



Role of intrapartum ultrasonography to predict mode of delivery/success rate of vaginal delivery

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Abstract

Objective: The study was conducted to find out the role of intrapartum trans-perineal ultrasound to predict vaginal delivery by measuring head-perineum distance and angle of progression along with other foetal parameters

Materials and Methods: A prospective study was performed in 80 pregnant women at S.N Medical College, Agra over a period of one year. The study population included primigravid with singleton pregnancy with cephalic presentation with normal BMI in the first stage of labor at term pregnancy (≥ 37 weeks). Trans perineal ultrasound was done to measure Head Perineum distance and Angle of progression. Data was collected on demographic features of patients and mode of delivery.

Results: Out of 80 pregnant women recruited in the study, 44 pregnant women had normal vaginal deliveries and 36 pregnant women had cesarean section. The mean head perineum distance for vaginal delivery and cesarean

section were 39.25mm and 41.86mm respectively ($p < 0.01$). The mean value of angle of progression of fetal head in vaginal delivery and cesarean section were 114.86° and 99.28° respectively ($p < 0.01$).

Conclusions: Intrapartum trans-perineal ultrasound can be used for evaluation of progress of labor and prediction of successful vaginal delivery and thus decrease maternal and neonatal morbidity associated with second stage cesarean section.

Keywords: Trans-perineal ultrasound (TPU), intrapartum translabial ultrasound (ITU), intrapartum sonography (IPS), head-perineum distance (HPD), angle of progression (AOP), midline angle (MLA), normal vaginal delivery (NVD), operative vaginal delivery (OVD), cesarean delivery (CD).

Introduction

Perinatal outcome can be improved if we can identify whether a woman would have normal vaginal delivery or cesarean section when she passes into labour. The incidence of caesarean section has increased over the

years and failure to progress during labor is one of the causes of cesarean section.

Second stage cesarean section is associated with increased maternal and neonatal morbidity. The incidence of intracranial hemorrhage depends on the mode of delivery, increasing from 1 in 1900 with spontaneous vaginal birth to 1 in 860 with vacuum delivery and 1 in 333 with caesarean section after failed operative vaginal delivery.¹

Digital vaginal examination is done routinely to assess dilation, effacement, consistency, position of cervix and to assess descent of fetal head during delivery but it is very subjective, inconsistent, may not be accurate, associated with infection and is inconvenient/painful to women in labour.²

Use of ultrasound during labor can overcome these limitations as it is more objective, less invasive, superior to vaginal examination for identifying the correct fetal head position and is able to predict labor outcomes in primiparous women.³ During labor ultrasound can be performed by trans-abdominal, transvaginal, trans-labial or trans-perineal route.

Transabdominal ultrasound is used to determine fetal head position in labor and is superior to digital vaginal examination with a higher degree of accuracy. On transvaginal scan cervical score including cervical length, funneling, position of cervix and distance of presenting part from external os can be obtained equivalent to bishop, s score. This may help to reduce the discomfort of repeated vaginal examination and increased women satisfaction with labour process especially in women at high risk of infection.⁴ Trans perineal ultrasound can be used to measure fetal head station and detect descent of head by using ultrasound markers including head perineum distance, angle of progression, fetal head symphysis distance and fetal head direction.⁵

Many studies available on intra labour ultrasonography during second stage of labour when cervix is fully (10cm) dilated while here we planned ultrasound to be started from first stage of labour(4cm) and repeated accordingly till one hour after full dilatation of cervix or delivery of foetus whichever occur earlier.

The aim of study was to evaluate the ability of intralabour transperineal ultrasound to predict mode of delivery in primigravid women with singleton pregnancy and its acceptance over repeated digital vaginal examination.

Materials And Methods

This prospective cohort study was performed in the labour room, department of obstetrics and gynecology in single tertiary center hospital from December 2021 to November 2022 over a period of one year. Approval for study was taken from the Institutional Review Board as well as the Research and Ethical Committee.

The study population included only primigravid women with singleton pregnancy with cephalic presentation with normal BMI in the first stage of labor at term pregnancy (≥ 37 weeks).

Informed consent was obtained from all individual participants included in the study.

Exclusion criteria included multiparous women, multiple pregnancy, women having clear indication for cesarean section, other than cephalic presentation, placenta previa, severe foetal growth restriction, hypertensive/ diabetic/ obese or women who were not willing to participate in the study.

Active phase of labor is diagnosed when cervical dilation is ≥ 4 cm and regular uterine contractions are taking place. After emptying urinary bladder women were laid down in supine position, keeping hips and knees flexed. Digital vaginal examination was performed to assess cervical dilation, position and descent of head. The

Esaoite Ultrasound machine available in labour room with 5MHz C6-2 convex transducer covered with gel and sterile, non-powdered glove was used. After application of antiseptic gel over perineum the transducer was applied in sagittal plane below the pubic bone at the midline between the labia. Small lateral transducer motions should be made to get a proper image of the symphysis pubis and foetal skull with no shadowing from the pubic rami.⁶ perineal ultrasound was performed to measure angle of progression (AOP) and head perineal distance (HPD).

To measure head perineum distance (HPD) transducer was placed on the perineum transversally between the labia majora in the posterior fourchette and compressing the soft tissue against the pubic bone. It was first described by Eggebo et al for evaluating fetal head station. It is measured by calculating the shortest distance from the perineal skin surface to the outmost bony limit of fetal skull.^{7,8}

Angle of progression (AOP) was measured in the sagittal plane. It is defined as angle through the midline of pubic symphysis and a line running from the inferior apex of symphysis tangentially to the fetal skull. Various studies have found it as a useful parameter for assessment of fetal head descent.^{9,10}

Head station in cm = Angle of progression (in degree) x 0.0937-10. 911.

The decision regarding the mode of delivery was based on digital vaginal examination and foeto-maternal condition and not the ultrasound findings.

Delivered women were divided into two groups- group A included normal/operative vaginal delivery (NVD/OVD), group B included cesarean delivery (CD)

Statistical Analysis: The quantitative data was expressed as Mean ± Standard Deviation. Comparison between

groups was made by using t test. P<0.05 was considered as statistically significant.

Results

Total numbers of pregnant women recruited in the study were 80. Out of these, 44 pregnant women had vaginal deliveries (NVD/OVD) and came under group A. While 36 pregnant women had cesarean section(CD) that included in group B. The indications for cesarean deliveries were due to failure in the progress of labor or due to foeto-maternal distress. There was no significant difference in maternal age, socioeconomic status, maternal BMI in both the group (table 1). Gestational age at delivery, weight of newborn, Apgar score and NICU admission in vaginal delivery group as well as cesarean group were also comparable (table 1)

Table 1: Demographic Characteristics of Patients

Demographic Parameters	Vaginal Delivery (N1=44) (group A)	Caesarean Section (N2=36) (group B)	P-Value
Age (yrs)	25.45 ± 1.08	25.44 ± 1.38	>0.05
BMI (kg/m ²)	28.48 ± 0.70	28.68 ± 0.55	>0.05
Gestational Age (weeks)	39.55 ± 0.50	39.44 ± 0.50	>0.05
Birth weight	2.5± 0.75	2.5± 1.05	>0.05
APGAR Score	7± 0.65	7± 0.75	>0.05
NICU admission	1± 0.25	1± 0.35	>0.05

The mean Head perineal distance for Vaginal delivery and Caesarean section were 39.25 mm and 41.86 mm respectively (p<0.01). The mean value of angle of progression of fetal head in vaginal delivery and

Caesarean section were 114.86° and 99.28° respectively (p<0.01) in our study. (Table 2)

Table 2: Comparison of Parameters according to Delivery Route

Parameters	Vaginal Delivery (N1=44) (group A)	Caesarean Section (N2=36) (group B)	P-Value
Mean Head Perineum Distance (mm)	39.25 ± 0.65	41.86 ± 0.52	<0.001
Mean Angle of Progression of Fetal Head (°)	114.86 ± 3.89	99.28 ± 4.69	<0.001

Discussion

Digital vaginal examination is considered as the gold standard in evaluating foetal head progression although it subjective with many limitations.^{11,12}

Trans perineal ultrasound (TPUS) can be promising tool in labour monitoring by measuring Head perineum distance (HPD) and angle of progression (AOP) especially in case of prolonged labour or before attempting an operative vaginal delivery (OVD).^{13,14} Despite being more precise, reproducible, less painful and easily acceptable by the patients it is less widely used. In our study all women who had Head perineum distance < 40 mm had a vaginal delivery. Similarly, Helene Ingeberg et al in their study also found Head perineum distance (HPD) of 40 mm a predictive of vaginal delivery.¹⁵ Kahrs et al in their study found head perineum distance 35 mm correspond to head station 0 and found significantly lower rate of caesarian section in women with Head perineum distance ≤ 35 mm compared to >35 mm (3.9% vs 22%, p<0.01).⁸ Similarly, Tutschek et al and Maticot-Baptista et al in their study found 36- and 38-mm head perineum distance

corresponding to head station 0 in their respective studies.^{10,16}

Head station can be assessed by ultrasound by using formula obtained by regression of head station over angle of progression.^{17,18} Angle of progression of 116° corresponds to zero head station. In our study we found that cut off value of 110° for angle of progression (AOP) for prediction of vaginal delivery while study by Helene Ingeberg study supported for AOP more than 105°. ¹⁵ Barbera AF et al and Eggebo TM et al in their studies found an Angle of progression of 120° and 110° as cut off for normal vaginal delivery.^{18,19}

Levy et al in their study found an Angle of progression <95° associated with an increased rate of caesarean delivery.²⁰ Larger Angle of progression (AOP) is associated with advance gestation age, spontaneous and successful vaginal delivery.²¹

Although our study has several limitations as small sample size, lack of control of confounding factors like foeto-maternal distress and attendant’s request/consent regarding decision for cesarean section.

Conclusion

Intrapartum Ultrasound can be used for evaluation of progress of labor and prediction of successful vaginal delivery and thus decrease maternal and neonatal morbidity associated with second stage cesarean section. Images stored can be use in case of any medicolegal issue in the future. In addition to use of ultrasound to make antenatal diagnosis of fetal abnormalities its use in labor should be encouraged. Intrapartum sonography (IPS) should always be performed in case of:

1. Slow progress to arrest of labour,
2. Suspect foetal malpresentation like occipito posterior,
3. Before instrumental delivery.

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