os to external os, after pulling back the probe until the lightest touch provided a good image of the cervical canal. The internal os was identified as a dimple or a small triangle

against the hypoechoic background of the amniotic fluid. Cervical length was measured 3 times and the mean cervical length was recorded[16].

2.3. Methods of induction of labor

The method of induction of labor was decided after the initial vaginal examination, when the modified Bishop's score was evaluated. There was universal electronic fetal monitoring for women undergoing labor induction. Induction of labor was by Dinoprostone (3 mg) pessary placed in the posterior fornix or amniotomy. Dinoprostone pessary was used for labor induction if the modified Bishop's score was < 5 (unfavourable cervix), and amniotomy was usually performed when the cervix was ≥ 3 cm dilated, and the presenting part was low (≥ 0 station). Following Dinoprostone pessary insertion, further assessment was made after 6 h and depending on the cervical dilatation, and presence of contractions, a further Dinoprostone pessary might be inserted or amniotomy performed. A maximum of two doses of Dinoprostone per day was allowed. The women were then assessed routinely again after another 6 h and, if the cervix remained unfavourable, those with non−urgent indications were usually rested overnight, and the process repeated the following morning. Following amniotomy for labor induction, oxytocin was usually given within 2 h if contractions were inadequate. Once in established labor, vaginal assessment was usually done every 4 h initially unless otherwise indicated[17,18].

After delivery, the recorded data were reviewed and analyzed to compare the cervical length measured by TVS with modified Bishop's score for cervical assessment before induction of labor.

2.4. Sample size justification

Using data of previous studies[18,19] setting the type−1 error (α) at 0.05, the power (1−β) at 0.8, the number of patients needed to produce a statistically acceptable figure was 120 patients.

2.5. Statistical analysis

Data were collected, and statistically analyzed using Statistical Package for Social Sciences (SPSS) version [15]. Numerical variables were presented as mean and standard deviation (±SD), while categorical variables were presented as number of cases and percentage. *Chi* square test (χ^2) was used for comparison between the groups. A difference with *P* value <0.05 was considered statistically significant otherwise it was insignificant.

3. Results

One hundred and twenty (120) women in their first

pregnancy were admitted to the hospital for induction of labor. Digital vaginal examination was done to evaluate the cervix, and to record the modified Bishop's score (Table 1), followed by TVS to record the cervical length.

After delivery, the recorded data were reviewed, and statistically analyzed. The indications of labor induction were; post–term (40 patients), PROM (27 patients), diabetes with pregnancy (24 patients), hypertension with pregnancy (17 patients), and small for gestational age (12 patients), (Table 2). The overall cesarean section rate was 23.3% (28/120), 8 (28.6%) emergency cesarean delivery due to fetal distress, and 20 (71.4%) cesarean section due to failure to progress. The patients delivered vaginally, and patients delivered by cesarean section were matched with no significant difference regarding; the maternal age (30.5±4.5) versus (33.8±9.4) years; respectively), and gestational age (37.2±6.3) versus (39.1±3.1) weeks; respectively), also,

the two studied groups were matched with no significant difference regarding the indications of labor induction, (Table 2).

The cervical length measured by TVS was significantly shorter in the patients delivered vaginally, compared with patients delivered by cesarean section (24.7±6.9) versus (26.5±8.2) mm, respectively; $P<0.05$). 72 (78.3%) of the patients delivered vaginally, and 10 (35.7%) of the patients delivered by cesarean section had cervical length < 25 mm. The cervical length < 25 mm was significantly related to successful induction, and large number of vaginal deliveries ($P<0.05$) (Table 3).

The modified Bishop's score was significantly high in the patients delivered vaginally, compared with patients delivered by cesarean section (6.0±2.7) versus (5.9±8.7), respectively; $P<0.05$. A total of 77 (83.7%) of the patients delivered vaginally, and 11 (39.3%) of the patients delivered

Table 1
Modified Bishop's score.

Variables	Score			
	0	1	2	3
Position	Posterior	Mid	Anterior	––
Consistency	Firm	Medium	Soft	––
Effacement (%)	0%–30% effaced	40%–50% effaced	60%–70% effaced	>80% effaced
Dilatation (cm)	Closed	1–2	3–4	>5
Station	−3	−2	−1	+1, +2

Table 2
The maternal age, gestational age, and the indications of labor induction in the studied populations.

Variables	Total number of the studied populations=120		Test used (χ^2) (P value) Significance
	Vaginal delivery (n=92)	Cesarean delivery (n=28)	
Maternal age (years) (Mean±SD)	30.5± .5	33.8±9.4	6.2 (NS)
Gestational age (weeks) (Mean±SD)	37.2±6.3	39.1±3.1	5.8 (NS)
Indications of labor induction [n (%)]			
Post–term	32 (34.7%)	8 (28.6%)	0.66 (NS)
PROM	20 (21.7%)	7 (25.0%)	0.77 (NS)
Diabetes with pregnancy	18 (19.5%)	6 (21.4%)	0.86 (NS)
Hypertension with pregnancy	12 (13.0%)	5 (17.9%)	0.59 (NS)
SGA	10 (1.1%)	2 (7.1%)	0.59 (NS)

NS = Non significant; PROM = Premature rupture of membranes; SGA = Small for gestational age; χ^2= *Chi* square test.

Table 3
The cervical length, Bishop's score, patients with cervical length < 25 mm, and Bishop's score > 5, and methods of labor induction in the studied population.

Variables	Total number of the studied populations=120		Test used (χ^2) (P value) Significance
	Vaginal delivery (n=92)	Cesarean delivery (n=28)	
Cervical length (mm) (Mean±SD)	24.7 ± 6.9	26.5 ± 8.2	<0.05 (0.000 2)[*]
Patients with cervical length < 25 mm [n (%)]	72 (78.3%)	10 (35.7%)	<0.05 (0.046)[*]
Bishop's score (Mean±SD)	6.0 ± 2.7	5.9 ± 8.7	<0.05 (0.047)[*]
Patients with Bishop's score > 5 [n (%)]	77 (83.7%)	11 (39.3%)	<0.05 (0.047)[*]
Methods of labor induction			
Dinoprostone [n (%)]	36 (39.1%)	22 (78.6%)	<0.05 (0.042)[*]
Amniotomy [n (%)]	56 (60.9%)	6 (21.4%)	<0.05 (0.025)[*]

[*] = significant; χ^2 = *Chi* square test.

by cesarean section had modified Bishop's score > 5. The Bishop's score > 5 was significantly related to successful induction, and large number of vaginal deliveries (*P*<0.05) (Table 3).

The use of Dinoprostone as inducing agent was significantly less in the patients delivered vaginally compared with patients delivered by cesarean section (39.1% versus 78.6%, respectively; *P*<0.05) (Table 3), also, the use of Dinoprostone as inducing agent was decreased when the cervical length measured by TVS was < 25 mm, and the modified Bishop's score > 5.

4. Discussion

The usefulness of transvaginal ultrasound in the prediction of successful induction of labor had been evaluated by many authors and all concluded that; it remains unknown whether it is clinically useful, or it could replace the modified Bishop's score. So, this study was designed to compare the cervical length measured by TVS with modified Bishop's score for cervical assessment before induction of labor.

In this study, the patients delivered vaginally, and patients delivered by cesarean section were matched with no significant difference regarding; the maternal age, gestational age, and indications of labor induction.

The results of this study were similar to a great extent to the result obtained by Bartha *et al.*, regarding, the indications of induction, and character of the patients (except the parity, all patients included in this study were primigravidas)[6].

Bartha & colleagues found that the percentage of women allocated to the unripe group and given prostaglandins for induction of labor was significantly decreased using the ultrasound thresholds than the standard criteria of a modified Bishop's score, 6 but, in this study, the use of Dinoprostone as inducing agent was decreased when the cervical length measured by TVS was < 25 mm, and the modified Bishop's was >5.

The modified Bishop's score can evaluate the parameters that cannot be evaluated by TVS such as consistency or station, its evaluation remains a matter of controversy depending on the differences in the clinical senses of the examiners, but, the sonographic assessment of the cervix is less subjective and can be used to take successful decision before induction of labor[5,11].

In this study, both methods of cervical assessment (cervical length and modified Bishop's score) were significantly related to successful induction, but, EIghorori & colleagues, concluded that the TVS cervical length assessment is better than Bishop's score in predicting the induction delivery interval and the success of induction of labour[19].

In this study, the cervical length measured by TVS was significantly shorter in the patients delivered vaginally, compared with patients delivered by cesarean section (24.7±6.9) versus (26.5±8.2) mm; respectively. A total

of 72 (78.3%) of the patients delivered vaginally, and 10 (35.7%) of the patients delivered by cesarean section had cervical length < 25 mm. The cervical length < 25 mm was significantly related to successful induction, and large number of vaginal delivery.

Also, in this study, the modified Bishop's score was significantly high in the patients delivered vaginally, compared with patients delivered by cesarean section (6.0±2.7) versus (5.9±8.7); respectively. A total of 77 (83.7%) of the patients delivered vaginally, and 11 (39.3%) of the patients delivered by cesarean section had modified Bishop's score > 5. The modified Bishop's score > 5 was significantly related to successful induction, and large number of vaginal deliveries.

Gonen *et al.* concluded that the TVS evaluation of the cervix before induction did not improve the prediction of cervical inducibility obtained by modified Bishop's score and both methods of assessment for the cervix were significantly associated with successful induction especially, when the modified Bishop's score < 5, and the cervical length 27 mm by TVS[20].

Pandis *et al.* concluded that the best cut off point for the prediction of successful induction was 28 mm for cervical length, and 3 for the modified Bishop's score, also, they stated that, the cervical length appears to be a better predictor of successful indication with 87% sensitivity & 71% specificity, and Daskalakis *et al.* concluded that the modified Bishop's score was not predictive for the mode of delivery and patients with a cervical length 27 mm were more likely to deliver vaginally, also, Boozarjomebri *et al.* found that the presence of cervical funneling was significantly associated with shorter latent phase and shorter induction delivery interval[3,16,21].

In this study, the best cut−off points for successful induction were 25 mm for the cervical length measured by TVS, and 5 for the modified Bishop's score, when the cervical length was < 25 mm, and the modified Bishop's score was > 5, the possibility of vaginal deliveries was increased.

Gomez *et al.* found that the only component of the Bishop's score that was predictive of the probability of vaginal delivery was the station & the best cut off points for predicting successful induction were 24 mm for cervical length measured by TVS and 4 for the modified Bishop's score[14].

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 ≤ 5 for the modified Bishop's score, also, they concluded that cervical length measured by TVS had superior sensitivity (80% versus 64%) than the modified Bishop's score[22].

Yang *et al.* found that the cervical length of 3 cm or less had 75% sensitivity and 83% specificity, also, they found

that there was a significant relationship between successful labor induction & cervical length, but not the modified Bishop's score[23].

Conclusions: Both methods of cervical assessment (cervical length measured by TVS, and modified Bishop's score) were significantly associated with successful induction, also, the use of Dinoprostone as inducing agent was significantly decreased, when the modified Bishop's score was > 5 and the cervical length was < 25 mm.

Conflict of interest statement

No actual or potential conflict of interest in relation to this article exists.

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