

Prediction of the mode of delivery in women subjected to induction of labor by measurement of angle of progression

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Abstract

Background: Transperineal ultrasound measurement is now widely spread and easy to perform method for assessing progressive descent of the head through the pelvis by measurement of many parameters. One of these is the angle of progression which is found to be a successful method that assist obstetrician in predicting the success of induction of labor and the mode of delivery whether vaginal delivery or caesarean section.

Objective: To assess the value of angle of progression (AOP) measurement by transperineal ultrasound in the prediction of the outcome of induction of labor at term whether vaginal or caesarean section.

Methods: This clinical prospective study was conducted in Al-Yarmouk teaching hospital in the labor ward at the obstetrics department in the period from 1st of December 2015 to 1st of March 2016. Hundred nulliparous women with singleton, term pregnancy (37- 42weeks) were admitted for induction of labor for various reasons. Before the induction; transperineal ultrasound was done to measure the angle of progression. Comparism was done between the group who delivered vaginally and those required caesarean section regarding the difference in angle of progression and induction-to-delivery interval.

Results: 77 (82.79%) were delivered vaginally and 16 (17.2%) required emergency Caesarean delivery. There were significant correlations between AOP and induction-to-delivery interval and the mode of delivery. AOP was significantly wider in those who delivered vaginally than women delivered by caesarean section.

Conclusion: The measurement of angle of progression can be used as a simple and risk free method to predict the mode of delivery before the induction of labor.

Key words: Induction of labor, angle of progression, transperineal U/S.

INTRODUCTION

Induction of labor accounts for about 20% of pregnancies and it is consider one of the commonest obstetric interventions all over the world.⁽¹⁻³⁾It is associated with increased rate of Caesarean section in about 25% of nulliparous and around 5% in parous women.^(1,3)

There is still controversial about the time of induction for common problems such as diabetes, post-term pregnancy and pre-eclampsia . successful vaginal

delivery could be predicted, if the induction of labor considered for soft indications. There for the presence of a simple and reliable method to assess the pregnant women would be of value in the prediction of the mode of delivery,⁽¹⁾ especially recognizing pregnant women at risk for failure of induction and this is of value to improve women's perception with their childbirth experience and pregnancy outcomes, as emergency Caesarean section has been associated with increased risk for maternal and/or fetal complications in comparison with elective Caesarean delivery.^(4,5)

A large evidence indicates that digital pelvic examination for determination of fetal head station and position during labor is imprecise and this have great implications that can lead to incorrect decision about the mode of delivery.⁽⁴⁻⁶⁾

Recently, ultrasound has been used widely in third trimester and before labor as a more precise and inexpensive method for the prediction of the mode of delivery.⁽⁵⁾

With the more availability of ultrasound systems in labor rooms, ultrasound is gaining acceptance as a valuable tool in the hands of obstetricians with a good number of studies testing to its diagnostic accuracy.^(2,7)

Many new researches suggest that ultrasound can provide accurate objective measurements for fetal head in labor and prediction of successful instrumental vaginal delivery.^(5,6) the so called the 'angle of progression' (AOP), has been shown to be reliable method for assessing fetal head descent during delivery, a method measuring the angle between the inferior margin of the midline of symphysis pubis to lowest point of the fetal skull by transperineal ultrasound.⁽⁴⁻⁹⁾

There is a significant relationship between the measures of this angle and the success of vaginal delivery whether assisted or spontaneous. If the angle was more than or equal to 120° there was a 90% chance of having vaginal delivery.⁽⁴⁾ It has been used to predict successful instrumental vaginal delivery in fetuses with occipitoanterior position.⁽¹⁰⁾

The measurement of this angle depend on fixed parameters so the variability of this new ultrasound method was very low and it can provide more objective assessment of the fetal head station at which a ventouse or forceps can be safely applied.⁽⁷⁾

Aim of the study:

To determine if transperineal ultrasound measurement of angle of progression can predict the possibility of successful induction of labor.

PATIENTS AND METHODS

This was a clinical prospective study conducted in Al-yarmouk teaching hospital/labor room for the period between 1st of December 2015 to 1st of March 2016 . Hundred nulliparous women with singleton pregnancy admitted for induction of labor for various reason at term were included. verbal consent was obtained from all participants. Demographic data including maternal height and weight were measured and body mass index

was calculated as pregnancy weight in kg/(height in m)². Maternal age, reason for induction of labor and gestational age were all determined. Gestational age was calculated from the first day of the last menstrual period and confirmed by first trimester ultrasound which was done to all participants before the start of induction.

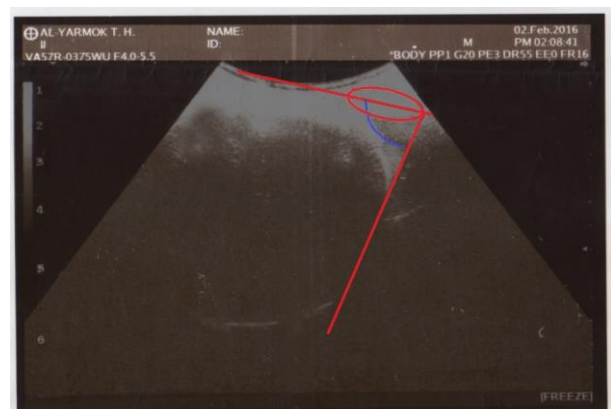
The inclusion criteria:

Nulliparous women, term pregnancy from 37 completed weeks of gestation to 42 completed weeks of gestation. single viable fetus with cephalic presentation ,occipitoanterior position with average size baby and adequate pelvis as judged by clinical examination.

Exclusion criteria:

Multiple pregnancy, malposition and malpresentation, non viable fetus, high order scar and fetal distress.

All participants were admitted to labor room at day time and full general and abdominal examination were done. We ask the patients to empty their bladder and transperineal ultrasound was then performed by the researcher with the use of transabdominal probe (5-9 MHz 2D) using Sonostar ultrasound machine to measure the angle. The probe enclosed in a latex glove covered with ultrasound gel and was then placed between the two labia on the perineum and an image was acquired to include the symphysis pubis and the fetal head. The angle between the midline of the pubic symphysis and the inferior margin of the pubic bone to the leading part of the fetal skull was measured . All of the images were obtained and recorded by printer. All patients tolerated the transperineal ultrasound procedure well, without any discomfort. Ultrasound assessment took few minutes.



Ultrasound picture of patient ended with caesarean section and AOP was 75°.



Ultrasound picture of patient delivered vaginally and AOP was 105°.

Digital pelvic examination was performed to assess the Bishop score and pelvis adequacy. Labor was induced with amniotomy and oxytocin if the cervix was favorable (Bishop score ≥ 6). If it is not, labor was induced with 25 μ g vagiprost applied vaginally every 6 h (up to a maximum of 100 μ g in 24 h). We defined successful induction of labor as resulting in a vaginal delivery, either spontaneous or operative.

The patients were followed from the time of induction of labor till delivery by register and labor ward team. All the data of induction outcomes were collected from the team and were recorded.

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Statistical analysis:

Each pregnant patient assigned a serial identification number. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 20. Shapiro-Wilk test was used to assess the normality of distribution of the continuous data. The continuous variables were presented as mean, standard deviation, median and interquartile range.

The categorical variables were presented by (frequency and percentages in tables). Pearson's Chi-square and Fisher's exact tests were used to assess statistical association between categorical data, accordingly. Independent student t and Mann-Whitney U tests were used to assess the difference between the continuous variables depending on its normality of distribution. A level of p – value less than 0.05 was significant.

RESULTS

Initially the study included 100 women who fulfill the inclusion and exclusion criteria, but 7 cases were excluded because they required emergency caesarean section for fetal distress. The remaining 93 cases were

divided in to two groups; 77 cases delivered vaginally and 16 cases delivered by caesarean section.

Table 1: criteria of patients. As seen from table (1) the difference between the two groups regarding maternal age, BMI, gestational age and weight of the fetus was statistically not significant.

Table 1: criteria of patients.

Maternal characteristic	Vaginal group Mean $\pm$ SD	Caesarean section Mean $\pm$ SD	P-Value
Age in years	26 $\pm$ 3.4	25 $\pm$ 4.2	0.359 NS
Body mass index(kg/cm)	24 $\pm$ 3.7	23.9 $\pm$ 3.7	0.93 NS
Gestation in weeks	39 $\pm$ 1.9	40 $\pm$ 1	0.078 NS
Fetal weight postdelivery(g)	3.288 $\pm$ 0.578	3.525 $\pm$ 0.526	0.184 NS
Student's t-test, SD=Standard deviation, NS= Not Significant at 0.05 level			

Table 2: The indications of induction of labor in both groups. There were (16) cases of caesarean sections and (77) cases of vaginal deliveries in relation to the angle in nulliparous women with prolongation in first stage of labor was expressed. Seven cases from those ended with cesarean section where excluded from the study. The difference between the two groups for postdate, hypertension and diabetes was significant (p value was < 0.05); whereas the difference was not significant statistically for preterm rupture of membranes (p value was > 0.05) as show in table 2.

Table 2: The indications of induction of labor in both groups.

Indication for induction of labor	Vaginal group No.	Caesarean section No.	P Value
Postdate	31	2	0.035*
Hypertension	4	5	0.001*, ^F
Diabetes	1	2	0.021*, ^F
Prelabor rupture of membranes	35	7	0.901 (NS)
Others	6	0	NV
Total(%)	77(82.8)	16(17.2)	
Chi-square test, ^F Fisher's exact test, * Significant at 0.05 level, NV= Not valid			

Table 3: The angle of progression and induction to delivery interval for both groups. The median of the angle of progression was 114(112-119) and 90(84-96)

in degree for those who delivered vaginally and caesarean respectively and there was statistically significant difference (p value<0.001). The two groups were compared for induction to delivery interval in hours which was 8 ± 2.1 and 11 ± 3 for patients who delivered vaginally and those who end with caesarean section respectively and the difference was significant statistically (p value<0.05) as shown in figure 1 and 2.

Table 3: Angle of progression and induction-to-delivery interval for both groups.

Parameter	Patients who delivered vaginally	Patients who delivered caesarean	P-Value
Angle of progression in degree ^w Median (IQR)	114(112 – 119)	90 (84 – 96)	<0.001*
Induction-to-delivery interval in hours ^s Mean $\pm$ SD	8 ± 2.1	11 ± 3	<0.001*

^w Mann-Whitney U test, IQR= inter-quartile range, ^s Student's t-test, * Significant at 0.05 level

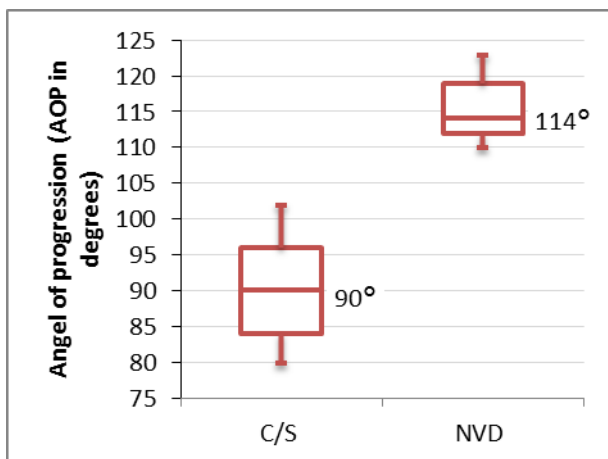


Figure 1: Comparison of median angle of progression between the study groups .

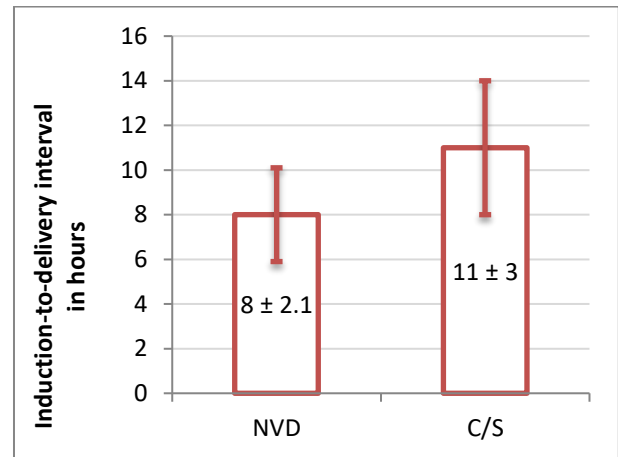


Figure 2: comparison in induction to delivery interval between the studied patients.

DISCUSSION

One of the most important determinant of the success of induction of labor is the station of presenting part. The inaccuracy of digital pelvic examination in assessing station and position of fetus head during delivery represent a big dilemma. Recent researches were open the window for the use of ultrasound-based methods during labor and the most reproducible one is the measurement of angle of progression.⁽²⁾

In the present research, the difference in the mean maternal age, gestational age at parturition, body mass index of the patients and birth weight between the two groups was not significant.

The measurement of angle of progression was different between those with and without successful induction of labor. The median of the angle in patients who delivered vaginally was (114degree) while the median of the angle in patients who delivered by caesarean section was (90 degree) so it was wider in patients who delivered vaginally. So that labor induction expected to be more fruitful in women with a wider angle which occur with a lower head station, than women with a narrow angle.⁽¹¹⁾

Kalache et al. measured this angle in females with induction failure at term. If angle of progression was 120°, then possibility of a successful vaginal delivery was 90%.⁽⁴⁾

As the measurement of this angle depends upon only two precise bony landmarks therefore, caput formation will not affect its measurement,⁽¹²⁾and is accurate regardless to the station of fetus head.⁽⁸⁾

Dietz and Lanzarone examined 139 females during labor (in first stage) by transperineal ultrasound examinations and estimated a distance between the

head of fetus and a line putted at a 90° angle from the pubic bone central axis and found that this measurement was helpful to predict the outcome. The research concludes that whenever the angle is greater, the chance that vaginal delivery will occur is more and that at an angle of 120°, gives a 90% success of a smooth vaginal delivery. This may be due to the fact that maternal pelvic axis is a curved line and the head of fetus passes through this axis as it descend through birth canal.⁽⁷⁾ Because parturition happened by head deflection, it may best to estimate fetal head station by an angular rather than linear measurements.^(7,12)

In other study, assessment of the angle before onset of labor was done and found that 95° as a cut-off value and can predict delivery mode because it has the best diagnostic performance. It has been shown, an AOP $\geq 95^\circ$ was associated with 98.7% chance of delivering vaginally in primigravida women.⁽⁵⁾

It has already been shown that measurement of the angle is reliable, with insignificant variability even in the hand of inexperienced sonographers.^(2,5)

Our results agree with those of Dückelmann et al., who used 2D ultrasound and found that the angle is reliable regardless of ultrasound experience and fetal head station.⁽¹³⁾

Levy et al perform a study conclude that if the angle in nulliparous non-laboring women is narrow ; this was associated with a higher rate of caesarean delivery at term.⁽¹⁴⁾

Another study found that when angle of progression was $\geq 110^\circ$, the majority of women underwent easy vaginal delivery and when angle of $< 110^\circ$, about half of them did.⁽¹⁰⁾

Making decision in labor ward can be fearful and may lead to mistakes and unnecessary intervention, this can rise caesarean section rates. Using new modality in ultrasound can help to reduce this and to undertake suitable interventions at the appropriate time.⁽¹⁵⁾

Angle of progression $> 120^\circ$ is found to be the best cut off for successful instrumental vaginal delivery in the second stage of labor. In their study they found that angle $> 110^\circ$ was good predictor of prolonged first stage of labor.⁽¹⁰⁾

In spite of all these new modalities in evaluating pregnant females before labor induction, several studies showing the great association of the clinical parameters like Bishop score and pelvimetry and the success of induction of labor.⁽¹⁶⁾

Conclusion:

The use of the angle of progression can predict vaginal delivery success in nulliparous women, this angle was significantly differ between those who ended with vaginal delivery and those ended with caesarean section

The results provide a vital role for the use of this angle as a simple and accurate landmarks to evaluate station of fetus head and provide useful predictor for the outcome of induction of labor.

Recommendation:

A further studies with large population and indications are needed to support our results. We recommend training programs for obstetricians with little ultrasound experience to measure the angle of progression with accuracy that can help us as a method for decision making regarding mode of delivery.

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