



ANTENATAL CERVICAL FUNNELING AS A PREDICTOR OF SUCCESSFUL VAGINAL BIRTH IN TERTIARY CARE INSTITUTION.

Obstetrics & Gynaecology

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ABSTRACT

Aim: To Predict the accuracy of cervical funneling for successful vaginal delivery prior to labor induction **Methods:** Prospective cohort study in labour ward of OG department. We recruited 160 women over 3 months from March 2022 to May 2022. TVS scan used for measuring the cervical funneling before onset of labour and vaginal delivery success was evaluated. **Results:** A total of 160 singleton pregnant women with intact membranes were recruited. Of these, 108 women (67.5%) had successful vaginal deliveries following induction. Cervical funneling was observed in 102 women (71.5%). The rate of successful vaginal delivery was significantly higher in women with cervical funneling than in those without funneling ($P < 0.001$). Multivariable analysis showed that cervical funneling, similar to traditional measures such as the Bishop score and cervical length, BMI, onset of labour, parity was an independent predictor of mode of delivery following labor induction. Maternal BMI, estimated fetal weight and labour induction were associated with prolonged active phase of labour. **Conclusions:** Like the conventional methods of cervical evaluation, such as the Bishop score and cervical length, cervical funneling may serve as a useful and valid predictor of mode of delivery prior to labor induction and gestational age at which to induce labour. It can be used in counseling the patient regarding the mode of delivery.

KEYWORDS

Induction of labour, Cervical funneling, cervical ripening, vaginal delivery

INTRODUCTION

Modern obstetrics aims at improving the safety of mother and the fetus during antenatal period and labor. Vaginal delivery is the most important event occurring in women's life. Predicting the chances of vaginal delivery is of paramount concern for all. Laboring women either go into labor spontaneously or undergo induction of labor. Induction of labor refers to the artificial initiation of labor prior to the commencement of spontaneous labor to attain vaginal delivery. Elective labor induction helps in the reduction of stillbirths and prevention of excessive fetal growth which may lead to macrosomia and other negative results. Rates of induction of labor have been rising globally, with rates of 25% annually reported in the United States, UK. In India rates are widely variable depending on Government / Private facility and nonteaching and teaching/tertiary care hospitals. Recently, cervical length measured by transvaginal ultrasonography has been used as a predictor of successful vaginal delivery and is more reliable than digital examination. Currently, cervical length is routinely measured to assess the maturity of the cervix at term. TVS scan is safe, accurate, and available tool in all obstetric units. It has an essential predictive as well as a diagnostic role in patients presenting in preterm birth. Thus this study was conducted to predict cervical funneling measurement as part of successful vaginal birth and its duration of labour.

AIM AND OBJECTIVES

To evaluate whether the presence of cervical funneling may serve as a predictor of successful vaginal delivery prior to labor induction and to compare its predictive ability with that of cervical length.

Review of Literature

Induction of labour is a fairly routine obstetric procedure worldwide, being performed in approximately 1.4–35% of all deliveries for either maternal and or fetal reasons. Studies comparing induction versus expectant management in post-term pregnancies found that it was associated with a significant reduction in perinatal mortality. Therefore, many studies have looked at various factors which may affect the likelihood of success of labour induction. An important factor is the cervical ripening, whereby certain favourable characteristics of the maternal uterine cervix would readily progress into labour and subsequently result in vaginal birth. In 1964, Bishop described a cervical scoring system using digital examination to assess cervical ripening. It encompasses several criteria such as the position, consistency, effacement and dilatation of the cervix, and also station of the presenting part, with a maximum score of 13. Studies have shown that a score of more than 8 is favourable for induction of labour, such that it would result in vaginal birth in over 90% of women. However, despite its simplicity and readiness to be performed, there are queries regarding its accuracy due to its subjective nature. Hence scoring may vary according to each clinician. In addition, cervical changes such as

funneling at internal os and cervical length may be difficult to assess in closed cervical os. For these reasons, many sought to find other methods of cervical assessment which may be more objective and reproducible in predicting the success of labour induction. Cervical evaluation in pregnancies using transvaginal ultrasonography (TVUS) has been documented since 1986, with no additional risks to the mother or the fetus. Multiple studies reported the use of transvaginal ultrasound of cervical length to be a sensitive method for predicting the success of labour induction. Daskalakis et al. reported that cervical length of < 27 mm measured by transvaginal ultrasound compared to Bishop score were more likely to deliver vaginally with a sensitivity of 76% and specificity of 75.5%. Analysis by Tan et al. also demonstrated that cervical length had a higher sensitivity in predicting failure of induction compared to Bishop score (80% vs 64%), and a slightly higher positive (30% vs. 27%) and negative (89% vs. 83%) predictive values.

Furthermore, TVUS was also noted to be better tolerated i.e. lower pain score compared to digital vaginal examination. However, multiple studies done over the years have shown conflicting results in terms of superiority of TVUS cervix compared to Bishop's score. Analysis of a study conducted by Chandra et al. failed to demonstrate a significant correlation between cervical measurement by ultrasound and the primary outcome i.e. successful vaginal delivery. Sharma et al. also published a similar study in 2017 and included a comparison of different statistical analyses of previous studies, whereby 9 out of the 13 studies showed that cervical length is a better predictor for success of induction of labour, 3 studies demonstrating a comparable significance with Bishop's scoring, and 1 study found that Bishop's scoring is superior to cervical length measurement. A recent Cochrane review in 2015 reported that there was no significant difference between TVUS and Bishop's score in terms of the main outcomes i.e. vaginal birth or caesarean delivery, and induction to delivery interval. But it is important to note that the evidence was based on trials with small sample size and hence warrants further research to support the use of TVUS for pre-induction cervical evaluation. Hence, this study was initiated to evaluate the association between TVUS of cervix and Bishop's Score in predicting successful induction of labour, as well as to determine the optimal cut-off points for cervical length measurement. The secondary endpoint was to assess patients' tolerability and acceptance for both procedures. This study hypothesized that cervical length measurement by TVUS would be a sensitive tool to predict the outcome of induction of labour, and used in the future to assist in the decision for induction of labour, either by complementing the existing Bishop score or as an alternative to Bishop score as the gold standard pre-induction cervical evaluation.

5. MATERIAL AND METHODS

A prospective cohort study was conducted in our hospital from March

2022 to May 2022 Around 160 singleton pregnant women attending the antenatal outpatient clinic or admitted in the ward, met the inclusion and exclusion criteria and after obtaining informed consent they were included in this study. Inclusion Criteria: singleton cephalic pregnancies with an uneventful antenatal course between 37+0 and 39+0 weeks of gestation Last antenatal visit within 7 days of delivery Membranes intact Exclusion Criteria: Elective lscs Women in active phase of labor Cervical insufficiency Severe obstetrics & medical conditions Twin pregnancy Preterm pregnancy Premature rupture of membranes After admission, clinically patients were evaluated by pelvic examination to determine fetal head engagement and the Bishop scores were calculated. figure 1. Thereafter, ultrasonography was performed by using the Philips Ultrasound 650 (clearvue, USA) and the C9-4v active array- a vaginal probe. 1. to evaluate cervix 2. to determine the cervical length 3. to check for the presence of funneling Then ultrasound with vaginal probe Is inserted into the vagina, 3 cm from cervix and length between the internal and external os of the cervix was measured. Observed the uterine cervix for atleast 60s And funneling was diagnosed only when the sonographic shape persisted during the time period. figure 2. The cervical longitudinal section was defined by the view of the cervical canal and the cervical length was defined as the shortest value based on four or more measurements. Cervical funneling was defined by sonographic findings of ballooning of the membranes into a dilated internal os with a closed external os, with protrusion of at least 15% of the entire cervical length . figure 3. When the bishop score was 4 and below Vaginal administration of prostaglandin E2, foleys catheter done for induction. When the bishop score was 5 and more, Continuous administration of oxytocin. After administration fetal heart rate continuously monitored by cardiotocography 30 min to 1 hr in all the patients. Data obtained based on mode of induction, delivery, time between the labour and delivery, maternal age, gestational age, decrease in hemoglobin level after delivery as a surrogate for the blood loss during the delivery and length of hospital stay. Demographic and clinical characteristics were compared between patients with and without funneling using Student's t-test for continuous values and using χ^2 test or Fisher's exact test for categorical values.

RESULTS (INCLUDING OBSERVATIONS)

Women aged 18 to 40 years old, with term (37 to 42 weeks gestational age) singleton pregnancies, who were planned for elective induction of labour were recruited and followed through the induction process until the delivery of the baby. Those with previous history of uterine surgery, placenta praevia, vaginal bleeding, multiple pregnancies, prelabour rupture of membranes, pre-eclampsia, intrauterine growth restrictions, known allergy towards prostaglandins, intrauterine fetal death, known fetal anomaly and estimated fetal weight $>3.8\text{kg}$ by scan were excluded from the study. Written consent was obtained from all recruited women Picture was magnified such that the cervix occupied at least 75% of the image. Three measurements of cervical length were taken over a period of 1 minutes(60secs) and the best shortest measurement was recorded. The presence of funneling was also documented, which was a funnel shape appearance at internal cervical os due to internal os dilatation, measuring at least 5mm. Subsequently, Bishop's cervical score was assessed by a different investigator (Investigator B) and each component was documented: os dilatation, cervical length or effacement, station of presenting part, position and consistency of cervix, with a maximum score of 13 (figure 1). Following that, women were asked to score their perception of pain for each procedure (TVUS and vaginal examination) using the 10-point Visual Analogue Scale (VAS), score 0 being 'no pain' and score 10 being 'very painful'. Their sociodemographic and obstetrics data were also collected. Age >35 years old was defined as advanced maternal age and height $<145\text{cm}$ was classified as short stature. Using standard labour induction protocol used at our Hospital either with an intracervical balloon (Foleys) catheter, inflated with 40-60cc of sterile water, placed for a maximum of 24 hours; or Prostaglandin E2 (Dinoprostone 3mg) tablets, 2 doses per day at least 6 hours apart, with a maximum of 3 doses in total; or intravenous oxytocin induction, with starting dose of 1–2 mU/min, increased at intervals of 30 min or more, aiming for 4–5 contractions in 10 minutes; or serial induction using a combination of methods above. The choice of induction of labour would be based on clinical risk assessment by the treating clinicians according to the hospital protocol. Augmentation of labour using oxytocin in labour room were done as per hospital protocol. Electronic fetal heart monitoring was performed for all patients Primary outcome measured was diagnostic accuracy of the cervical length compared with Bishop score in predicting successful induction of labour.

Caesarean delivery was performed for presumed fetal distress based on non-reassuring cardiotocograph tracing; or failure of induction of labour, defined as inability to achieve active phase of labour (cervical dilatation of $>4\text{cm}$) after 24 h of prostaglandin administration $\pm 12\text{h}$ of oxytocin infusion; or poor progress, which is defined as progress in cervical dilatation by less than 2 cm after 4 hours of oxytocin. A total of 200 women were assessed for eligibility, 10 women declined to participate and 30 women were excluded as not meeting the inclusion criteria.

Eventually, a total of 160 women were recruited and analysed, which included 72 nulliparous (44.9%) and 88 multiparous (55.1%) women. More than half of them were induced electively at 39wks as our hospital follows ARRIVE Trial (83cases, 51.8%), followed by FGR (20cases, 12.5%), oligohydramnios (18cases, 11.2%), hypertension (14cases, 8.75%), post term (9cases, 5.6%), medical conditions like heart and liver complicating pregnancies (7cases, 4.3%), diabetes (5cases, 3.1%) and other reasons, such as reduced fetal movements, fetal anomaly due to late confirmation of pregnancy beyond second trimester. Maternal demographic characteristics were shown in chart 1.

There was no statistically significant difference among the primigravida and multigravida groups in terms of mean maternal age (25 ± 5), mean height (150 ± 5), mean weight (60 ± 5), body mass index (25.90 ± 5.25), mean gestational age at induction ($39\text{ wks} \pm 2\text{wks}$), estimated fetal weight by transabdominal scan ($3\text{kg} \pm 0.5\text{kg}$), as well as the indications of induction of labour in chart 2.

Successful induction of labour i.e. vaginal delivery occurred in 108 women (67.5%). A total of 52 women (32.5%) delivered via Caesarean Section, with the indication of fetal distress (30 women, 18.7%), poor progress of labour (14 women, 8.75%) and failed induction of labour (8 women, 5%). There was a high degree of correlation between the cervical length and Bishop score, with r-value of 0.745, $p < 0.001$. Variables such as parity, cervical length, presence of funneling and Bishop score were associated with successful induction of labour. Table 1.

DISCUSSION

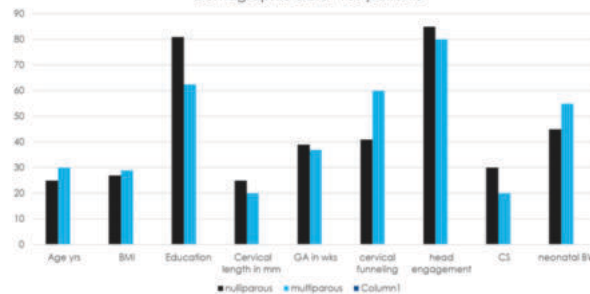
The bishop score is a well-established method for antenatal for induction of labor. Results present that cervical status by cervical funnelling, bishop score and cervical length are found to be independent predictors of successful vaginal delivery following labor induction. Thus compared to conventional methods, presence of cervical funnelling on tvs predict the success of labor induction and is associated with reduction of delivery time. My study findings were similar to the studies done by tan et al., brieger et.al. □ Suggesting cervical funnelling frequently present with shortened cervical lengths, its not surprising that both could serve as valid predictors of vaginal delivery.

Overall duration of labor shorter with cervical funneling observed related to cervical dilation but not the descent of the fetus or shortening 2nd stage of labour.

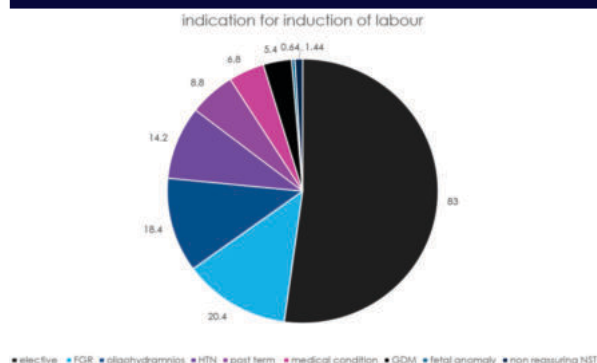
SUMMARY AND CONCLUSION

To summarize it can be said that induction of labour is the safest alternative to the spontaneous onset of labor, hence the doctor and the patient should understand the need for induction, methods of induction and the risk associated with it. Other modes of delivery in case of failed induction should be emphasized. So to conclude, the goal of induction is always to achieve the best maternal and fetal outcome. Compared to the conventional methods of cervical evaluation like Bishop score and cervical length, cervical funneling may serve as a useful and valid predictor of mode of delivery prior to labor induction.

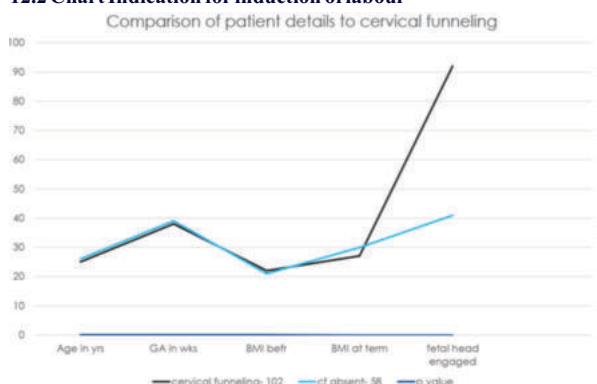
Demographic data- 160 patients



12.1 Chart Demographic data of cases



12.2 Chart Indication for induction of labour



12.3 Chart Comparison of patient with cervical funneling

Comparison of outcomes as per cervical funneling

	Cervical funneling Present- 102	Absent - 58	P- value
Cervical length in mm	13.72 $\pm$ 6.25	22.31 $\pm$ 6.80	<0.001
Bishop score <6	78(77.1%)	52.2(90%)	0.007
Vaginal delivery	92(90.5%)	44(75%)	0.004
Duration of 2 nd stage in min	52 $\pm$ 40	50 $\pm$ 47	0.805
Delivery within 12hrs	63/92 (68.4%)	26/44(59%)	0.003
Delivery time in mins	805 $\pm$ 579	946 $\pm$ 512	0.073

12.4 Table comparison of outcomes

11. Figures and Illustrations

Modified Bishop's Score

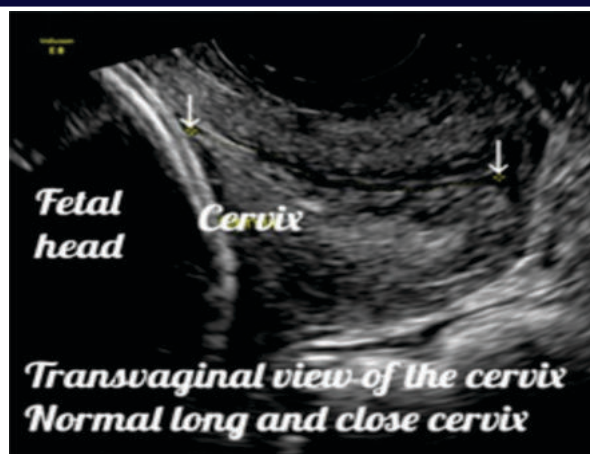
BISHOP SCORE

BISHOP SCORE = (total)		Date of Bishop Score:/...../.....		
Score	0	1	2	3
Dilation	Closed	1-2	3-4	5
Length	>4	3-4	1-2	0
Consistency	Firm	Medium	Soft	—
Position	Posterior	Midline	Anterior	—
Head: station	-3	-2	-1, 0	+1, +2

Favourable score->6

Best score-8

13.1 Figures modified bishop score figure 1



13.2 Figures transvaginal scan view of cervix

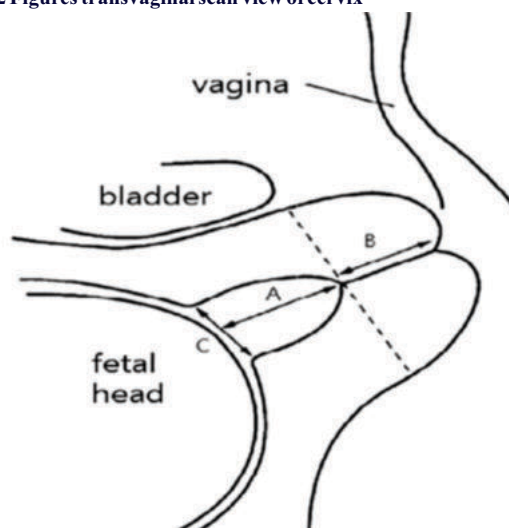


Figure 1 Transvaginal ultrasound of the cervix with funneling, showing funnel length (a), functional length (b) and funnel width (c). Cervical funneling was defined as bulging of the membranes into the endocervical canal with the bulge protrusion at least 15% of the entire cervical length $[A/(A+B) > 0.15]$. Adapted from cervical funneling: sonographic criteria predictive of preterm delivery.

Figures transvaginal view of cervix with funneling and measurement points figure 3

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