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Original Research Article

Ultrasonographic measurement of cervical length versus Bishop score for prediction of successful induction of labor

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ABSTRACT

Background: Induction of labor is a commonly used procedure by obstetrician which denotes artificially stimulating uterine contraction and initiating labor. This study aims to compare transvaginal measurement of cervical length and Modified Bishop score for the prediction of successful labor induction.
Methods: This was a prospective cross-sectional study done at Paropakar maternity and Women's Hospital, Kathmandu, Nepal from September 2021 to August 2022. 274 term pregnant women admitted for induction of labor were included in the study. Transvaginal sonography and Modified Bishop scoring were done within 24 hours prior to induction. Vaginal delivery within 24 hours of labor induction was considered as successful.
Results: Among 274 patients that were included in the study, 203 (74.08%) of the induced patients had vaginal delivery within 24 hours and 70 (25.9%) had induction failure. Majority of the patient belonged to the reproductive age group of 19-35 years (239, 85.9%) and most of them were primigravida 157 (56.7%). The sensitivity and specificity of transvaginal cervical length and Modified Bishop Score was 72% and 66.8% vs 24% and 85%. The overall accuracy of prediction of successful labor induction was higher for transvaginal cervical length (72% vs 35%).
Conclusions: Transvaginal measurement of cervical length is more accurate in predicting success of labor induction in compared to Modified Bishop Score.

Keywords: Cervical length, Induction of labor, Modified Bishop Score

INTRODUCTION

Induction of labor is defined as the process of artificially stimulating the uterus to start labor. It is usually performed by administering oxytocin or prostaglandins to the pregnant woman or by manually rupturing the amniotic membranes.[1-3] The incidence of induction of labor has increased worldwide and varies from region to region. It is estimated that about 20% of pregnancies are induced for various medical reasons after weighing the risk and benefits of the induction of labor.[4]

While until now, Bishop score has remained the standard method in prediction of the duration and safety of induced labor, however there are also predictors like transvaginal sonography findings, BMI, patients age and parity e.t.c of successful labor induction that have seen studied by several clinicians.[5,6]

Hence, this study aims to evaluate the role of transvaginal ultrasonography measurement of cervical length to preinduction of labor and compare its efficacy of prediction of successful labor induction with efficacy of Bishop score.

METHODS

This was a prospective cross-sectional study done at Paropakar maternity and Women's Hospital, Kathmandu, Nepal from September 2021 to August 2022. Sample size was calculated using the formula $n=z^2pq/d^2$, where z=1.96 taken at 95% of confidence interval, p=80% (sensitivity of transvaginal ultrasonography as per Kamran et al) q=100-p=20%, d=5% (maximum tolerable error) which came out to be 270.[8]

All the singleton cephalic term pregnant women who are admitted for labor induction were included in this study after confirming the weeks of gestation by LMP and 1st trimester scan, while high risk pregnancy (diabetes mellitus, hypertensive disorder of pregnancy, antepartum hemorrhage), patient with prelabor rupture of membrane, estimated fetal weight of >4 kg, fetal congenital anomaly, and grand multipara were excluded.

Early term: 37 0/7 weeks through 38 6/7 weeks. Full term: 39 0/7 weeks through 40 6/7 weeks. Late term: 41 0/7 weeks through 41 6/7 weeks. Postterm: 42 0/7 weeks and beyond

Data collection was started after getting letter of permission from the hospital's Institutional Review Board. The informed written consent was taken. All the patients were interviewed for detailed history including age, parity and demographic profile. BMI of the patient was calculated. Transvaginal ultrasonography was done after patient was allowed to void and cervical length was determined by visualization of internal and external os within 24 hours prior to induction. Observer bias was avoided as all the ultrasound was done by senior radiologist with more than 8 years of experience.

Then, digital vaginal examination was done to determine the dilatation of cervix, cervical length, position, consistence of the cervix and fetal head station. Modified Bishop score (Table 1) was then calculated by the given below method.

Table 1: Modified Bishop Score.

Score	0	1	2
Dilatation of cervix	<1cm	1-2cm	>1cm
Cervical length	>2cm	1-2cm	<1cm
Position of cervix	Posterior	Mid	Anterior
Consistency of cervix	Firm	Soft	Soft and stretchable
Station of head	≥-2cm	-1	≥0

Patients were then induced as per hospital protocol with either misoprostol or syntocin. The time of induction was noted. The patients were kept under close observation regarding the progress of labor, dose required for induction, need of augmentation and type of delivery. The time required from labor induction to vaginal delivery were noted and the patients who required cesarean section were identified as failure of induction. In addition, maternal and fetal outcome after delivery were also noted.

Statistical analysis

Data entry and analysis was done using SPSS version 23. Mean and standard deviation was derived. Paired t test was used to compare variables. Sensitivity, specificity, negative predictive value, positive predictive value and accuracy were generated. P value of <0.05 was considered significant.

RESULTS

Among 274 patients that were included in the study, 203 (74.08%) of the induced patients had vaginal delivery within 24 hours and 70 (25.9%) had induction failure, 20 of the induction failure had vaginal delivery after 24 hours and 50 of had cesarean section most which were for fetal distress (22) followed by non-progress of labour of labour (15), failed induction (8) no-reassuring CTG (4) and cephalopelvic disproportion in 2 cases.

Majority of the patient belonged to the reproductive age group of 19-35 years (239, 85.9%) followed by <19 years (26, 9.4%) mean age of the patient was 25±4.5majority of the patient were primigravida 157 (56.7%) as depicted in Table 1. The women extremes of age were more likely to have induction failure but was not statistically significant (p=0.5), while increased BMI was negatively related to the incidence of induction failure with p value of 0.009 which is statistically significant. In relation to parity, 78.2% of primiparous women and 71.2% of multiparous women had vaginal delivery within 24 hours with the p value of 0.006. Fetal weight of 3.1-3.5 kg was more likely of successful induction (Table 2).

Table 3 shows that 238 of the total patients had their modified bishop score <4 i.e. 86.8% and 36 (13.2%) had their score ≥4. Among the patients with bishop score of <4, 178 had successful induction while 60 failed to deliver within 24 hours. Among the patients with bishop score of ≥4, 26 had successful induction followed by vaginal delivery with 24 hours. 164 patients had preinduction cervical length in transvaginal sonography <3cm among which 140 (87.5%) had successful induction and 60 (12.5%) had induction failure, while 109 had preinduction cervical length ≥3cm among which 63 (57.79%) had successful labor induction and 46 (42.25%) had failed induction.

The sensitivity and specificity of transvaginal cervical length was 72% and 66.8% while that of Bishop score was 24% and 85%. The PPV and NPV of transvaginal ultrasound was 82.9% and 71% while that of Bishop Score was 71% and 30%. The overall accuracy of prediction of successful labor induction of transvaginal cervical length was 72% which was far superior to Bishop Score which was 35% (Table 4).

Table 2: Clinicodemographic profile of the patients and its relation to successful induction.

Variables	Successful induction N (%)	Induction failure N (%)	P value
Age (years)			
≤19	15 (57.6)	11 (42.3)	0.52
19-35	187 (78.5)	52 (21.4)	
>35	4 (44.4)	5 (55.54)	
Weeks of gestation			
Early term (37-38+6)	17 (62.9)	10 (37.03)	0.1
Full term (39-40+6)	122 (72.2)	34 (27.8)	
Late term (41-41+6)	66 (85.6)	11 (14.4)	
Post term (>=42)	9 (60)	6 (40)	
BMI (kg/m^2)			
<19	-	-	0.009
19-25	56 (82.3)	9 (17.7)	
25-30	97 (73.4)	35 (26.5)	
30-35	38 (69)	17 (30	
>35	13 (59)	9 (41)	
Parity			
Primi	115 (78.2)	32 (21.7)	0.006
Multi	94 (71.2)	33 (28.7)	
Baby weight (kg)			
<2.5	3	-	0.015
2.6-3	57 (80.2)	14 (19.8)	
3.1-3.5	117 (95.1)	6 (4.9)	
3.6-4	24 (55.8)	19 (44.2)	
>4	5 (71.4)	2 (28.6)	

Table 3: Cervical length and Bishop score in relation to success of labor induction.

Parameters	Induction success N (%)	Induction failure N (%)	P value N (%)
Bishop score			
<4	178 (74.7)	60 (25.3)	0.6
≥4	26 (72.2)	10 (27.8)	
Cx length			
<3cm	140 (85.3)	24 (14.7)	<0.001
≥3cm	64 (58.1)	46 (41.9)	

Table 4: Comparison and analysis of transvaginal sonography and Bishop score.

	Cut off	Sens	SP	PPV	NPV	ACC
Cervical length	3	72	66.8	82.9	51	72
Bishop score	4	24	85	71	30	35

PPV-Positive Predictive Value, NPV-Negative Predictive Value
Sens-Sensitivity, SP-Specificity, ACC- Accuracy

Majority of the patients 90.2% preferred transvaginal sonography over Bishop score (Figure 1).

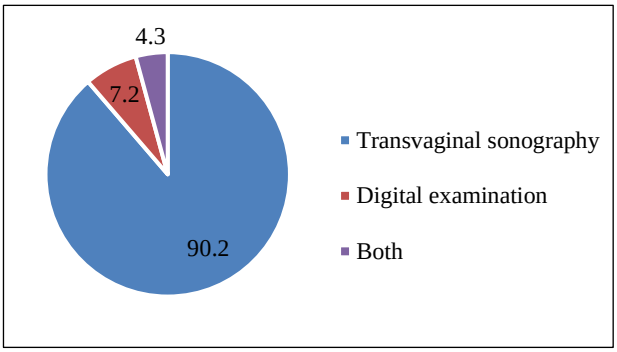

Figure 1: Patient's preference to predictive technique in relation to pain.

DISCUSSION

Induction of labor, in which the contraction is stimulated with the aim of vaginal delivery, is one of the most frequently used procedure by an obstetrician in their day to day practice. Vaginal delivery within 24 hours of induction determines successful labor induction.[7] Despite of its poor predictive value, Bishop score has always been the most commonly used indicator for predicting success of labor induction.[5,6,8,9] In the recent time, measurement of preinduction transvaginal cervical length, which unlike Bishop score is more subjective approach, has been gaining its popularity. Generally, labor is induced at term, but can be done earlier if indicated when prolonging pregnancy is contraindicated and mother and fetus are at risk.[2,3] In this study, only those pregnant women whose labor was induced after 38 weeks of gestation were included.

The majority of women in our study belonged to the age group of 19-35 years (239, 85.9%) which was similar to that of the study done by Anikwe et al, Kamram et al where the age range was 19-40 years with the mean age 30.68±6.38 years and by Srivastava et al where the age range was 18-37 years.[4,8,9] This result also nearly matched the study Eid et al where the age group ranged 17-41 years.[8] Most of the patients in our study undergoing induction were at 39-40 weeks of gestation similar to the study by Agrawal et al where the majority of case belonged to 40-41 weeks of gestation.[10,9]

Bajpai et al in their study have concluded that maternal age, parity, Bishop score, cervical length and weight of the newborn all might affect the mode of delivery after labour induction.[11] In addition to these components, we have also taken into account the weeks of gestation and BMI that have an impact on mode of delivery. Late term (41-41+6) and normal BMI (19-25 kg/m^2) being favorable component for vaginal delivery after induction. Regarding parity, the result varied from other investigators who in their study have found that multiparous women were more

likely of successful induction though not statistically significant.[12-14]

The current study compared the transvaginal cervical length with the cut off of 3 cm with modified bishop score with cut off value of 4 to compare their efficacy in predicting successful labor induction. Various studies have also been conducted in recent years to compare the same.[11-20] In this study, 203 (74.08%) among 274 patients had successful labor induction (delivery within 24 hours of induction) similar to the study by Agrawal et al, Khalifa et al, Monika et al, Ware et al and Eid at al where labor induction was successful in 74%, 75.6%, 69% and 70% respectively.[11,13-15] This finding was lower than the study by Bajpai et al (86.9%) and Aggarwal et al (81.33%).[17,18]

In this study, we found that the sensitivity of transvaginal cervical length (3cm) was higher than that of Modified Bishop Score (72% vs 24%) while specificity was higher in modified Bishop Score (66.6% vs 85%). Looking into the overall accuracy, transvaginal cervical length was found superior to Modified Bishop Score for prediction of successful labor induction (72% vs 35%). Khalifa et al also revealed higher sensitivity of cervical length in compared to Bishop Score (80% vs 64%).[13] However, in contrast to these result, Monika et al in their study revealed no significant difference in sensitivity in both groups.[14]

In a study by Tan et al the patients admitted that transvaginal sonography was better tolerated then digital examination which was similar with our findings where 90.2% of the patients preferred transvaginal sonography.[20]

CONCLUSION

This study concluded that ultrasonographic measurement with the cut off value of 3 cm carried better value in predicting success of labor induction.

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