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Objective Transvaginal Cervical Length Versus Subjective Bishop's Score in Predicting Success and Response of Labour Induction

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Abstract: Background: *Bishops score is the widely accepted subjective scoring system of cervix prior to labour induction to predict its success. On the other hand, preinduction transvaginal ultrasound measurement of cervical length is being evaluated for its use in the prediction of successful induction of labour.*
Aim: *The aim of the study is to compare modified Bishop's score and transvaginal ultrasound cervical length for prediction of success of induction of labour.*
Methods*: This is a prospective comparative study of modified Bishop's score and transvaginal cervical length in 130 pregnant women who underwent induction of labour in Department of Obstetrics & Gynaecology, Gandhi medical college and hospital, Secunderabad, Telangana State,from 1st November 2016 to 30th September 2018.*
Results*: Out of 130 women, 80 (61.5%) women delivered vaginally and 50 (38.5%) women undergone emergency caesarean section. Bishops score > 6 and cervical length ≤ 2.6 cms were taken as cut off points. Bishops score >6 has specificity of 92%, sensitivity of 43% and transvaginal cervical length ≤ 2.6cm has specificity of 82% and sensitivity of 30% indicating transvaginal cervical length is also reliable, objective indicator of success of induction of labour. Mean cervical length in less than 12 hours induction – delivery interval is 30.27±1.29 (mean ±SD) mm and in more than 24 hours group is 34.26±1.78 (mean ± SD) mm. It shows that cervical length and induction delivery interval are directly proportional.*
Conclusion:- *Bishop's score is better predictor of success of induction of labour compare to transvaginal cervical length in our study. However transvaginal cervical length is an independent parameter which predicts the likelihood of vaginal deliveries within 24 hours.*
Keywords: *Induction of labour, Bishops score, Transvaginal cervical length*

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I. Introduction

Induction of labour is the artificial initiation of uterine contractions prior to their spontaneous onset leading to progressive dilatation and effacement of the cervix and delivery of the baby, after 28 weeks of gestation[1].The aim of induction of labour is to achieve vaginal delivery with a healthy mother and baby. Induction is indicated when the benefits to either mother or the foetus outweigh those of continuing the pregnancy. Indications include prolonged pregnancy, rupture of membranes without labour, hypertensive disorders of pregnancy, gestational diabetes, non reassuring foetal status, oligohydramnios, etc.

Induction of labour is a common and essential element of contemporary obstetric practice with an incidence of approximately 20% of pregnancies. Rate of induction of labour increased from 9.5% in 1991 to 20.6% in 2003 in UK[2]. It had more than doubled in United States from 9.5% in 1991 to 22.5% in 2006[3], whereas in Australia it was 26.1% in 2003[4]. According to WHO, the recommended rate of labour induction is 10%. The success of induction is significantly influenced by status of cervix at the time of induction. The state of cervix [which includes form, consistency, position and dilatation] appears to exert the most significant influence on induced labour outcome and considered to be the most important factor while selecting an induction method. Cervical ripening and myometrial excitement, which finally culminate in labour. Estrogen, progesterone, oxytocin, prostaglandins, relaxin, second messengers, corticosteroids, calcium and sympathetic amines[5,6] are all thought to play a role in labour in humans.

E.H. Bishop in 1964 devised a useful practical scoring system to assess the state of the cervix prior to the induction of labour[7]. Bishop[8] reported on 1000 cases of elective induction of labour performed at single hospital. The Bishop's score[9], since its introduction in 1964 remains the gold standard for assessing favourability for induction of labour. But it has its own fallacies like being subjective, painful and has inter and intra observer variability.So it is not reproducible.

Calder[10] modification of Bishop's score:

CERVICAL FEATURE	PELVIC SCORE			
	0	1	2	3
Dilatation of cervix	<1 cm	1-2 cm	2-4 cm	>4 cm
Length of cervix	4 cm	2-4 cm	1-2 cm	<1 cm
Station of presenting part	- 3 cms	-2 cms	-1/0 cm	+1/+2 cm
Consistency of cervix	Firm	Average	Soft	-
Position of cervix	Posterior	Mid/ anterior	-	-

Test score 0-5 is unfavourable, 6-12 is favourable.

Measurement of cervical length by TVS for prediction of success of induction of labour is being used widely now. It is less painful, more reproducible and avoids inter observer variations. Supravaginal portion of cervix comprises about half the length of cervix which is difficult to assess digitally and this is highly variable among subjects. The present study was done to find out pre induction cervical length by transvaginal sonography, determine Bishop's score and to compare the obstetric outcome with these two variables.

II. Material And Methods

This prospective study was done at Gandhi Medical College and Hospital from November 2016 to September 2018 for a period of about 2 years in 130 pregnant women, who were admitted for induction of labour in the Department of Obstetrics & Gynaecology.

Inclusion criteria included Singleton pregnancies of 37 weeks gestation and above undergoing induction of labour with live foetus with cephalic presentation.

Pregnant women with previous caesarean scar/uterine scar and women in spontaneous labour were excluded from the study.

All women have given their written informed consent and the study has been approved by the ethical committee of Gandhi Medical College and Hospital.

Methodology:

After confirming the indication for induction, transvaginal ultrasound was done by same obstetrician in all women. With the empty bladder in supine position, transvaginal probe of 8 MHz was inserted into the vagina. After insertion vaginal probe is withdrawn slightly, so that no pressure is applied on cervix. A clear view of cervix in sagittal plane was obtained. Mean Cervical length was noted.

Before induction of labour, attending resident was blindfolded to ultrasound results and cervical assessment was determined by Modified Bishop's Score.

Women with Bishop's Score ≤ 6 received PG E_2 gel 0.5mg intracervically which was repeated after 6 hours up to a maximum of 3 doses. Both intravaginal as well as intracervical PGE_2 have been shown to be more successful in achieving vaginal delivery within 24 hours when compared to oxytocin, alone or in combination with amniotomy[11].

Patients with Bishop's Score > 6 were induced with oxytocin 1 – 2 milli units/min(physiological doses[12,13]) increased every 30 minutes until 3 – 4 good uterine contractions in 10mins were established. Maximum permissible dose is 32 milli units/min.

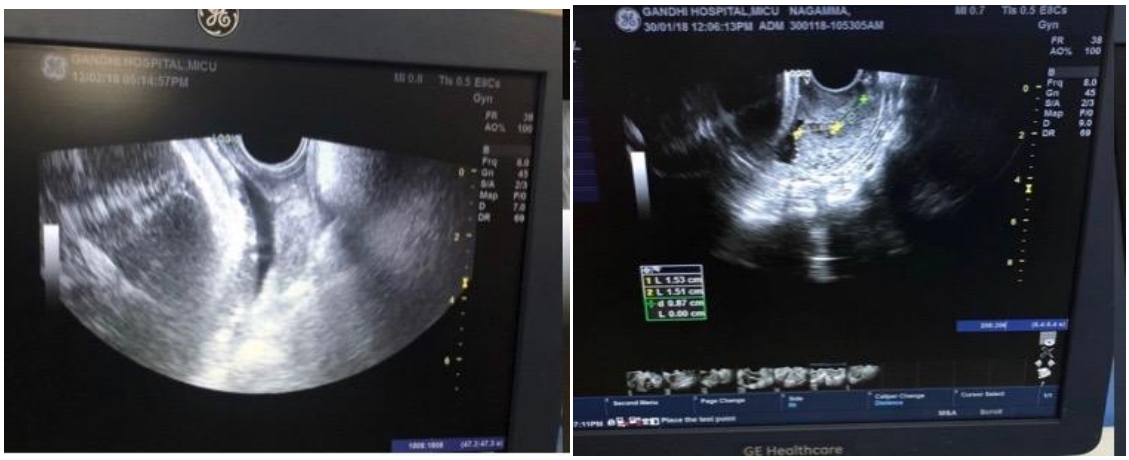
Labour was monitored using WHO modified partogram.

Time of induction, doses of PG E_2 and Oxytocin required for induction, time at which woman entered active labour, mode of delivery, induction delivery interval were noted. Birth weight of the baby, neonatal and postnatal complications were also recorded.

Vaginal delivery was considered as successful induction of labour.

Induction- delivery interval is defined as period from the first administration of PGE_2 gel or oxytocin to delivery.

Failed induction is defined as an inability to achieve the active phase of labour corresponding to $\geq$ 4cms of cervical dilatation within 12 hours of initiating oxytocin or 24 hours of insertion of 1st dose of PGE_2 gel.



Trans vaginal sonographic pictures showing cervical length

III. Results

In our present study Mean (± SD) age of patients was 23.54 ± 3.59 years with a range of 18 – 36 years.

TABLE – 1 – DEMOGRAPHIC CHARACTERISTICS

Demographic characteristics	Results (n = 130)	Percentage (%)
Mean Age	**23.54 ± 3.59 yrs**	**Range 18 – 36 yrs**
Mean Gestational Age	**39.62 ± 1.15 wks**	
Parity		
Nullipara	68	52.3%
Multipara	62	47.7%
Indications for labour Induction		
Prolonged pregnancy	50	38.46
Mild IUGR	16	12.30
Oligohydramnios	24	18.46
Gestational diabetes	10	7.69
Gestational Hypertension	22	16.9
Bad obstetric history	8	6.15
Study parameters		
Bishop Score	Primi	Multi
	4 ± 1.47	4.06 ± 1.09
Ultrasonographic cervical length	Primi	Multi
	30.98 ± 6.49 mm	30.78 ± 7.40 mm
Vaginal Delivery	80	61.5%
Cesarean section	50	38.5%

Table 1 is showing demographic and clinical parameters in the study group. The most frequent indication for labour induction in our study was prolonged pregnancy (38.5 %) followed by oligohydramnios (18.5%), gestational hypertension (16.9%), mild IUGR (12.3%) and so on.

The mean pre induction Bishop score in the study population was 4 ± 1.47 in primi and 4.06 ± 1.09 in multipara. Similarly the mean pre induction TVS cervical length of the group was 30.98 ± 6.5 mm in primi and in multi 30.78 ± 7.40 mm. Among transvaginal ultrasound findings cervical length was similar in both primigravidae and multiparous women, where as cervical funnelling was present in majority of parous women.

TABLE 2 – RELATIONSHIP BETWEEN MODIFIED BISHOP'S SCORE AND TRANSVAGINAL CERVICAL LENGTH WITH REGARDS TO PARITY

TVS cervical length in mm	n	Modified Bishop's Score					
		≤ 3		4 – 6		>6	
		Primi	multi	Primi	Multi	Primi	multi
≤ 25	22	0	0	4	14	4	0
25.1 – 30	36	8	2	12	12	0	2
30.1 – 35	40	12	2	10	16	0	0
35.1 – 40	22	8	2	4	8	0	0
>40	10	6	2	0	2	0	0

Majority of women had cervical length between 25 and 35 mm whose modified Bishop's score was between 4 & 6. Parous women had better Bishop's score than primigravidae with similar cervical length. This may be because of presence of funnelling and dilatation in parous women. Majority of parous women needed only 1 dose of dinoprostone gel where as primigravidae need more than 1 dose of injection of labour.

Among 130 women, 18 had no change in cervical status even after 3 doses of dinoprostone gel, out of these women 16 were primigravidae and 2 were parous women. All of them underwent caesarean section for failed induction. Remaining 112 women responded to induction and entered active phase of labour.

TABLE 3 - RESPONSE TO INDUCTION WITH RELATION TO CERVICAL LENGTH AND MODIFIED BISHOP'S SCORE

Response to induction	**n**	**Mean cervical length in mm**	**P - value**	**Mean Bishop's Score**	**P - value**
Responded	112	29.89	0.0038	4.75	0.0003
No response	18	36.91		3	

Table 3 shows cervical length has statistical significance between women who have responded and those who have not responded to induction of labour. It also shows modified Bishop's score is strongly significant in predicting response to labour induction.

Indications for caesarean section in our present study were failed induction of labour in 18 cases, secondary arrest of dilatation in active phase of labour in 16 cases, meconium stained liquor in active phase of labour in 10 cases and pathological cardiotocography in active phase of labour in 6 cases.

TABLE 4 – THE MODE OF DELIVERY IN WOMEN WHO ENTERED ACTIVE PHASE OF LABOUR IN RELATION TO PARITY IS REPRESENTED

Parity	Vaginal delivery		LSCS		P- value
	n	%	n	%	
PRIMI	24	46.15	28	53.84	0.00019
MULTI	56	93.33	4	6.66	

More than 90% of parous women had vaginal delivery whereas only 46.15% of primi had vaginal delivery and parity had significant relationship with mode of delivery (P = 0.00019).

TABLE 5 – DIAGNOSTIC INDICES OF BISHOP'S SCORE AND ULTRASONOGRAPHIC CERVICAL LENGTH IN PREDICTION OF SUCCESSFUL LABOUR INDUCTION

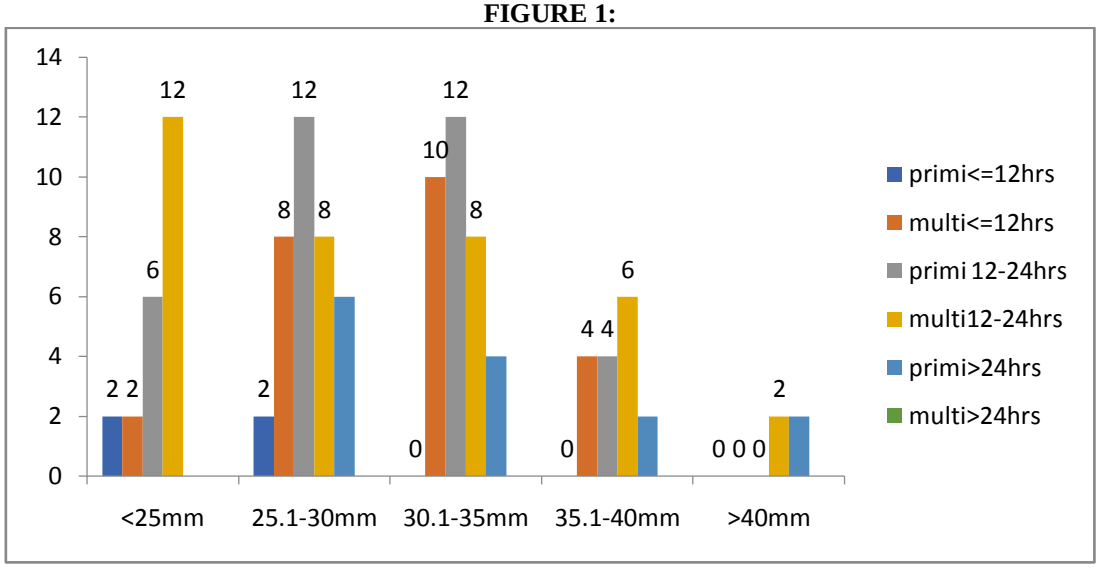
PARAMETER	**BISHOP'S SCORE >6**	**TVS CL ≤ 2.6 cm**
Sensitivity	43%	30%
Specificity	92%	82%
PPV	89%	72%
NPV	51%	42%

Clinical evaluation of cervix with cut off value of Bishop's score of > 6 and transvaginal cervical length ≤ 2.6 cms found that sensitivity and specificity of cervical length being 30% and 80% respectively and sensitivity and specificity of Bishop's score being 43% and 92% respectively. Specificity of Bishop's score is as high as 92% compare to transvaginal cervical length. Specificity of transvaginal cervical length is 82% indicating transvaginal cervical length is also an independent and reliable objective indicator in predicting normal vaginal deliveries.

TABLE 6 – RELATIONSHIP BETWEEN INDUCTION-DELIVERY INTERVAL AND CERVICAL LENGTH BY TRANSVAGINAL ULTRASOUND IS REPRESENTED

Transvaginal Cervical length in mm	n = 56	Induction Delivery Interval in hours					
		≤ 12 hours		12– 24hours		>24 hours	
		primi	Multi	Primi	Multi	Primi	multi
<25	22	2	2	6	12	0	0
25.1 – 30	36	2	8	12	8	6	0
30.1 – 35	34	0	10	12	8	4	0
35.1 – 40	16	0	4	4	6	2	0
> 40	4	0	0	0	2	2	0

FIGURE 1:



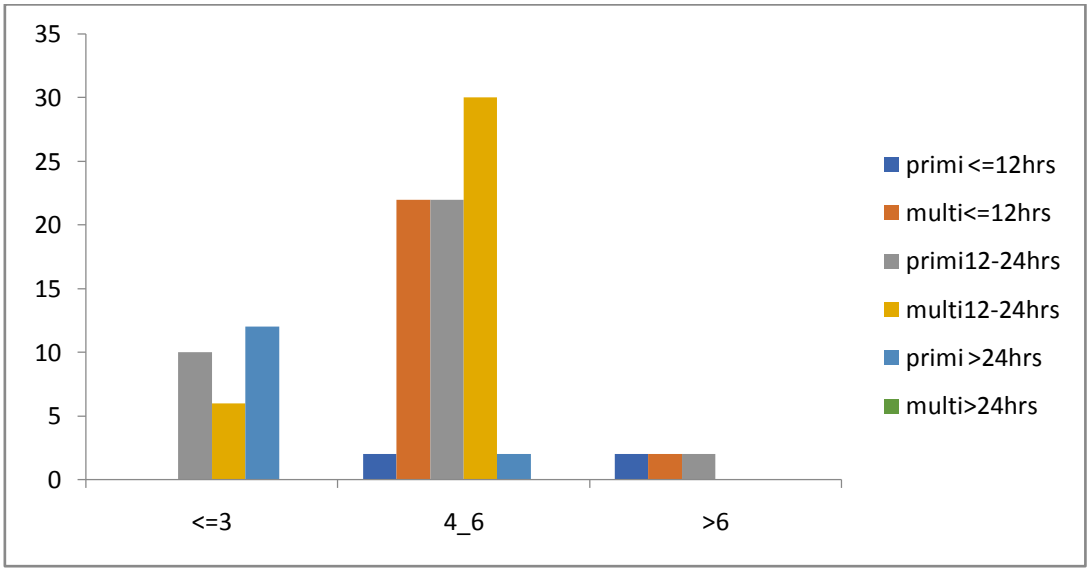
Among primigravidae with cervical length between 25mm and 35mm, 66.66% had induction delivery interval between 12 to 24 hours, when compared to 47.05% of parous women. 27.77% primigravidae with above cervical length had induction delivery interval of more than 24 hours. As cervical length is increased, induction-delivery interval also got prolonged.

Mean cervical length in less than 12 hours induction-delivery interval is 30.27±1.29 (mean ±SD) mm and in more than 24 hours group is 34.26±1.78 (mean ± SD) mm. It shows that cervical length and induction delivery interval are directly proportional.

TABLE 7 – BISHOP'S SCORE AND ITS RELATION WITH INDUCTION DELIVERY INTERVAL ARE REPRESENTED

Modified Bishop's Score	n = 112	Induction delivery interval in hours					
		≤ 12		12- 24		>24	
		Primi	Multi	Primi	Multi	Primi	multi
≤ 3	28	0	0	10	9	12	0
4-6	78	2	22	22	30	2	0
>6	6	2	2	2	0	0	0

FIGURE 2:



None of the parous women had induction-delivery interval more than 24 hours. Among primigravidae with Bishop's Score between 4 and 6, 84.61% had an induction-delivery interval between 12 to 24 hours and 7.69% had an interval of more than 24 hours. Among parous women with the same score range 57.69% delivered between 12 and 24 hours after induction.

Among Primigravidae with Bishop's score less than equal to 3, 54.54% had an induction-delivery interval of more than 24 hours. Women with Bishop's score less than or equal to 3 had mean interval of 20.37±4.78 (mean ± SD) hours, whereas, in women with score more than 3 mean interval was 17.46±3.86 (mean ± SD) hours. As Bishop's Score increased, induction-delivery interval shortened

Among these 130 women induced 6 had postpartum haemorrhage (4 vaginal 2 LSCS), 5 had puerperal fever and 2 had caesarean wound gaping. Maternal morbidity is 10%.

Among neonates, 8 babies had NICU admissions for respiratory distress, 5 had meconium stained liquor, 1 baby had septicaemia. Perinatal morbidity was 10.7%.

IV. Discussion

The widely adopted method of evaluation of cervical condition before induction of labour is Bishop's score. As it has its own limitations, other line transvaginal ultrasound measurement of cervical length in predicting the success of indication of labour has been our present study.

Our present study shows that Bishop's score is more effective predictor of successful labour induction when compared to transvaginal ultrasound cervical length measurement. But it strongly predicts the likelihood of vaginal delivery within 24 hours. As transvaginal ultrasound cervical length has high specificity and positive predictive value, it can be considered as independent parameter or along with Bishop's score in predicting success of labour induction.

TABLE 11 - DEMOGRAPHIC FACTORS LIKE AGE, GESTATIONAL AGE AT INDUCTION, PARITY WERE COMPARED WITH OTHER STUDIES

Study	Age in years	Gestational age at induction in weeks	Parity	
			Nulliparous %	Multiparous %
J.L.Bartha et al[14]	28.4±4.3	39 -42	62.5	37.5
Meijer-Hoogeveen et al	31 (median)	37 -42	67	33
Sujatha Chandra et al[15]	27.9±5.2	41.1±0.3	64	36
Present study	23.5±3.59	39.62±1.15	52.3	47.7

In our present study, demographic factors like maternal age is less in the present study compared to other studies, but gestational age at induction is similar to other studies like J.L. Bartha et al , Meijer-Hoogeveen et al and Sujatha Chandra et al.

TABLE 12 – INDICATIONS FOR INDUCTION OF LABOUR IN PRESENT STUDY ARE COMPARED WITH OTHER STUDIES

Indication	J.L.Bartha et.al %	Meijer-Hoogeveen et al %	Present study %
Prolonged pregnancy	27.5	48.03	38.46
Oligohydramnios	28.75	-	15.38
Medical complications	18.75	37.25	32.30
Fetal growth restriction	16.25	7.84	12.3
Elective induction	8.75	6.66	13.84

Prolonged pregnancy is the major indication for induction of labour in present study and in Meijer – Hoogeveen study, whereas, it is oligohydramnios in J.L.Bartha et al study.

TABLE 13 – COMPARISON OF PREVIOUS STUDIES IN PREDICTION OF THE OUTCOME AFTER LABOUR INDUCTION BY BISHOP SCORE AND CERVICAL LENGTH BY ULTRASOUND IN THE PRESENT STUDY IS COMPARED WITH OTHER STUDIES

Study	Sample size	mean Cervical length (mm)	P value	Mean Bishop's score	P value	Best predictor
Paterson-Brown et al[16]	50	-	NS	5±1	0.02	BS
Ware and Raynor[17]	77	25±10	<0.01	4±3	NS	CL
Chandra et al[15]	122		NS		<0.01	BS
Rane et al[18]	382	18(median)	<0.01		NS	CL
Present study	130	30.87±6.88	0.1	4±2	0.0001	BS

BS – Bishop's score CL – cervical length

Our findings are in agreement with Chandra et al, Paterbrown et al and Rozenberg et al who noted no statistically significant predictive value of transvaginal cervical length in determining successful induction when compared to Bishop's score.

Other studies like Phadnis et al[19] and Gabriel et al[20] showed that TVS cervical length is better predictor than Bishop's score.

In addition to cervical length, many other factors related to uterine behaviour like parity, maternal passage and fetus influence the success of labour induction.

V. Conclusions

Though transvaginal cervical length measurement is reproducible quantitative and objective method, it requires expertise space and resources. On the other hand, Bishop's score is the most cost effective and simpler method of predicting the outcome of labour induction. Our present study shows that induction – delivery interval is significantly associated with both the pre induction Bishop's score and sonographically measured cervical length. However TVS cervical length was better than Bishop's score in predicting the likelihood of vaginal deliveries within 24 hours of induction.

In resourceful settings transvaginal cervical length may be used as an adjunct to Bishop's score to increase the prediction of labour induction outcome. Further studies may be required for recognizing the value of ultrasonographic parameters like cervical wedging, posterior cervical lip angle, fetal head perineum distance in predicting successful induction.

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