International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Singh R et al. Int J Reprod Contracept Obstet Gynecol. 2023 Nov;12(11):3322-3327
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20233302

Original Research Article

Assessment of role of fetal head to perineum distance by ultrasound as a predictor of successful vaginal delivery prior to induction of labour

Richa Singh, Poonam Yadav, Abhilasha Yadav, Ishu Grewal*

Department of Obstetrics and Gynecology, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India

Received: 02 September 2023
Revised: 07 October 2023
Accepted: 09 October 2023

***Correspondence:**
Dr. Ishu Grewal,
E-mail: ishugrewal1996@gmail.com

ABSTRACT

Background: Objective of the study was to determine the obstetrical outcome assessed as successful vaginal delivery by using ultrasonographically measured fetal head to perineal distance.
Methods: We conducted a prospective observational study on 180 antenatal women fulfilling inclusion and exclusion criteria at department of obstetrics and gynaecology, Sarojini Naidu Medical College, Agra. Trans-perineal ultrasonography for measurement of fetal head to perineum distance was done. After the scan, vaginal examination was done under all aseptic precautions to assess the various components of Bishop score (cervical position, cervical length, consistency, dilatation, station). Induction of labour was given after reaffirming that there was no contraindication for induction of labour. Monitoring of labour was done according to World Health Organization (WHO) modified partograph and cardiotocograph. Outcome of induction was considered successful if it resulted in vaginal delivery. Sensitivity and specificity of Bishop score, cervical length and foetal head to perineal distance was calculated and compared.
Results: It was observed that predictability of fetal head to perineum distance measured using trans-perineal ultrasound was higher in all aspects compared to Bishop's score and cervical length.
Conclusions: The foetal head-perineum distance measured by trans-perineal ultrasound is an easy, definitive and non-invasive method for prediction of successful induction of labour and can be used as an adjunct tool to add more information to per vaginal examination findings. Based on imaging findings, patients can be counselled before induction of labour regarding the probability of successful induction.

Keywords: Fetal head to perineum distance, Bishop's score, Induction of labour

INTRODUCTION

Spontaneous vaginal delivery is the desirable outcome for pregnancy. However, not all women get into spontaneous labour and as many as 13–20% require induction of labour for varied indications which include both maternal and foetal causes.[1]

Bishop's score is a conventional method used to predict suitability of the patient for induction of labour. It seems to be a determinant of achieving vaginal delivery and is associated with induction-to-vaginal delivery time interval.[2] Bishop's score being a subjective predictive factor, chances of erroneous judgement and inter- observer variability are high. Hence, it influences the outcome of women chosen for vaginal delivery by induction; many of the patients end up in operative delivery, contributing to increasing rate of caesarean deliveries and complications which are associated with emergency caesareans. Thus, identification of women at high risk for caesarean delivery before induction of labour has significant clinical implications. There are continuous efforts to standardize labour prediction models using intrapartum ultrasound

which nullifies subjective errors of digital pelvic examination.

Ultrasound has been evolving as an important adjunct tool for the obstetricians to counsel the patients before induction of labour and explain them the probability of successful induction based on imaging findings. The primary goal is to improve the quality of care and outcomes for pregnant women undergoing induction of labour.

Transvaginal sonography for cervical length measurement is better tolerated than digital examination for Bishop score assessment and both cervical length and Bishop score are useful predictors of the need for caesarean delivery following labor induction. A cervical length >20 mm at labor induction at term is an independent predictor of caesarean delivery.[3]

Ultrasound parameters such as fetal head position with respect to pelvic girdle, fetal spine position, angle of progression, head to symphysis distance and head to perineum distance have been extensively explored.

The aim of the present study is to evaluate the role of fetal head–perineum distance as a predictor of successful vaginal delivery using transperineal ultrasound and compare its predictability with cervical length and Bishop's score.

METHODS

This prospective observational study was conducted on 180 antenatal women fulfilling inclusion and exclusion criteria, who attended OPD and labour room of Departments of obstetrics and gynaecology for induction of labour at Sarojini Naidu Medical College, Agra from October 2020 to September 2022.

Inclusion criteria

Inclusion criteria includes patients in third trimester of pregnancy from 35 to 42 weeks of gestation with a live singleton pregnancy with cephalic presentation with reactive CTG requiring induction of labour with no contraindication for vaginal delivery.

Exclusion criteria

Exclusion criteria includes cephalopelvic disproportion, malpresentation, macrosomia, multiple pregnancy, active genital herpes, uterine fibroid, placenta previa, vasa previa, foetal distress, non- reactive CTG, low biophysical profile, intrauterine fetal demise, history of scarred uterus, previous cesarean section, any other obstetrical indication requiring emergency lower segment caesarean section.

After a detailed history and complete general and obstetrical examination, a routine obstetric scan for fetal maturity and well-being was done. All eligible women underwent transperineal ultrasound assessment. By placing abdominal probe covered with sterile glove/ condom on the perineal area between two ischial tuberosities directing towards the presenting part. The shortest distance from the outer bony limit of fetal skull to skin surface of the perineum in a transverse view is measured to represent fetal head to perineum distance as shown in Figure 1.

Figure 1: Transperineal ultrasound depicting fetal head to perineum distance prior to induction of labour.

After the scan, vaginal examination was done under all aseptic precautions to assess the various components of Bishop score (cervical position, cervical length, consistency, dilatation, station). Indication for induction was noted after reaffirming that there was no contraindication for induction of labour.

A Bishop score of 8 or greater is considered to be favorable for induction, or the chance of a vaginal delivery with induction is similar to spontaneous labor. A score of 6 or less is considered to be unfavorable if an induction is indicated cervical ripening agents may be utilized.[4]

If cervix was found unfavourable, induction of labour was done using dinoprostone gel 0.5 mg (6 hourly induction, maximum 3 doses, if patient did not get into active phase of labour, then induction was considered unsuccessful) or else oxytocin drip in cases where cervix was found favourable. The patients were followed up till delivery. Monitoring of labour was done according to WHO modified partograph and cardiotocograph.

Failure to achieve regular uterine contractions (every 3 minutes) after 1 cycle of completion of cervical ripening consisting of: NICE Guidelines 2021- insertion of 3 intracervical PGE2 at 6 hrs interval and 12-24 hrs of oxytocin infusion after rupture of membranes or one PGE2 pessary within 24 hours.[5]

Non-progress of labour was defined according to WHO modified partograph with the following criteria: protracted active phase, secondary arrest of cervical dilatation, secondary arrest of descent, and prolonged second stage of labour.

RESULTS

Out of 198 women on whom the study was conducted, 18 women were excluded as they underwent operative delivery for indication such as foetal distress or meconium stained liquor with unfavourable cervix. The final data analysis was done on 180 women, of which 128 women that is 71% women gave birth vaginally and 52 women underwent caesarean section due to failed induction.

Table 1 shows distribution according to maternal profile. The Bishop's score ranged from 1 to 8, cervical length ranged from 1.5 to 4 cm and foetal head to perineum distance ranged from 3.2 to 6.8 cm.

Table 1: Patient profile.

Parameters	Mean±SD
Maternal age (in years)	25.98±3.6
B.M.I (kg/m^2)	22.15±2.05
Gestation (in weeks)	38.6±0.6
Bishop's score	4.06±1.88
Cervical length (in cm)	2.72±0.52
Foetal head to perineum distance (in cm)	5.12±0.97

Table 2 shows the correlation of bishop's score, cervical length (in cm) and foetal head to perineum distance (in cm) with the mode of delivery. Greater the pre-induction Bishop's score, more are the chances of vaginal delivery post induction. When cervical length is more, chances of caesarean section increase. With Foetal head to perineum distance of <4 cm, almost all women gave birth vaginally and with distance of >6 cm, majority underwent caesarean section.

Table 3 depicts the diagnostic accuracy of the studied predictive factors (Bishop's score, cervical length, foetal head to perineum distance) in determining successful vaginal delivery. It was observed that when Bishop's score was more, the rate of vaginal delivery increased, whereas when Bishop's score was less than 3, rate of caesarean section increased. We found that at Bishop's score of ≥3, sensitivity calculated was 87.5%, specificity was 48.08%. Positive and negative predictive value was 80.58% and 60.98% respectively. Sensitivity and specificity, achieved at cervical length ≤3 cm was 85.94% and 55.77% respectively. Positive and negative predictive value was 82.71% and 61.70% respectively. Sensitivity at FHPD (≤5.5 cm) was 89.84% and specificity was 86.54%. Negative and positive predictive value was 94.26% and 77.59% respectively.

Table 2: Correlation of pre-induction Bishop's score, cervical length and fetal head to perineum distance with mode of delivery.

Variables	Vaginal delivery, n (%)	Caesarean section, n (%)
Pre- induction Bishop's score		
0-2	16 (12.5)	25 (48.1)
3-4	26 (20.3)	17 (32.7)
5-6	64 (50)	08 (15.4)
>6	22 (17.2)	02 (3.8)
Cervical length (in cm)		
3.1-4	18 (14.1)	29 (55.8)
2.1-3	84 (65.6)	20 (38.5)
<2	26 (20.3)	03 (5.7)
Foetal head to perineum distance (in cm)		
6.1-7	03 (2.3)	33 (63.5)
5.1-6	45 (35.2)	15 (28.8)
4.1-5	53 (41.4)	03 (5.8)
3.1-4	27 (21.1)	01 (1.9)

It was observed that predictability of foetal head to perineum distance was higher in all aspects compared to Bishop's score and cervical length.

Table 3: Diagnostic accuracy of the studied predictive factors in determining successful vaginal delivery.

Parameters	Cut-off	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Accuracy (%)
Pre-induction Bishop's score	≥3	87.50	48.08	80.58	60.98	76.11
Cervical length (in cm)	≤3	85.94	55.77	82.71	61.70	77.22
Fetal head to perineum distance (in cm)	≤5.5	89.84	86.54	94.26	77.59	88.89

DISCUSSION

Induction of labor is the most frequently done obstetrics procedure accounting for 13-20% of term pregnancies. The goal of induction of labor is to achieve successful vaginal delivery. However, induction of labor is associated with an increased risk of operative procedure, with a caesarean delivery rate of around 25% in nulliparous women and around 5% in parous women. There are various factors which need to be assessed before induction, to estimate its success and to minimize the risks of caesarean section. These factors include parity, Bishop's score, body mass index, maternal age and estimated fetal weight. One important factor responsible for failure of induction of labor is improperly chosen patient for vaginal delivery. Therefore, there are continuous efforts to standardize labor prediction models using ultrasound

which nullifies subjective errors of digital pelvic examination.

Outcome of various studies is summarized in Table 4. In the study conducted by El-Bishry et al, mean age was found to be 27.9±4.0 years.[6] No significant difference was found between vaginal delivery and caesarean section in cases regarding maternal age. In Ali et al study, mean maternal age in years was found to be 26.95±3.5.[7] Also in the study conducted by Eggebø et al median age of patients was 30 years.[8]

Patients were distributed according to the gestational age. Majority number of patients 78.9% had 37-40 weeks of gestation. Mean (±SD) gestational age was 38.58±0.68 weeks. In the study conducted by El-Bishry et al, mean gestational age was found to be 39.8±1.0 weeks.[6] In their study mean gestational age was found to be comparable and p value was statistically insignificant. Similarly, In Ali et al study mean gestational age in weeks was 38.82±1.08.[7]

Study group was also distributed according to the parity of the patients. It was found that majority number of patients 51.6% were primigravida and 33.9% cases were second gravida and only 0.6% cases had parity ≥4. In the study conducted by Obeidat et al, it was found that parity is one of the main predictors of successful labour induction.[9]

Kamlungkuea et al, conducted a retrospective cohort study to evaluate factors predicting a successful vaginal delivery following labor induction and develop and induction prediction model in term pregnancy.[10] History of previous vaginal delivery (aOR 5.75, 95% CI 3.701-8.961), maternal delivery BMI <25 kg/m2 (aOR 2.010, 95% CI 1.303-3.286), estimated fetal weight <3500 g (aOR 2.193, 95% CI 1.246-3.860), and gestational age ≤39 weeks (aOR 1.501, 95% CI 1.038-2.173) significantly increased the probability of a successful vaginal delivery following labor induction.

Out of 128 women who delivered vaginally, 87.5% had Bishop's score of ≥3. Out of 52 women who delivered by caesarean section, 48.1% of women had Bishop's score of <3. Thus it was observed that with increasing Bishop's score, the rate of vaginal deliveries was more. Sensitivity of Bishop's score in predicting mode of delivery at cut off ≥3 was 87.50%. Specificity was 48.08%. Positive predictive value and negative predictive value was 80.58% and 60.98% respectively. Also this finding was highly significant by Chi-square test (p<0.0001).

El-Bishry et al, in their study found that Bishop's score is positive predictor of vaginal delivery after induction of labour with sensitivity 91.4% and specificity of 32.5%.[6]

Similar results were found in the study conducted by Ali et al, when Bishop's score was more, rate of vaginal delivery as more and when the Bishop's score was <3, chances of caesarean section increased.[7] They found that at cut off ≥3, maximum sensitivity (74%) and maximum specificity (74.4%) could be achieved. P value was observed to be 0.001 which is highly significant.

Obeidat et al found in their study that in multiparous women, the rate of vaginal delivery was significantly higher in women with higher Bishop scores.[9] Laura Batinelli et al observed in their study that high Bishop score at the beginning of the IOL was predictive factor for vaginal delivery (OR=0.62, p=0.034).[11]

Correlation of cervical length with mode of delivery was studied in this study. It was found 85.9% of the women who delivered vaginally had cervical length of ≤3 cm and in women who underwent caesarean section 55.8% of women had cervical length of >3 cm. Sensitivity of cervical length was calculated at ≤3 cm and was found to be 85.94%. Specificity calculated was 55.77%. Positive predictive value and negative predictive value was 82.71% and 61.70% respectively. Thus, cervical length was found to be a positive predictor of vaginal delivery post induction of labour. Lesser is the cervical length more are the chances for vaginal delivery. Findings were found to be statistically significant by Chi-square test (p=0.0001).

In the study conducted by El-Bishry et al similar results could be seen, sensitivity of cervical length was found to be 82.9%, specificity was 59.7%.[6]

Also, Ali et al, in their study observed that with higher cervical length rate of caesarean section was more.[7] It was found that only 15.7% cases required caesarean section when cervical length was below or equal to 3 cm. Findings were found to be statistically significant with Chi-square test (p=0.001). Sensitivity and specificity was then calculated at cut-off <3cm and was found to be 83% and 76.2% respectively. Thus, suggesting cervical length could be a predictor of success of induction of labour.

El Mekkawi et al stated in their study that a cervical length of <28 mm had 87.5% sensitivity, 86.3% specificity, 61.4% positive predictive value, 96.5% negative predictive value for successful labour induction which is similar to our study.[12]

Saccone et al studied to evaluate the predictive accuracy of transvaginal ultrasound (TVU) cervical length (CL) for spontaneous onset of labour in singleton gestation enrolled at term by a meta-analysis.[13] For the prediction of spontaneous labour within 7 days for CL <30 mm the pooled sensitivity was 64% and pooled specificity was 60%. The higher the CL, the better the sensitivity; the lower the CL, the better the specificity. A woman with a singleton gestation at term and a TVU CL of 30 mm has a <50% chance of delivering within 7 days, while one with a TVU CL of 10 mm has an over 85% chance of delivery within 7 days.

Relationship between Foetal head to perineum distance (FHPD) and mode of delivery was studied in present study and it was found that 89.9% who delivered vaginally had

FHPD ≤5.5 cm and 86.5% of the women who underwent caesarean section, had FHPD >5.5 cm. Thus, with more FHPD, there are more chances of caesarean section.

Similar results were seen in the study conducted by Ali et al, 7.1% required caesarean section with FHPD ≤5.5 cm, 95% required caesarean section and this finding was found to be statistically significant (p=0.001).[7] Fetal head to perineum distance of ≤5.5 cm, there was maximum sensitivity (97%) and specificity (88.1%). Thus, FHPD could be a predictor of successful vaginal delivery.

Eggebø et al found in their study that at FHPD cut-off of <4 cm, sensitivity was 69% and specificity was 82% for successful vaginal births.[8]

Torkildsen et al studied on transperineal ultrasound for prediction of delivery mode, at cut-off <4 cm sensitivity was 62%, specificity was 85% for successful labour induction.[14]

Alvarez-Colomo et al analysed the validity of ultrasonography in predicting the outcomes of labour induction, compared with Bishop score (BS), and to design a predictive model including ultrasound and clinical variables.[15] Caesarean section was performed in 30.5% of cases. Cervical length (26.1 versus 31.4) and fetal head to perineum distance (44.7 versus 51.3) were lower in the vaginal delivery group. The area under the curve obtained for fetal head to perineum distance (0.734) was greatest, followed by cervical length (0.663) and bishop's score (0.678). Therefore, fetal head to perineum distance and the cervical length are useful in predicting the result of the induction labour comparable to Bishop score. Also using ultrasound scan is significantly better tolerated than vaginal exam.

Table 4: Comparison of various studies using fetal head to perineum distance in predicting successful vaginal birth as outcome.

References	No. of patients (N)	Patient characteristics	Parity	FHPD cut-off (cm)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Torkildsen et al[14]	110	Term patients with singleton vertex with prolonged first stage	Primigravidae	≤4	62	85	93	43
Eggebo and Hassan[8]	150	Term patients with singleton vertex with prolonged first stage	Primigravidae	≤4	69	82	92	48
Ali et al[7]	219	Term patient with singleton vertex who underwent induction of labour	Both primigravidae and multigravidae	≤5.5	97	88.1	92.9	94.9
Present study	180	Term patient with singleton vertex who underwent induction of labour	Both primigravidae and multigravidae	≤5.5	89.84	86.54	94.24	77.59

It was observed that predictability of foetal head to perineum distance was higher in all aspects compared to Bishop's score and cervical length.

Limitations

Though it appears that transperineal ultrasound assesses head to perineum distance more objectively, it cannot completely replace the role of vaginal examination in labour. Adequacy of pelvis for vaginal delivery, assessment of cephalopelvic disproportion, softness and stretchability of cervix are till today well determined by digital examination. So, foetal head to perineum distance can be used as an adjunct tool to add more information to per vaginal examination findings.

However, further studies are required to know whether incorporation of the studied parameter improves the efficacy of intrapartum sonography in predicting successful induction.

CONCLUSION

The foetal head-perineum distance measured by trans-perineal ultrasound is an easy, definitive and non-invasive method for prediction of successful induction of labour and can be used as an adjunct tool to add more information to per vaginal examination findings. Based on imaging findings, patients can be counselled before induction of labour and the probability of successful induction can be explained.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Battista L, Chung JH, Lagrew DC, Wing DA. Complications of labor induction among multiparous women in a community-based hospital system. Am J Obstet Gynecol. 2007;197:7.
2. Teixeira C, Lunet N, Rodrigues T, Barros H. The Bishop Score as a determinant of labour induction success: a systematic review and metaanalysis. Arch Gynecol Obstet. 2012;286(3):739-53.
3. Tan PC, Vallikkannu N, Suguna S, Quek KF, Hassan J. Transvaginal sonographic measurement of cervical length vs. Bishop score in labor Tan induction at term: tolerability and prediction of Cesarean delivery. Ultrasound Obstet Gynecol. 2007;29(5):568-73.
4. Wormer KC, Bauer A, Williford AE. Bishop Score. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2022.
5. NICE. Overview | Inducing labour | Guidance | NICE. 2021. Available at: https://www.nice.org.uk/guidance/ng207. Accessed on 12 June 2023.
6. El-Bishry G, Kholy A, Sweed M, Hassan N. The Accuracy of Fetal Head to Perineum Distance and Cervical Length in Predicting the Outcomes of Labor Induction. Evid Based Women's Health J. 2020;10:16-26.
7. Ali J, Hebbar S. Ultrasound Assessment of Foetal Head-Perineum Distance Prior to Induction of Labour as a Predictor of Successful Vaginal Delivery. J Obstet Gynaecol India. 2019;69(2):129-35.
8. Eggebø TM, Heien C, Økland I, Gjessing LK, Romundstad P, Salvesen KA. Ultrasound assessment of fetal head-perineum distance before induction of labor. Ultrasound Obstet Gynecol. 2008;32(2):199-204.
9. Obeidat RA, Almaaitah M, Ben-Sadon A, Istaiti D, Rawashdeh H, Hamadneh S, et al. Clinical predictive factors for vaginal delivery following induction of labour among pregnant women in Jordan. BMC Pregnancy Childbirth. 2021;21(1):685.
10. Kamlungkuea T, Manonai J, Suriyawongpaisal P, Hansahiranwadee W. Factors Predicting Successful Vaginal Delivery Following Induction of Labor in Term Pregnancy. Int J Womens Health. 2022;14:245-55.
11. Batinelli L, Serafini A, Nante N, Petraglia F, Severi FM, Messina G. Induction of labour: clinical predictive factors for success and failure. J Obstet Gynaecol. 2018;38(3):352-8.
12. El Mekkawi SF, Hanafi S, Khalaf-Allah AE, Abdelazim IA, Mohammed EK. Comparison of transvaginal cervical length and modified Bishop's score as predictors for labor induction in nulliparous women. Asian Pac J Reprod. 2019;8:34-8.
13. Saccone G, Simonetti B, Berghella V. Transvaginal ultrasound cervical length for prediction of spontaneous labour at term: a systematic review and meta-analysis. BJOG. 2016;123(1):16-22.
14. Torkildsen EA, Salvesen KÅ, Eggebø TM. Prediction of delivery mode with transperineal ultrasound in women with prolonged first stage of labor. Ultrasound Obstet Gynecol. 2011;37(6):702-8.
15. Alvarez-Colomo C, Gobernado-Tejedor JA. The validity of ultrasonography in predicting the outcomes of labour induction. Arch Gynecol Obstet. 2016;293(2):311-6.

Cite this article as: Singh R, Yadav P, Yadav A, Grewal I. Assessment of role of fetal head to perineum distance by ultrasound as a predictor of successful vaginal delivery prior to induction of labour. Int J Reprod Contracept Obstet Gynecol 2023;12:3322-7.