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# Ultrasound Criteria for Expecting Mode of Delivery after Induction of Labour in Primigravida with Postdates

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## Abstract

**Background:** Intrapartum transabdominal US of the positions of the fetal head recorded during labor could be useful indicator for expecting persistent Occipito Posterior position and labor induction failure.

**Methods:** To evaluate the role of US in expecting mode of delivery.

**Results:** Group1 shows a mean perineal-head distance of 35.8mm ±3.8mm while in group 2 it is 50.4mm ± 2.8 mm.68.3% of subjects in groups1 show occipito-anterior head positions compared to 32.8% in group2.

**Conclusions:** Pre-induction US assessment can be used as an objective tool for the prediction of mode of delivey including TVS measurement of cervical canal length in mm, TPS perineal head distance assessment in mm, as well fetal head position assessed by TAS.

**Keywords:** Labour; Transperineal; US

## Introduction

The percent of labour induction increased in the past years. In induction of labour either electively or medically is associated with higher incidence of cesarean section especially in primigravida with two fold increase than in spontaneous labour [1,2].

Pregnant women always ask about the risk of failure of labour induction and the possibility of CS. Researches revealed that intrapartum CS is related to a increased possibility of fetomaternal complications than planned CS delivery [3].

Bishop scoring system is still the standard method for prediction of the outcome of induction of delivery, with unfavorable cervical assessment with Bishop Score below six is the clinical risk factor. But Bishop Score has disadvantage of being subjective and has high intra observer and inter observer variability. Many studies revealed that Bishop Score is a poor predictor of outcome but might assist in prediction of the the length of the latent phase [4].

The role of TVUS is its ability to visualize the cervix completely; also it can evaluate the effacement and the internal os and is less invasive than vaginal exam [5].

Position of Fetal head affect the progress of delivery as occipito posterior positions could associate with prolonged and difficult labour. Arrest of labor might happen when the fetal head couldnot rotate or descend. As a result, fetal occipito- posterior position is associated with a higher possibility of CS, and in ladies in whom the baby is in the occipito- posterior position; vaginal delivery could be complicated by perineal tears or extension of an episiotomy [6].

Intrapartum Tran abdominal US of the positions of the fetal head recorded during labor could be useful indicator for expecting persistent Occipito Posterior position and labor induction failure [7].

Evaluation of Fetal head station in labor is based on the relation between the leading edge of the fetal head and maternal pelvic landmarks (ischial spines). However, from physicians with high experience there is high changeability in the analysis of fetal station, reflecting how hard and unreliable this clinical estimation can be, particularly when caput or molding are present. Therefore, a more objective way for evaluating fetal station will lead to better decisions as regard stoppage of progress in labor. Ultrasound was reported as a helpful technique for assessment of the level of the fetal presenting part within the maternal pelvis [8].

## Patients and Methods

### Study Type

A prospective observational cross-sectional study was made on postdate primigravida undergoing induction of labour at 40+ weeks of gestation at emergency unit of Obstetrics and Gynecology department Suez Canal university hospital and Aljazeerah Hospital, Egypt.

### Inclusion Criteria

- Primigravida ,Singleton pregnancy ,Postdate pregnancy at 40+ wks
- Reassuring non- stress test, Adequate pelvis by clinical pelvimetry
- Cephalic presentation with intact membranes

### Exclusion Criteria

- Multiparous Pregnancy, Ruptured membranes, Women presented in active stage of labour, Contraindication for induction of labour such as (Placenta previa- fetal malpresentation-previous cesarean deliveries –previous myomectomy……..etc.)
- Chronic maternal illnesses such as (chronic hypertension-pregestational diabetes-thyroid dysfunction……etc.)
- Pregnancy induced illnesses such as (preeclampsia-gestational diabetes …….etc.)

### Sample Size

The sample size will be calculated using the following formula:

$$n = \left[ \frac{Z_{\alpha/2} * \sigma}{\mathrm{E}} \right]^2$$

Where:

**n** = sample size
$\mathbf{Z}_{\alpha/2}$ = 1.96 (The critical value that divides the central 95% of the Z distribution from the 5% in the tail)
**σ** = the estimate of the standard deviation =1.4 [(2)]
**E** = Margin of error/width of confidence interval = 10%
So, by calculation sample size won't be less than 139 [9].

### Sampling Method

Conventional non-randomized sampling of all pregnant women admitted to Suez Canal University emergency unit and Aljazeerah Hospital meeting the inclusion criteria till the sample size is reached.

### Study Design

All women included in the study were informed about the exact indication of induction of labour. Detailed counseling about hazards of labour induction including but not limited to uterine hyperstimulation, risk of emergency CS and uterine rupture. Benefits of induction of labour were also explained including avoidance of caesarean deliveries with subsequent short and long term complications. Informed consent regarding participating in the study and induction of labour itself was then signed.

Detailed history taking and detailed general and local examinations were done. Gestational age was confirmed by date of LMP and early first trimester US. Non-stress test and formal pregnancy US was done to evaluate fetal wellbeing and growth.

Tran's abdominal ultrasonography to assess estimated fetal body weight, fetal head position and amniotic fluid index, transvaginal ultrasonography to estimate cervical canal length and transperineal ultrasonography to measure perineal- head distance were carried out in the outpatient and emergency unit.

**Assessment of our study parameters as follows:**

Cervical canal length measurement:

- Cervical length is the linear distance between calipers placed at the internal and external os [10].

Expected fetal body weight measurement:

• This was calculated automatically by the equipment, using Hadlock's reference table [11].

Amniotic fluid index measurement:

• This was measured by dividing the uterus into four imaginary quadrants.

Fetal head position assessmsent:

• Transverse suprapubic transabdominal real time ultrasound was performed to identifythe landmarks depicting fetal occiput position as the midline cerebral echo, fetal thalami and cerebellum for occiput transverse and anterior positions, and the fetal orbits for occiput posterior positions [12].

Fetal head position was classified

**1) Occipito-anterior positions including** (left occiput anterior (LOA) -occiput anterior (OA), and right occiput anterior (ROA)).

**2) Non-occipito-anterior positions including** (left occiput posterior (LOP) - occiput posterior (OP), right occiput posterior (ROP), right occipito transverse (ROT), and left occipito transverse (LOT)).

**Perineal-head distance**

• Transperineal ultrasound examination was performed with the woman in a supine position and with an empty bladder. The shortest distance from the outer bony limit of the fetal skull to the skin surface of the perineum was measured with the probe held over the perineal with firm pressure, but without creating any discomfort for the woman. All measurements was repeated three times, and a mean value was calculated [13].

**Induction of labour protocol was carried out according to SOGC Clinical Practice Guideline September 2013 as follows [14]:**

• The Bishop score was done by performing a vaginal examination and assessment of fetal head station, cervical canal dilation, cervical effacement, cervical position and cervical consistency.

• A bishop score of six or more generally indicates that the cervix is ripe, or 'favourable' and there is a high chance of spontaneous labour, or response to interventions made to augment labour by amniotomy and oxytocin intravenous drip and those patient was excluded from the study.

• A bishop score less than six indicate unriped cervix with need of ripening by vaginal Prostaglandin E1misoprostol 200 mcg (Misotac©) SIGMA pharmaceutical industries.

• Scored tablets were divided into four quarters and one quarter (50 mcg) was administered into post vaginal fornix every 4 hours as long as contractions are absent for 24 hours.

• Electronic fetal monitoring was performed for 30 minutes after administration of misoprostol and for 60 minutes after any tachysystole.

• After ripening of cervix, oxytocin was administered 4 hours after the last dose of Misotac©using low-dose regimen with 1 to 2 mU/min, increased incrementally by 1 to 2 mU at 30-minute intervals till achievement of effective uterine contractions.

• Labour progress follow up was done using partogram.

• Women who failed to develop uterine contractions and enter active stage of labour was defined as failed induction, delivered by CS and excluded from the study.

• Women who entered active phase of labour with failure to progress in presence of effective uterine contractions (3-5 per 10 minutes which lasts for more than 40 seconds) were delivered by CS but involved in the study [15].

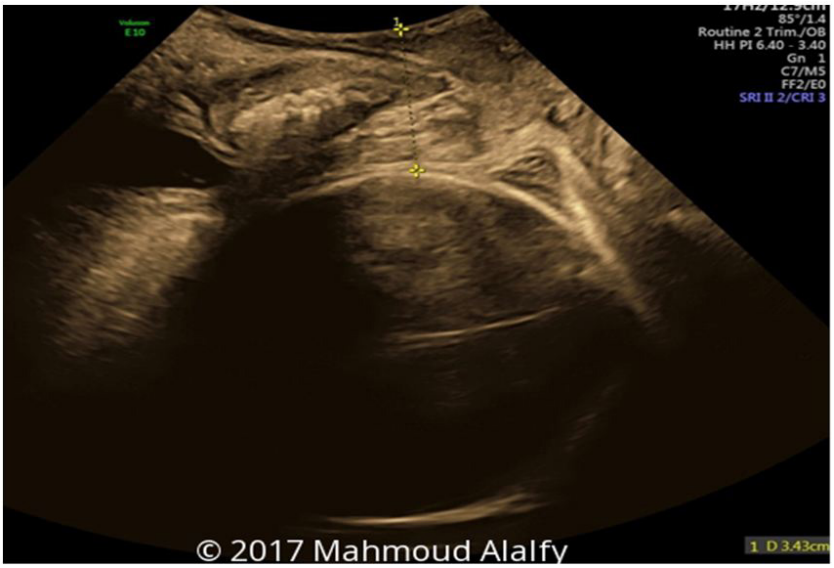


**Figure 1A:** Demonstrates a head perineal distance

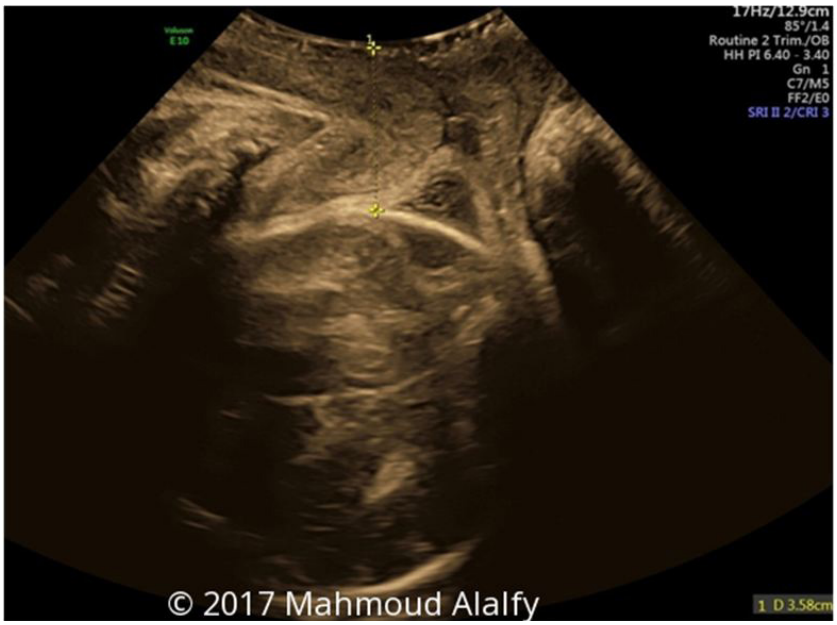


**Figure 1B:** Demonstrates a head perineal distance

- **Indicators of failure to progress in primigravida:**
  - Prolonged first stage>20 hours, Prolonged second stage >2 hours without epidural anesthesia, Protracted dilation < 1.2 cm/hrs.
  - Protracted descent < 1 cm/hrs, Arrest of dilation >2 hours.
  - Arrest of descent >2 hours ,Prolonged third stage >30 min
- Two groups of women based on the outcome of induction of labour were defined; those with successful induction who experienced vaginal delivery (group 1) and those with caesarean delivery due to failure to progress (group 2).
- Women who delivered by CS due to other cause apart from failure to progress as (failure to develop uterine contractions after receiving vaginal misoprostol for 24 hours or emergency CS for fetal distress) were excluded from the study.

The main outcome measure was successful vaginal delivery after induction of labour.

## Statistical Analysis

Collected data was processed using SPSS version 22. Quantitative data were expressed as mean ± SD while qualitative data were expressed as numbers and percentages.

Student *t* test was used to test significance of difference for quantitative variables and Chi Square was used to test significance of difference for qualitative variables. A probability value (p-value) <0.05 was considered statistically significant.

## Results

The present study included 149 pregnant women presented to the emergency Obstetrics and Gynecology department in Suez Canal University hospital and Aljazeerah Hospital and fulfilled the inclusion. The study population was one group of pregnant postdates (beyond 40 weeks gestation) women, with singleton viable fetus, cephalic fetal presentation, and no previous uterine scars.

During study duration (10 months) about 566 pregnant women were admitted for induction of labour for various indications of which about 270 women were postdate primigravida who met inclusion criteria; of whom 190 accepted to participate in the study. Those decided to abort the trial of induction or terminated by CS due to other causes apart from failure to progress were excluded from study sample as shown in study consort flow chart (Figure 2).

One hundred forty nine women completed the study and two groups of women, based on the outcome of induction of labour were defined; those with successful induction who experienced vaginal delivery (group 1) and those with caesarean delivery due to failure to progress (group 2).

**Table 1** shows that the study included 149 pregnant women with a mean age of 25 years ± 3.3 years. The mean gestational age was 40 weeks and 5 days at time of induction.

**Table 2** shows the distribution of clinical vaginal examination data among pregnant women in the study. The mean cervical dilatation was 1.7 cm ± 0.7; the Mean cervical effacement was about 25 %. Mean bishop score value was 3.7 ± 1.1. The fetal head position was Occipito-anterior in 48 (32.2%) and in 77.2% of the study population, the fetal head station was -2 or higher.

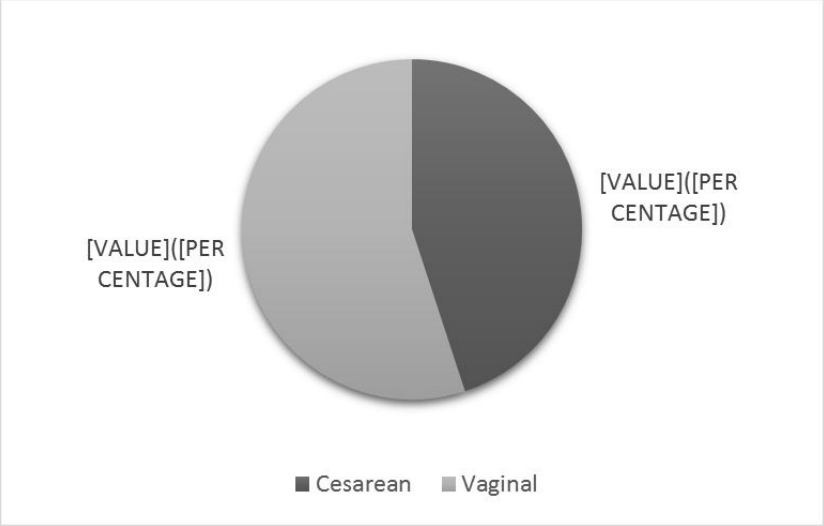


**Figure 2:** Distribution of mode of delivery after induction of labour in study subjects

| | Mean ±SD | Range |
|---|---|---|
| **Age (in years)** | 24.8±3.3 | 18-37 |
| **Duration of marriage (in years)** | 2.1±1.0 | 1-4 |
| **Gestational age** | 40 weeks 5days ±8.6 days | 40 weeks- 42weeks 2days |
| **BMI*** | 26±2 | 23- 32 |

**Table 1:** Demographic data of the study population
*BMI: Body Mass Index

| Clinical parameter | | Mean ± SD | Range |
|---|---|---|---|
| **Cervical dilatation (in cm)** | | 1.7±0.7 cm | 1-3 cm |
| **Cervical effacement %** | | 25.7±7.4 % | 0-40 % |
| **Bishop score** | | 3.7±1.1 | 1-6 |
| | | **Number** | **Percentage** |
| **Cervical consistency** | Firm | 74 | 49.6 % |
| | Medium | 60 | 40.3 % |
| | Soft | 15 | 10.1 % |
| **Cervical position** | Posterior | 49 | 32.9 % |
| | Midway | 80 | 53.7 % |
| | Anterior | 20 | 13.4 % |
| **Fetal head station** | Station -3 | 56 | 37.6 % |
| | Station -2 | 59 | 39.6 % |
| | Station -1 | 22 | 14.7 % |
| | Station 0 | 12 | 8.1 % |

**Table 2:** Distribution of clinical examination data among study population

**Table 3** shows that mean cervical canal length as measured by transvaginal ultrasound was 28.3 mm ± 4.6 mm. The mean perineal head distance was 45.6 mm ± 5.5 mm. AFI and EFBW showed narrow range of variation between study subjects.

| Ultrasound parameter | | Mean ± SD | Range |
|---|---|---|---|
| **AFI*** | | 10.4±2.3 cm | 4-16 cm |
| **EFBW**** | | 3220.8±340.1 gm | 2600-4200 gm |
| **Cervical length** | | 28.3±4.6 mm | 20-37 mm |
| **Perineal-head distance** | | 45.6±5.5 mm | 35-56 mm |
| **Fetal Head position** | **Occipito-anterior** | 48 | 32.2 % |
| | **Non occipito-anterior** | 101 | 67.8 % |

**Table 3:** Ultrasound examination data among study population
* AFI = Amniotic fluid index
** EFBW = Expected fetal body weight

**Figure 2** shows the distribution of mode of delivery after induction of labour in study subjects with 82 (55 %) women have vaginal delivery (group 1) while 67 (45%) experienced caesarean delivery due to failure to progress (group2).

**Table 4** shows the demographic characteristics in both the study groups.

| | Vaginal delivery (Group 1) n=82 | Cesarean section (Group 2) n=67 | P value |
|---|---|---|---|
| **Age (in years) (Mean ±SD)** | 24.8±3.5 | 24.9±3.1 | 0.897# |
| **Duration of marriage (in years)** | 2.1±1.0 | 2.1±0.9 | 0.736* |
| **1 year** | 28(34.1%) | 20(29.9%) | 0.443¥ |
| **2 years** | 30(36.6%) | 25(37.3%) | |
| **3 years** | 14(17.1%) | 18(26.9%) | |
| **4 years** | 9(11.0%) | 4(6.0%) | |
| **5 years** | 1(1.2%) | 0(0.0%) | |
| **Gestational age (in days) (Mean ±SD)** | 286.2±11.2 | 284.8±3.4 | 0.341# |

**Table 4:** Demographic data of study groups
#Student's-t test used *Mann-Whitney test used ¥Chi- square test used

**Table 5** shows comparison between clinical vaginal examination data before induction of labour between the study groups. The mean cervical dilatation in vaginal delivery group was 2.2 ± 0.9 while in cesarean section group was 1.4 ± 0.6 which was statistically significant. Mean cervical effacement was 30.5% ± 8.2 % in vaginal examination group compared to 20.9% ± 10.5%in cesarean section group.44% of patients in group 1 had soft cervix compared with 4% in group2.mean bishop score in group1 was 4.2 ± 1.6 while in group2 2.6 ± 1.2.

| | Vaginal delivery (Group 1) n=82 | Cesarean section (Group 2) n=67 | P value |
|---|---|---|---|
| **Cervical dilatation (in cm) (Mean ±SD)** | 2.2±0.9 | 1.4±0.6 | <0.001*$ |
| **Cervical effacement % (Mean ±SD)** | 30.5% ±.2% | 20.9%±10.5% | <0.001*$ |
| **Cervical consistency** | | | |
| **Firm** | 8(9.8%) | 38(56.7%) | <0.001¥$ |
| **Medium** | 30(36.6%) | 25(37.3%) | |
| **Soft** | 44(53.7%) | 4(6.0%) | |
| **Cervical position** | | | |
| **Posterior** | 16(19.5%) | 33(49.3%) | <0.001¥$ |
| **Midway** | 46(56.1%) | 34(50.7%) | |
| **Anterior** | 20(24.4%) | 0(0.0%) | |
| **Fetal head station** | | | |
| **Station -3** | 17(20.7%) | 29(43.3%) | <0.001$ |
| **Station -2** | 24(29.3%) | 19(28.4%) | |
| **Station -1** | 23(28%) | 13(19.4%) | |
| **Station 0** | 18(22%) | 6(9.0%) | |
| **Bishop score (Mean ±SD)** | 4.2±1.6 | 2.6±1.2 | <0.001*$ |

**Table 5:** Clinical vaginal examination findings distribution between study groups
* Mann-Whitney test used ¥ Chi- square test used $ statistically significant at p<0.05

**Table 6** shows that the mean cervical canal length in group1 was 25.8 mm ± 3.7mm compared with 31.4mm ± 3.5mm ingroup2 which was statistically significant. Group1 shows a mean perineal-head distance of 35.8mm ± 3.8mm while in group 2 it is 50.4mm ± 2.8 mm.68.3% of subjects in groups1 show occipito-anterior head positions compared to 32.8% in group2. AFI and EFBW show no statistically significant difference.

AFI Amniotic fluid indexEFBW Expected Fetal Body weight

**Table 7** shows analysis of ROC curve of the optimal cut off point of bishop score at the time of induction in the prediction of successful induction of labour which was ≤ 4 with 79.9% sensitivity and 63.5 % specificity with area under the curve 81% as shown in Figure 2.

**Table 8** shows analysis of ROC curve of the optimal cut off point of cervical canal length at the time of induction in the prediction of successful induction of labour which was ≤ 26.6mm with 85 % sensitivity and 65.7% specificity with area under the curve of 88% as shown in figure 2.

| | Vaginal delivery (Group 1) n=82 | Cesarean section (Group 2) n=67 | P value |
|---|---|---|---|
| **Cervical length in mm (Mean ±SD)** | 25.8±3.7 | 31.4±3.5 | <0.001#$ |
| **Perineal head distance in mm (Mean ±SD)** | 35.8±3.8 | 50.4±2.8 | <0.001#$ |
| **AFI (Mean ±SD))** | 10.4±2.4 | 9.4±2.2 | 0.854 |
| **EFBW (Mean ±SD)** | 3242.7±350.2 | 3211.9±329.2 | 0.585 |
| **Us fetal head position** | | | |
| **Occipito-anterior** | 56(68.3%) | 22(32.8%) | <0.001 |
| **Non occipito-anterior** | 26(31.7%) | 45(67.2%) | |

**Table 6:** Ultrasound parameters distribution between study groups
* Mann-Whitney test used
¥Chi- square test used
$statistically significant at p<0.05
# Student's-t test used
AFI Amniotic fluid indexEFBW Expected Fetal Body weight

| Cut off value | ≥ 4 | |
|---|---|---|
| **Sensitivity** | 79.9 % | |
| **Specificity** | 63.5 % | |
| **Area under the curve** | 0.81 | |
| **Standard error** | 0.04 | |
| **P value** | <0.001 | |
| **95% Confidence Interval** | **Lower bound** | 0.74 |
| | **Upper bound** | 0.88 |

**Table 7:** Analysis of ROC curve of the bishop scoreht

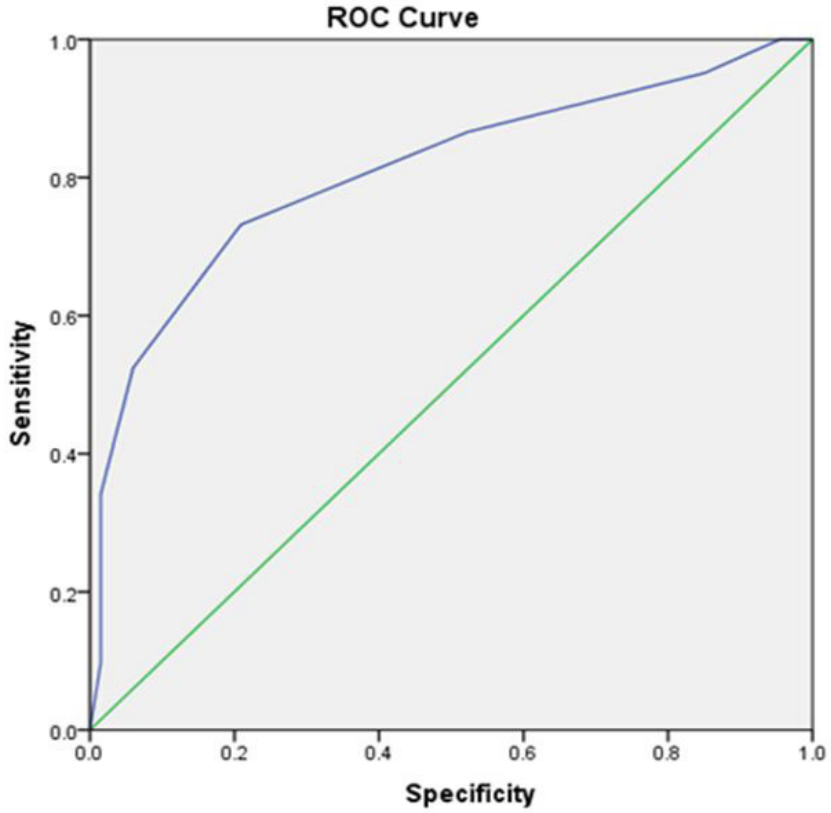


**Figure 3:** ROC curve of bishop score optimal cut off value in prediction of successful induction

**Table 9** shows analysis of ROC curve of the optimal cut off value of perineal-head distance at time of induction in the prediction of successful induction of labour which was ≤ 46.5mm with 92.7 % sensitivity and 62.5% specificity with area under the curve of 97% as shown in Figure 4.

| Cut off value | ≤ 26.6 mm | |
|---|---|---|
| Sensitivity | 85 % | |
| Specificity | 65.7 % | |
| Area under the curve | 0.88 | |
| Standard error | 0.028 | |
| P value | <0.001 | |
| 95% Confidence Interval | Lower bound | 0.822 |
| | Upper bound | 0.932 |

**Table 8:** Analysis of ROC curve of the cervical canal length

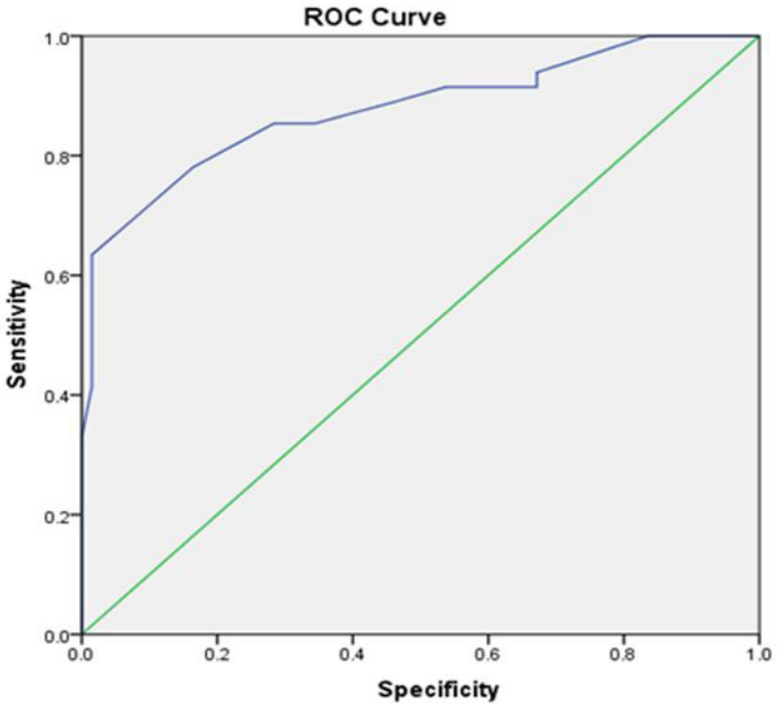


**Figure 4:** ROC curve of cervical canal length optimal cut off value in prediction of successful induction

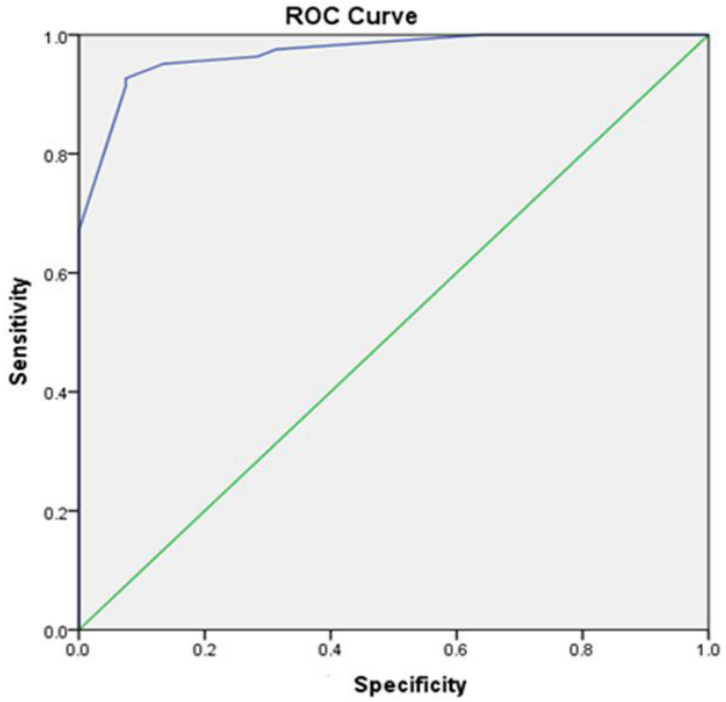


**Figure 5:** ROC curve of perineal-head distance optimal cut off value in prediction of successful induction

| Cut off value | ≤ 46.5 mm | |
|---|---|---|
| Sensitivity | 92.7 % | |
| Specificity | 62.5 % | |
| Area under the curve | 0.97 | |
| Standard error | 0.012 | |
| P value | <0.001 | |
| 95% Confidence Interval | Lower bound | 0.946 |
| | Upper bound | 0.993 |

**Table 9:** Analysis of ROC curve of TPS perineal head distance

**Table 10** shows logistic regression analysis was done to detect predictors of vaginal delivery. Variables entered on to the model were AFI, EFBW, US fetal head position, cervical length and perineal-head distance. As presented in table predictors of vaginal delivery were US fetal head position, cervical length and perineal-head distance.

| | β | P value | OR | 95% C.I. for OR | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| US Fetal Head Position | -0.433 | 0.030 | 0.65 | 0.60 | 0.96 |
| Cervical length | -0.330 | 0.040 | 0.89 | 0.73 | 0.94 |
| Perineal head distance | -0.832 | <0.001 | 0.44 | 0.32 | 0.60 |
| Constant | 42.400 | <0.001 | | | |

**Table 10:** Logistic regression analysis of US predictors of vaginal delivery

## Discussion

The rate of delivery induction increased in the previous two decades and is associated with an increased risk of cesarean delivery particularly in nulliparous women who have an overall 2.2 fold higher risk than women presenting in spontaneous labor [2,16].

As well as assessment of the cervix, there are many factors that could help in prediction of mode of delivery in spontaneous and induced labor. These include fetal head position amniotic fluid volume and fetal weight [17,18].

The majority of studies have used each of these ultrasonographic parameters separately as predictors of outcome of induction of labour, however this study aimed to determine whether a combination of several ultrasound parameters i.e. amniotic fluid index, estimated fetal body weight, fetal head position, cervical canal length and perineal-head distance could improve the prediction of the successful vaginal delivery after induction of labor and whether this would allow more accurate counseling and better informed consent in the decision-making process regarding induction of labor.

This study was a prospective observational cross-sectional study of primigravida with postdates who underwent induction of labour at 40+ weeks of gestation at emergency unit of Obstetrics and Gynecology department, Suez Canal university hospital and Aljazeerah hospital.

The study included 149 pregnant women fulfilling the inclusion and exclusion criteria. At the beginning of the study, subjects were one group of pregnant postdates (beyond 40 weeks gestation) women, with singleton viable fetus, cephalic fetal presentation, and no previous uterine scars.

During study duration (10 months) about 566 pregnant women were admitted for induction of labour for various indications. About 270 women were postdating primigravida meeting inclusion criteria; of whom 190 accepted to participate in the study. Those decided to abort the trial of induction or terminated by CS due to other causes apart from failure to progress were excluded from study sample.

One hundred forty nine women completed the study and two groups of women based on the outcome of induction of labour were defined; those with successful induction who experienced vaginal delivery and those with caesarean delivery due to failure to progress (group 2) with 82 (55%) women have vaginal delivery while 67 (45%) experienced Caesarean delivery (group2).

The mean age of study subjects was 25 years ± 3.3 years. The mean gestational age was 40 weeks and 5 days at time of induction. The mean BMI was 26 ± 2.3with statistically insignificant differences.

In the study comparison between clinical vaginal examination data between both study groups was statistically significant in predicting outcome of induction of labour as mean cervical dilatation in vaginal delivery group was 2.2 ± 0.9 while in cesarean section group was 1.4 ± 0.6 and mean cervical effacement was 30.5% in vaginal examination group compared to 20.9% in cesarean section group.

Several studies evaluated bishop score as a predictor of induction outcome as in Xenakis's prospective study involved 597 pregnancies stratified by low (4 to 6) and very low(0 to 3) Bishop scores. It was found that the highest risk of CS in both nulliparous and parous women was with scores of 0 to 3versus with a Bishop score > 3. Even women with a score of 4 to 6 had a significantly

higher risk of CS than those with spontaneous labour. The rate of failed induction was higher for women with a very low Bishop score (0 to 3) in both nulliparous and parous women [19].

In our study the mean bishop score in group 1 was 4.2 ± 1.6 while in group 2 was 2.6 ± 1.2 and the ROC curve of the optimal cut off point of bishop score at the time of induction was ≥ 4 for prediction of successful induction with 79.9% sensitivity and 63.5 % specificity.

Several studies compared the ability of the Bishop score to predict successful labour induction with ultrasound assessment of the cervix with conflicting results. Peregrineet al. reported cervical length > 1 cm to be a predictor for CS with induction of labour [20]. In contrast, Hatfield *et al.* found that cervical length was not predictive of successful labour induction [21].

Rozenberg *et al.* reported that the Bishop score was a better predictor of time interval from induction to delivery and Groeneveld et al suggested that the best cut-off value for the Bishop score for the prediction of successful induction was 3, with a sensitivity of 56.3% and a specificity of 72.2% [22,23].

In the present r study transvaginal ultrasonographic assessment of cervical canal length mean in vaginal delivery group was 25.8 mm ± 3.7mm compared with 31.4mm ± 3.5mm in CS group which was statistically significant .Also cervical canal length value with cut off point ≤ 26.6 mm showed 88% sensitivity and 65.7% specificity for the prediction of successful induction.

Rane *et al.* Log rank tests demonstrated that the best discriminator of induction to delivery interval was sonographic cervical length. ROC curves showed that area under the curve was 82 % using the optimum cut-off of 24 mm a sensitivity of 84% and a specificity of 59% [5].

Another research compared the role of transvaginal ultrasonographic measurement of the cervical length versus the Bishop score, prior to induction of labour. Only the Bishop score in nulliparous women showed a significant relationship in predicting successful labour induction (area under the ROC curve 0.679) [23].

Eggebø *et al* studied fetal head-perineum distance measured by ultrasound imaging as a predictive factor for induction of labor and showed that area under the ROC curve for prediction of vaginal delivery were 62% with sensitivity of 71% and specificity of 52% when fetal head–perineum distance cut off value ≤ 40 mm [13].

Barbera *et al* has used TPS imaging to quantify fetal head descent by measuring the angle between the long axis of the pubic symphysis and a line extending from its most inferior portion tangentially to the fetal skull concluded that TPS allows a diagnosis of fetal station with accuracy comparable to that of digital examination [8].

In the present study the mean perineal-head distance assessed by TPS was 35.8mm ± 3.8mm in vaginal delivery group while in those delivered by CS it was about 50.4mm ± 2.8 mm. Area under ROC curve for prediction of successful induction of labour was 97% with optimal cut off value ≤ 46.5 mm with 92.7 % sensitivity and 62.5% specificity.

Fetal head position assessed by TAS in this study showed that 68.3% of subjects in vaginal delivery group showed occipito-anterior head positions compared to 32.8% in CS group. Choi et al concluded that perinatal complications occurred more frequently in OP positions group than OA positions and OT positions groups suggesting that the position of the head during the first and second stage of labor could be useful indicators for predicting the persistent OP position and labor dystocia [7].

A systematic review conducted by Verhoeven *et al.* to determine whether sonographic assessment of occipital position of the fetal head can contribute to the prediction of the mode of delivery concluded that sonographic assessment of occipital position of the fetal head before delivery should not be used in the prediction of mode of delivery as Summary point estimates of sensitivity and specificity were 0.39 (95% CI, 0.32–0.48) and 0.71 (95% CI, 0.67-0.74), respectively [6].

In our study AFI and EFBW show no statistically significant difference. While in a previous study by Umber 2009showed that induction of labor with vaginal misoprostol at term in women with AFI < 5 cm is associated with an increased risk of CS or instrumental vaginal delivery and intrapartum fetal distress but it is associated with increased risk of meconium stained liquor [24].

Little *et al.* found that EFBW less than 3000 gm wasn't associated with increased risk of CS. However, for women with EFBW of greater than 3500 g, an 85% increased risk of CS was apparent. These results indicate that provider knowledge of larger EFBW may be associated with a higher rate of CS. Conclusion limiting the use of US to determine fetal weight near term may help to reduce the CS rate [25].

## Conclusion

There was a significant difference between both groups regarding mean values of TVS cervical canal length and TPS perineal head distance as well fetal head position assessed by TAS.While there was no significant difference in AFI or EFBW.

Pre-induction US assessment can be used as an objective tool for the prediction of mode of delivey including TVS measurement of cervical canal length in mm, TPS perineal head distance assessment in mm ,as well fetal head position assessed by TAS.

Combination of statistically significant US parameters can formulate equation to predict the possibility of successful vaginal delivery after induction of labour in postdates primigravida.

More studies need to be performed with larger sample size and more statistic data processing to formulate an ultrasonic scoring system which can be comparative with clinical bishop score for prediction of induction outcome.

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