Original Research Article

Ultrasound assessment of foetal head-perineum distance prior to induction of labour as a predictor of successful vaginal delivery: a prospective study from a tertiary care hospital of Rajasthan

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ABSTRACT

Background: Induction of labor (IOL) is one of the most frequent obstetric procedures require for various obstetrics indications in 13-20% of term. Traditionally success of induction has been determined by Bishop score, but this score is observer based and significant inter observer disagreements have been noted. Ultrasound can help obstetricians in counselling patients before induction of labour and explain the probability of successful induction. So in this study we did ultrasound assessment of foetal head-perineum distance prior to induction of labour as a predictor of successful vaginal delivery.
Methods: All eligible women who are planned for induction of labour will undergo ultrasound assessment of foetal head–perineum distance prior to induction of labour. Transvaginal ultrasound will also be performed using ultrasound probe to measure cervical length. After the scans, prevaginal examination will be performed to assess the various components of modified Bishop score (min 0, max 10). If cervix is found unfavourable, induction of labour will be done. If patient did not go into active labour, then induction will be considered unsuccessful) or else oxytocin drip in cases where cervix is found favourable. The patients will be followed up till delivery.
Results: Out of 125 patients enrolled for the study, 101 women delivered successfully vaginally and 24 had to undergo caesarean delivery. Of these 24 cases of caesarean delivery, 11 cases were excluded as the operative procedure was performed for indication not related to unsuccessful induction such as occurrence of foetal distress in labour, thick meconium-stained liquor with unfavourable cervix. The final analysis was performed from 114 subjects (101 vaginal births and 13 caesarean births).
Conclusions: Transperineal fetal head–perineum distance is less painful as less time consuming and less acceptable by patients compare to Transvaginal measurement of cervical length and painful digital examination for bishop score.

Keywords: Bishop score, FHPD

INTRODUCTION

Traditionally success of induction has been determined by Bishop score, but this score is observer based and significant inter observer disagreements have been noted.[3]

This influencesthe outcome of women chosen for vaginal delivery by induction; many of them end up in operative delivery mainly due to non-progress of labour and foetal distress.

Ultrasound was first suggested to relate the level of fetal

head to the tip of maternal coccygeal bone in 1977.[4] Ultrasound examination prior to labour has proven to be one of the important aids to obstetricians in order to decide proper plan of labour. The parameters can be easily recorded and analysed.The procedure per say is least time-consuming, has a quick learning curve and can be easily mastered.

Transperineal ultrasound allowing direct visualization of the fetal skull, first described in the mid-1990s, now has widespread use to evaluate the progress of labor. The head-perineum distance (HPD), the head-pubis distance and the angle of progression of the fetal head can be evaluated with this simple, objective and non-invasive method. This examination is applicableto all pregnant women with low inter- and intra-observer variability.

One of the important parameters during labour that determine the successful outcome is distance of the presenting part from the outlet. Traditionally, this is determined by the head distance either above or below the ischial spine, which is determined by per vaginal examination. However, digitally assessed head station during intrapartum period many times is erroneous, inaccurate and not consistently reproducible by different examiners.[5] In fact, intrapartum ultrasound examination is more specific and correlates well with different sonographers, and there is a significant disagreement between vaginally performed assessment and ultrasound assessment.[6]

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. Ultrasound can determine cervical dilatation in latent phase of labour (<4 cm of cervical dilatation), but thereafter cervical dilatation can be better assessed only by PV examination (>6-10 cm) in active phase of labour. However, many mothers feel vaginal examination is more painful and theoretically it can increase the risk of ascending bacterial infection. By adopting intrapartum ultrasound, one can minimise the number of vaginal examination and can effectively determinethe foetal head position in relation to maternal pelvis (occipito-anterior or occipito-posteriopositions). At present, it can only be said that ultrasound can be a useful adjunct tool to add more information to digital assessment and helps obstetricians to cross-check and improve findings of PV examination.

The aim of our study is to evaluate effectiveness of transperineal ultrasound inpredicting a successful vaginal delivery in comparison with other methods and explore its acceptance among women when compared to digital transvaginal examination.

METHODS

This was a prospective observational study conducted at Department of Obstetrics and Gynaecology, Pannadhaya Rajkiya Mahila Chikitsalya, RNT Medical College, Udaipur from December 2021 to November 2022. Cases were selected by systematic random sampling as per inclusion and exclusion criteria.

Sample size

The study of Eggebo et al observed that sensitivity and specificity of fetal head–perineum distance for predicting vaginal delivery was 67.4% and 47.2% respectively.[13] Taking these values as reference, the minimum required sample size with desired precision of 15%, 80% power of study and 5% level of significance is 114 patients. To reduce margin of error, total sample size taken is 125.

Inclusion criteria

The study population included term patients between 37 and 40-41weeks, with live singleton cephalic pregnancy who were induced for various reasons, Age between 18 and 35 years, Living fetus with vertex presentation, Reactive CTG, Women with pre-labour rupture of membranes (PROM), Indication for medical induction of labor (postdatism, pre-eclampsia, fetal IUGR oligohydroamnios).

Exclusion criteria

Patients in active labour, Previous LSCS, history of uterine rupture, prior classical or T shaped uterine incision, previous myomectomy, Major foetal anomaly, Patients with any immediate maternal or fetal indication of LSCS, Fetal presentation other than longitudinal cephalic, Active genital warts, Previous pelvic surgeries like VVF, pelvic floor repair.

Methodology

After Institutional Ethical Committee Approval this study was carried out in all eligible women admitted for delivery who are planned for induction of labour were undergo imaging procedure. An abdominal probe was covered with sterile glove and placed on the perineal area between two ischial tuberosities and directed towards the presenting part. The shortest distance from the outer bony limit of foetal skull to skin surface of the perineum in a transverse view was measured to represent FHPD. Following transperineal scan, transvaginal ultrasound was also performed using ultrasound probe to measure cervical length. After the scans, pervaginal examination was performed to assess the various components of modified Bishop score (min 0, max 10). If cervix is found unfavourable, induction of labour will be done using dinoprostone gel 0.5 mg (8-12 hourly induction, maximum 2 doses, if patient did not go into active labour, then induction was considered unsccessful) or else oxytocin

drip in cases where cervix is found favourable. The patients were followed up till delivery.

All eligible women admitted for delivery who were planned for induction of labour underwent imaging procedure. A 3.5-MHz abdominal probe was covered with sterile glove and was placed on the perineal area between two ischial tuberosities and was directed towards the presenting part. The shortest distance from the outer bony limit of foetal skull to skin surface of the perineum in a transverse view was measured to represent FHPD (Figure 1). Following transperineal scan, transvaginal ultrasound was performed using 5.5-MHz ultrasound probe to measure cervical length. After the scans, pervaginal examination was performed to assess the various components of modified Bishop score (min 0, max 10). If cervix was found unfavourable, induction of labour was using dinoprostone gel 0.5 mg (6 hourly induction, maximum 3 doses, if patient did not get into active labour, then induction was considered unsuccessful) or else oxytocin drops in cases where cervix was nicely favourable. The patients were followed up till delivery.

Figure 1: FHPD.

Outcome of induction was considered as successful when it resulted in a vaginal delivery. (vacuum and for ceps delivery were also included.) Outcome was considered unsuccessful when it resulted in caesarean delivery (for reasons like failed induction and non-progress of labour). Caesarean section done for foetal distress was excluded from the study as foetal distress is not related to distance of head from perineum. Failed induction was defined as inability to achieve active phase of labour (as indicated by the cervical dilatation less than 4 cm). Non-progress of labour was defined according to WHO modified partograph with the criteria: 1) Protracted active phase (dilatation line crossing alert line and nearing the action line), 2) Secondary arrest of cervical dilatation, 3) Secondary arrest of descent, and 4) Prolonged second stage.

RESULTS

Out of 125 patients enrolled for the study, 101 women delivered successfully vaginally and 24 had to undergo cesarean delivery. Of these 24 cases of caesarean delivery, 11 cases were excluded as the operative procedure was performed for indication not related to unsuccessful

induction such as occurrence of foetal distress in labour, thick meconium-stained liquor with unfavourable cervix. The final analysis was performed from 114 subjects (101 vaginal births and 13 caesarean births) (Figure 2).
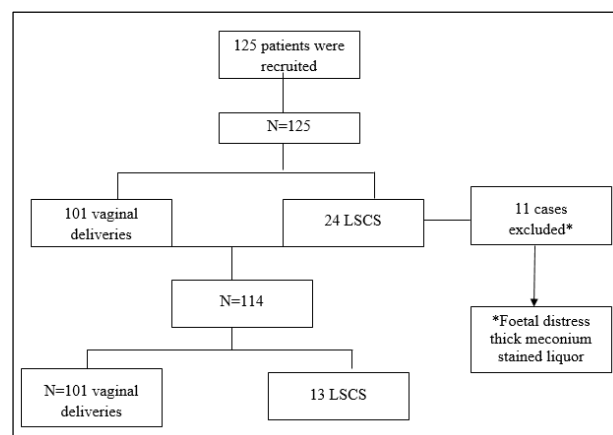

Figure 2: Consort statement (flow chart).

Table 1 shows that 27.2% patients were induced for postdatism, 25.6% and 21.6% were induced for prolonged latent phase and PIH respectively.

Table 1: Indication for induction.

Indication	N	%
Postdatism	34	27.2
Prolonged Latent Phase	32	25.6
P I H	27	21.6
Oligohydramnios	10	8.0
IUGR	4	3.2
Gest. Diabetes	3	2.4
PROM	15	12.0
Total	125	100.0

Women with fetal head to perineum distance 2.8-3.5 cm were 9.9%, 79.2% were with between 3.6-4.3 cm, 6.9% were of 4.4-5.0 cm and 3.9% were >5cm each. Maximum women (79.2%) with fetal head to perineum distance of 3.6-4.3cm were delivered vaginally (Table 2).

Table 2: Fetal head to perineum distance (N=114).

	Total No.	Vaginal delivery (%)	Caesarean delivery (%)	%
2.8-3.5cm	10			8.77
3.6-4.3cm	80			70.17
4.4-5.0cm	12			10.52
>5.0cm	12			10.52
Total	114			100

The Table 3 shows that women with bishop score 1 were 2.6%, score 2 were 1.75%, score 3, 4, 5 and 6 were 15.80%, 29.82%, 33.33% and 16.66%, respectively.

According to Table 4 mean of maternal age is 24.65 years, gestational age=39.3 weeks, FHPD=4.03 cm, Bishop score=4.61, cervical length=2.69 cm and baby birth weight is 2.72 kg.

Table 3: Bishop score (N=114).

Bishop score	N	%
1	3	2.6
2	2	1.75
3	18	15.80
4	34	29.82
5	38	33.33
6	19	16.66
Total	114	100.0

Table 4: Mean of different parameters.

Parameters	Mean±SD (range)
Maternal age (years)	24.65±4.5 (19-30)
Gestational age (weeks)	39.3±1.01 (37-41)
Fetal head perineum distance	4.03±0.38 (2.8-5.4)
Bishop score	4.61±1.06 (1-6)
Cervical length (cm)	2.69±0.45 (1.8-4.2)
Baby birth weight (kg)	2.72±0.33 (2-3.7)

DISCUSSION

Our study reveals that an early delivery may have advantages, induction of labour is becoming a common technique in high-risk pregnancies. Approximately 5-15% of pregnant women have their labour routinely induced for a variety of maternal and foetal reasons.[8] Unsuitable patient selection for vaginal birth is one of the key causes of induction failure. Undiagnosed cephalopelvic disproportion cases that attempt vaginal delivery may experience labour complications due to failure of cervical dilatation and head descent, necessitating an emergency surgical delivery. It's critical to assess a strategy to foretell a successful vaginal delivery because the rate of abdominal deliveries has increased over time and the failure of descent is the second most prevalent reason for doing caesarean sections.

The Bishop score, which requires a digital pelvic examination, has historically been used to gauge the success of inductions, but current research reveals that this method is highly erroneous, subjective, and does not accurately predict the fall of the foetus' head during the first and second phases of labour.[9] Prior to labour, an ultrasound examination has been shown to be one of the most useful tools for the obstetrician to determine the best course of action. These days, ultrasound machines are widely accessible, safe, non-invasive, simple to operate, and easy to master. The parameters are simple to assess and record. There is mounting evidence that measuring the FHPD (foetal head-perineum distance) with transperineal ultrasound can help determine if labour induction will be successful. The process itself least time-consuming, quickly learnable, and readily masterable.[9]

This study has shown that successful vaginal birth within 24 hours of labour induction happened in 81.5% of singleton pregnancies treated with dinoprost gel at 37-42 weeks. The research has also shown that the foetal head-to-perineum distance, the preinduction bishop score, and cervical length are all strongly related to the time between induction and delivery. The likelihood of a vaginal delivery is increased by a smaller foetal head to perineum distance, a higher Bishop score, and a shorter cervical length.[10] In terms of successful labour induction leading to birth within 24 hours of induction, transperineal evaluation of the distance between the foetal head and perineum was a stronger predictor.

A research by Pandis et al examined 240 pregnant women who were carrying singletons between 37 and 42 weeks gestation. 194 (80.8%) of the women gave birth vaginally, and 142 (73.2%) of these did so within 24 hours of the induction. According to a research by Cubal et al on 197 women, 166 of them delivered vaginally (84.3%) and 31 underwent caesarean sections (15.7%).[11]

In our study, out of 101 women, 88.6% gave birth vaginally, 93% did so within 24 hours of labour induction, and 7% did so within 48 hours. The key outcome measures from our study and the other study are compared in Table 5 below.

Table 5: Comparison of the primary outcome measures with other study.

Outcome measures	Pandis et al. (No.240) No. (%)	Cubal A et al. (No.197) No. (%)	Present study (total No. 114) No. (%)
Number of vaginal delivery	194 (80.4)	166 (84.3)	101 (88.6)
Number of LSCS	46 (19.2)	31 (15.7)	13 (11.4)
Number delivered within 24hrs	142 (73.2)	135 (68.5)	93 (81.5)

In our study we defined successful induction of labour as vaginal delivery occurring within 24 hrs. This end point has been traditionally used in several studies to examine the efficacy of an inducing method.

Sonographically measured fetal head to perineum distance, the preinduction bishop score and cervical length successfully predicted vaginal delivery within 24 hrs. As the fetal head to perineum distance and cervical length

increases the likelihood of delivering within 24hrs decreases whilst, as bishop score increase, the likelihood of delivering within 24hrs increases. There was a significant association between cervical length and the induction to delivery interval. The likelihood of vaginal delivery within 24 hrs increased with decreasing cervical length.

The receiver operating characteristic curves for the three variables showed that the area under curve in ROC curve for fetal head to perineum distance is greater than both ROC curve for cervical length and area under curve in bishop score. ROC curves were constructed to determine appropriate cut off for fetal head to perineum distance, bishop score and trans vaginal cervical length in predicting the labour induction, shown score <5.1 cm is best cutoff for fetal head to perineum distance, >3 is for Bishop score and <3.1 cm is for trans vaginal cervical length.

In our study though the sensitivity of the fetal head to perineum distance in predicting the successful labour induction is higher (96.2%) compared with that of cervical length measured trans vaginally (84%). The specificity and positive predictive value for fetal head to perineum distance was 86.4% and 91.6% compared with cervical length was 76.4% and 86.8% and the Bishop Score 68% and 80% are respectively. Predictive value for fetal head to perineum distance <0.001 compare to cervical length was < 0.001 and bishop score (p > 0.05).

CONCLUSION

The fetal head-perineum distance measured by transperineal ultrasound is an easy, simple, reliable, comfortable and non-invasive method for prediction of mode of delivery in women before induction of labour and can be used as an adjunct method for assessment of fetal head descent during labour. The fetal head-perineum distance Bishop score and transvaginal cervical length all three are good predictors of successful induction of labour. The fetal head-perineum distance provides a better prediction of the likelihood of vaginal delivery within 24hrs of induction. Transperineal fetal head-perineum distance and TVS cervical length both are objective method and bishop score is subjective method so, subjective variations occur in bishop score by different observers but not in Transperineal fetal head-perineum distance. So, transperineal fetal head-perineum distance provides better prediction of successful vaginal delivery within 24hrs of induction compared to transvaginal cervical length and bishop score. Transperineal fetal head-perineum distance could be used as a better alternative to TVS cervical length and Bishop Score for successful labour induction in the setting where the appropriate equipment and expertise are available. Transperineal fetal head-perineum distance is less painful as less time consuming and less acceptable by patients compare to Transvaginal measurement of cervical length and painful digital examination for bishop score.

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