Role of 'Angle of Progression' in prediction of vaginal delivery in primiparous women

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SUMMARY

Background: The rate of cesarean sections performed has undoubtedly increased in recent years. The health and life of the woman giving birth are more at risk during a cesarean section than during a normal delivery. Considering the concerning trend of a rising ratio of cesarean sections. Predicting the manner of birth and tracking the progression of labor have both been linked to transperineal ultrasonography (TPU). The measurement of the angle formed by the long axis of the pubic symphysis and a line that extends tangentially from its most inferior border to the fetal skull yields the angle of progression (AOP).

Objective: This study aims at evaluating the role of measuring the 'angle of progression' (AOP) at the onset of the active phase of labor in prediction of vaginal delivery in primiparous women.

Patients and Methods: Study Design: A diagnostic test accuracy study (prospective). Study setting: Department of obstetrics and gynecology at Ain Shams University Maternity Hospital (labour ward). Study time: Between May 2020and May 2021. Study population: Pregnant women attended Ain Shams University Maternity Hospital with the following criteria:

Results: This diagnostic test accuracy prospective study was conducted at Ain Shams University Maternity Hospital starting from May 2020 to evaluate the role of measuring the angle of progression (AOP) at the onset of the active phase of labor in prediction of vaginal delivery in 56 full term primiparous women. Statistical analysis of our results showed that vaginal delivery was in more than nine tenths (51 vs. 5) of the studied cases and no significant differences according to mode of delivery were detected between studied women regarding maternal age, BMI, fetal gestational age and fetal weight. Also, rupture of membranes was non-significantly more frequent in cases that delivered vaginally while station of fetal head, cervical dilatation, cervical effacement and angle of progression were significantly higher in cases that delivered vaginally. We can deduce that, angle of progression had significant high diagnostic performance; station of fetal head had significant moderate diagnostic performance, while cervical dilatation and cervical effacement had significant low diagnostic performance. Finally, angle of progression ≥97.0° had highest diagnostic characteristics, followed by station ≥0.0 station followed by cervical dilatation ≥5 cm and cervical effacement ≥75%. Different cut points had their sensitivity & NPV higher than their specificity & PPV.

Conclusion: In prediction of progress of spontaneous vaginal delivery in primiparous women, transperineal ultra-sonographic angle of progression with cutoff value \geq 97.0° had highest predictive and diagnostic value, followed by station of fetal head \geq 0.0 followed by cervical dilatation \geq 5 cm and cervical effacement \geq 75%. On the other hand rupture of amniotic membranes, maternal age, BMI, fetal gestational age and fetal weight had no significance in delivery progress prediction.

Keywords: Angle of progression; Transperineal sonography

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INTRODUCTION

The percentage of cesarean sections performed has undoubtedly increased in recent years. The health and life of the woman giving birth are more at risk during a cesarean section than during a normal delivery. Given the concerning trend of a rising ratio of cesarean sections [1].

Now, the internal digital vaginal exam serves as the foundation for determining the labor's stage and development. However, there is a lot of evidence that suggests that palpation during childbirth is prone to many errors in evaluating the position and lie of the presenting part in both the first and second stage of labor, and that it is inaccurate and does not allow for precise determination of the head's progression in the birth canal [2].

Predicting the mode of delivery and tracking the progression of labor have both been linked to transperineal sonography (TPU). The symphysis pubis's long axis and a line that extends from its most inferior border tangentially to the fetal skull are measured to determine the angle of progression (AOP), a metric [3].

Previous literatures revealed that transperineal ultrasonography measurements of AOP taken shortly after complete cervical dilation are helpful in forecasting spontaneous vaginal birth [4].

Transperineal sonography has been demonstrated to be an easily performed, repeatable procedure with low inter- and intra-observer variability for measuring arterial pressure (AOP) [3].

In order to assist patients and manage their labor, the AOP may be able to estimate the length of the second stage of labor and spontaneous vaginal birth [5].

It has been demonstrated earlier that nulliparous women with a pre-labor broad AOP ($\geq 95^{\circ}$) had a higher success rate for vaginal birth than those with a tighter angle [3].

AIM OF THE WORK

This study aims at evaluating the role of measuring the 'angle of progression' (AOP) at the onset of the active phase of labor in prediction of vaginal delivery in primiparous women.

PATIENTS AND METHODS

Study design: A diagnostic test accuracy study (prospective)

Study setting: Department of obstetrics and gynecology at Ain Shams University Maternity Hospital (labour ward)

Study time: Between May 2020and May 2021

Study population: Pregnant women attended Ain Shams University Maternity Hospital with the following criteria.

Inclusion criteria: Primiparous women. At the onset of the active phase of labor (defined as cervical dilatation ≥ 3 cm and cervical effacement $\ge 80\%$. Viable singleton pregnancy. Term pregnancy (37 – 41+6 weeks of gestation). Vertex presentation with occiput anterior position.

Exclusion criteria: Women with extremes of estimated fetal weight (sonographic estimated fetal weight < 2.5 kg or > 4 kg). Women undergoing induction of labor as the progression of labour may be affected and the progress of labor may not be normal. Women with chronic or acute fetal compromise because in the majority of cases normal vaginal delivery may be of a risk for the fetus. Multi-fetal pregnancy. Preterm pregnancies <37 weeks. Women refused to participate or continue the study.

Sampling method: Systemic random sample.

Sample size: 56 women.

Sample size justification: Sample size was calculated, setting the power $(1-\beta)$ at 0.8 and the type-1 error (α) at 0.05. Data from a previous similar study [6] showed that AUC for AOP in prediction of vaginal delivery was 0.902. Therefore, 38 women who delivered vaginally were needed to find such an accuracy. Among primiparous women, who were at the onset of the active phase of labor, and assuming a rate of 20% of Cesarean section for failure of progress and a rate of 15% of Cesarean section for evident or suspected intrapartum fetal compromise, a minimal sample size of 56 women was needed.

Ethical considerations: Following a detailed discussion of the steps and aim of the current study, the participating women provided informed written permission. Women were allowed not to participate or withdraw at any time without fear of consequences to their entitlement to proper medical treatment. The Department of Obstetrics and Gynecology and the Faculty of Medicine at Ain Shams University accepted the study protocol through their Ethical Research Committee.

Study interventions and procedures:

All cases were subjected to:

Complete history taking: Personal, obstetric, medical surgical, etc.

General examination: Vital signs, BMI, etc.

Obstetric examination: Fundal, abdominal and pelvic grips

Pelvic examination:

• **Cervix:** Dilatation, effacement (length), consistency and position.

- Fetal head: Position and station.
- Fetal membranes: Intact or ruptured.

Trans-perineal ultrasound (TPU):

- Occiput anterior position was confirmed by visualization of the fetal cerebellum or cervical spine.
- · Head station was determined.
- · AOP was measured:
- The ultrasound probe was located between the labia below the pubic symphysis in a mid-sagittal position.
- A sagittal view of the long axis of the pubic symphysis was obtained by a small lateral movement of the transducer, at the same plane, and a sagittal view of the leading position of the fetal head was determined.
- A line was drawn between the calipers placed at the two ends of the long axis of the pubic symphysis. A second line was drawn from the distal point of the pubic symphysis tangentially to the fetal skull contour. AOP was the angle between these two lines.
- The TPU scan was performed using the curved ultrasound probe with frequency 3.5 – 5 MHz of Samsung-Medison SonoAce X6 set (Fig. 1.).
- The scans were performed by one of three sonographers with at least 3-year experience in performing TPU scan (Fig. 1.).
- Head station and AOP were measured at the onset of active phase of labor and at the second stage of labor.

Outcomes:

Primary outcome: A rate of vaginal delivery.

Secondary outcome: Cutoff value of AOP to predict vaginal delivery and its clinical validity.

Statistical analysis

MedCalc* version 7.0 was used for the statistical analysis, with a significance level of 0.05. For numerical variables that were normally distributed, the data were shown as mean and standard deviation; for numerical variables that were not normally distributed, the data were shown as median and interquartile range; or, for categorical variables, as frequency and percentage. For each of the enrolled women, a receiver operator characteristic (ROC) curve was created to gauge how predictable AOP was for vaginal birth. Sensitivity, specificity, positive, and negative predictive values were used to describe predictability.

Statistical package

Data entry and statistical analysis of the collected data



was performed by the use of a reliable genuine software program.

RESULTS

Tab. 1. shows that maternal (age & BMI) and fetal (gestational age& weight) characteristics among the studied cases.

Tab. 2. shows that predictors of mode of delivery; rupture of membranes, station, cervical dilatation, cervical effacement and angle of progression.

Tab. 3. shows that vaginal delivery was in more than nine tenths of the studied cases.

Tab. 4. shows that no significant differences according to mode of delivery regarding maternal (age& BMI) and fetal (gestational age& weight) characteristics.

Tab. 5. shows that rupture of membranes was nonsignificantly more frequent in cases that delivered vaginally. Station, cervical dilatation, cervical effacement and angle of progression were significantly higher in cases that delivered vaginally.

Tab. 6. shows that in predicting vaginal delivery; angle of progression had significant high diagnostic performance, station had significant moderate diagnostic performance, while cervical dilatation and cervical effacement had significant low diagnostic performance.

Tab. 7. shows that in predicting vaginal delivery; angle of progression $\ge 97.0^\circ$ had highest diagnostic characteristics, followed by station ≥ 0.0 station. Different cutpoints had their sensitivity NPV higher than their specificity & PPV.

DISCUSSION

Trans-perineal ultrasonography (TPU) has been proposed as a valuable method for tracking labor progress and predicting birth mode [7].

One of the most promising sonographic findings, the angle of progression (AOP), has been demonstrated to

be beneficial in predicting spontaneous vaginal birth and identifying the duration of the second stage of labor, which may be valuable in counseling and managing patient's labor [8].

This diagnostic test accuracy prospective study was conducted at Ain Shams University Maternity Hospital starting from May 2020 to evaluate the role of measuring of the angle of progression (AOP) at the onset of the active phase of labor in prediction of spontaneous vaginal delivery in 56 full term primiparous women.

Regarding mode of delivery; statistical analysis of our results showed that vaginal delivery was in more than 90% (51 *vs.* 5) of the studied cases and no significant differences according to mode of delivery were detected between study women regarding maternal age, BMI, fetal gestational age and fetal weight.

Brunelli et al. [8] studied the prediction of the manner of delivery in the second stage of labor and the persistence of the occiput posterior position, as determined by the angle of advancement. Sixty-three nonconsecutive women in the second stage of labor were recruited, all of whom had transabdominal ultrasonography diagnosis of posterior occiput position. Measurement of the angle of progression at rest was done using a transperineal ultrasonography on each lady. Women who delivered fetuses in the occiput anterior position and those who persistently delivered their babies in the occiput posterior position were compared in terms of the growth angle. According to them, there was no discernible variation in the manner of birth amongst the study women based on parity or gestational age at delivery. They concurred with the research findings.

Minajagi et al. [9] evaluated the predictive power of transperineal ultrasound-measured AOP in nulliparous women to determine the method of delivery prior to the commencement of labor. In a tertiary care hospital, a prospective observational research was carried out on 120 nulliparous women with fetal head station greater than 0 who had visited the antenatal clinic at > 38 weeks of gestation but were not in labor. Transperineal ultrasound

was used to measure AOP and compare it between women who had vaginal birth (VD) and Caesarean section (CS) owing to labor dystocia. They concurred with the findings of the current study and reported that, out of 120 nulliparous women, 92 (76.67%) gave birth naturally, and 28 (23.33%) had cesarean sections because of labor arrest. Between the two groups, there was no discernible statistical difference in the mother's age, the patients' body mass index (BMI), the GA at delivery (weeks), or the birth weight (grammes).

Gillor et al. [10] evaluated if angle of progression (AOP) measurements taken before to labor may help predict a successful vaginal delivery following cesarean section in women who had never given birth vaginally before. A prospective observational cohort research that was carried out at a single tertiary facility and involved term women who wanted to try labor but had only had one prior cesarean delivery (CD) and no prior vaginal deliveries. The AOP was measured before to the commencement of labor using transperineal ultrasonography. Contrary to the current study, they claimed that 67 (60.4%) of the 111 women participated in the trial had a successful vaginal delivery following CD. Clinically determined fetal weight discrepancies between the mothers were found to be statistically significant. Perhaps as a result of using various study methodologies, lower clinically estimated fetal weights (EFW) were demonstrated to be more beneficial with a VBAC.

In their 2017 study, Pérez et al. [11] looked at the angle of progression (AOP) and established a cut-off value for the prediction of vaginal delivery. This prospective observational study involved 101 pregnant women and was

Tab. 1. Maternal and fetal characteristics among the studied cases.	Variables	Mean ± SD	Range	
	Maternal			
	Age (years)	24.3 ± 4.6	17.0–37.0	
	BMI (kg/m ²)	28.9 ± 3.2	23.0-36.0	
	Fetal			
	Gestational age (weeks)	38.6 ± 1.2	37.0-41.0	
	Fetal weight (kg) 3.1 ± 0.4 2.5		2.5-3.9	
		Total = 56		

Tab. 2. Predictors of mode of delivery among the studied cases.	Variables	Ν	%
	Runture of membranes	22	39.3
	Rupture of membranes	Median (1st-3rd IQ)	Range
		0.0 (-1.0-1.0)	-2.0-2.0
	Station	Mean \pm SD	Range
	Cervical dilatation (cm)	5.8 ± 1.4	4.0-9.0
	Cervical effacement (%)	71.6 ± 11.1	50.0-100.0
	Angle of progression (°)	107.5 ± 10.7	88.0-127.0
	Total=56. IQ: Interquartiles		

Tab. 3. Mode of delivery among the studied cases.	Variables	N	%
	Normal vaginal delivery	51	91.1
	Cesarean delivery	5	8.9
	Total=56		

Tab. 4. Comparison according to mode of delivery regarding maternal and fetal characteristics.	Variables	Vaginal (N=51)	Cesarean (N=5)	P-value	
	Maternal				
	Age (years)	24.3 ± 4.4	24.4 ± 7.1	^ 0.980	
	BMI (kg/m ²)	28.9 ± 3.2	28.4 ± 3.3	^ 0.728	
	Fetal				
	Gestational age (weeks)	38.6 ± 1.2	38.4 ± 1.5	^ 0.742	
	Fetal weight (kg)	3.1 ± 0.3	3.0 ± 0.5	^ 0.550	
	^Independent t-test, #Chi square test, & Fisher's Exact test				

Tab. 5. Comparison according to mode of delivery regarding different predictors.	Variables	Vaginal (N=51)	Cesarean (N=5)	P-value	
	Rupture of membranes	21 (41.2%)	1 (20.0%)	§0.638	
	Station	0.0 (1.0-1.0)	-1.0 (-2.01.0)	#0.006*	
	Cervical dilatation (cm)	5.9 ± 1.4	4.6 ± 0.9	^ 0.044*	
	Cervical effacement (%)	74.4 ± 10.5	64.0 ± 11.4	^ 0.040*	
	Angle of progression (°)	108.9 ± 10.0	92.8 ± 5.5	^ 0.001*	
	[^] Independent t-test. [#] Mann Whitney test. [§] Fisher's Exact test				

Tab. 6. Diagnostic performance of different vaginal delivery predictors.	Factors	AUC	SE	Р	95% CI	Cut off		
	Station	0.857	0.075	0.009*	0.710-1.000	≥0.0		
	Cervical dilatation (cm)	0.780	0.099	0.040*	0.587-0.974	≥5.0cm		
	Cervical effacement (%)	0.749	0.125	0.048*	0.504-994	≥75.0%		
	Angle of progression (°)	0.925	0.055	0.002*	0.817-1.000	≥97.0°		
	AUC: Area Under	Curve. SE: Stand	lard Error. CI: Cor	r. Cl: Confidence Interval. *Significant				

Tab. 7. Diagnostic performance of vaginal delivery predictors' cutpoints.	Charactors	Value	95% CI	Value	95% CI
	Characters	Station ≥0.0		Cervical dilatation ≥5 cm	
	Sensitivity	80.4%	66.9%-90.2%	82.4%	69.1%-91.6%
	Specificity	80.0%	28.4%-99.5%	60.0%	14.7%-94.7%
	DA	80.4%	67.6%-89.8%	80.4%	67.6%-89.8%
	Youden's index	60.4%	23.7%-97.1%	42.4%	0.0%-86.5%
	PPV	97.6%	87.4%-99.9%	95.5%	84.5%-99.4%
	NPV	28.6%	8.4%-58.1%	25.0%	5.5%-57.2%
	LR+	4.02	0.69–23.32	2.06	0.70-6.07
	LR-	0.25	0.12-0.50	0.29	0.12-0.74
	LR	16.40	1.65–163.21	7.00	1.02-48.16
	Карра	0.333	0.054-0.613	0.260	0.000-0.560
		Cervical eff	Cervical effacement ≥75% Angle of progression ≥		
	Sensitivity	49.0%	34.8%-63.4%	92.2%	81.1%-97.8%
	Specificity	80.0%	28.4%-99.5%	80.0%	28.4%-99.5%
	DA	51.8%	38.0%-65.3%	91.1%	80.4%-97.0%
	Youden's index	29.0%	0.0%-66.7%	72.2%	36.3%-108.0%
- - - - - - - - - - - - 	PPV	96.2%	80.4%-99.9%	97.9%	88.9%-99.9%
	NPV	13.3%	3.8%-30.7%	50.0%	15.7%-84.3%
	LR+	2.45	0.42-14.47	4.61	0.80-26.65
	LR-	0.64	0.38–1.07	0.10	0.03-0.28
	LR	3.85	0.40-36.82	47.00	4.19-527.19
	Карра	0.089	0.00-0.225	0.568	0.234–0.902

CI: Confidence Interval, YI: Youden's Index, DA: Diagnostic Accuracy, PPV: Positive Predictive Value, NPV: Negative Predictive Value, LR+: Positive Likelihood Ratio, LR-: Negative Likelihood Ratio, LR: Diagnostic Odds Ratio

carried out at the department of obstetrics and gynecology, university hospital Parc Taulí, Sabadell, Barcelona, Spain. They presented with a singleton cephalic presentation, were in labor when they were hospitalized, and were full-term pregnant. At the time of admission, the AOP was measured. According to their findings, which were consistent with the current investigation, there were no appreciable variations in the study women's method of delivery in terms of maternal age, body mass index, gestational age at delivery, newborn weight, or neonatal outcomes. Of the women who gave birth, 72 (71%) had spontaneous vaginal delivery, 19 (19%) had an instrumental delivery, and 10 (10%) had a cesarean section.

The value of AOP in predicting vaginal delivery was examined by Marsoosi et al. (2015). They tracked 70 singleton pregnant women in this prospective research, which was conducted at Shariati University Hospital (Tehran University of Medical Sciences). Admission and the start of the second phase, just after the digital exam, were the times when AOP was measured. According to them, which is in line with the current study, 65 women (92.9%) gave birth vaginally (59 did so spontaneously and 6 used a vacuum), while 5 women (7.1%) underwent a cesarean section because their labor did not advance to the second stage. With relation to delivery mode, there were no statistically significant changes in the study women's demographics.

Regarding mode of delivery different predictors; statistical analysis of our results showed that rupture of membranes was non-significantly more frequent in cases that delivered vaginally. Station of fetal head, cervical dilatation, cervical effacement and angle of progression were significantly higher in cases that delivered vaginally. Angle of progression had significant high diagnostic performance; station of fetal head had significant moderate diagnostic performance, while cervical dilatation and cervical effacement had significant low diagnostic performance.

According to a study by Brunelli et al. [8], which supported the findings of the current study, the only independent predictor that could predict the method of delivery was the angle of advancement (odds ratio, 0.849; 95% confidence range, 0.775–0.0930; P<.001).

In agreement with the current study, Minajagi et al. [9] reported a statistically significant higher mean value of AOP (100.7 \pm 6.9°) in vaginally delivered females compared to females who had caesarean sections (91.7 \pm 6.1°), with a P-value < 0.01 indicating that the AOP is wider in vaginally delivered females. However, they disagreed with the current study, stating that the station of the fetal head

was not significantly different in vaginally delivered cases, which could be due to different study methodologies and women's criteria.

In agreement with the present study, Marsoosi et al. [6] reported that in the initial phase of labor, the accuracy of the AOP in predicting vaginal delivery was 87.5% (95% confidence interval [CI], 77.9-97.1; P = 0.005), while the accuracy of the digital evaluation of fetal station was 85.5% (95%CI, 75.2-95.6; P = 0.009). Consequently, in the initial phase of labor, AOP proved to be a more reliable predictor of vaginal delivery than digital fetal station assessment. However, they disapproved of the current research and reported that in the latter phase of labor, the AUC for predicting vaginal delivery was 90.2% (95%CI, 81–99.3; P=0.003) for AOP and 94.9% (95%CI, 89.1-100; P=0.001) for digital fetal station assessment, therefore, digital fetal station measurement in the second stage of labor demonstrated a superior prediction of vaginal delivery; this may have been caused by a different sample size compared to the current study.

Regarding diagnostic performance of vaginal delivery predictors' cut points; angle of progression $\ge 97.0^{\circ}$ had highest diagnostic characteristics, followed by station ≥ 0.0 station followed by cervical dilatation ≥ 5 cm and cervical effacement $\ge 75\%$. Different cut points had their sensitivity& NPV higher than their specificity& PPV.

In contrast to the current study, Brunelli et al. [8] reported that the optimal cutoff range was assessed to be 121.5°, with a sensitivity of 72% and specificity of 67%. The area under the receiver operating characteristics curve was reported to be 0.731 (95% confidence interval, 0.594–0.869). Compared to women who had babies vaginally, those who had cesarean sections had a much smaller angle of advancement (113.5°±8.1 vs. 128.0°±10.7; P<.001). Because diverse women's criteria and study techniques may have contributed, the area under the receiver operating characteristics curve for the prediction of cesarean delivery was 0.866 (95% confidence range, 0.761–0.972).

Comparing transperineal ultrasonography (TPUS) to digital transvaginal examination, Solaiman et al. [12] assessed the women's acceptability of TPUS and its predictive power for the manner of delivery during protracted labor. An individual tertiary center hospital's obstetrics and gynecology emergency ward served as the study's site. 28 pregnant women who were in the first or second stages of labor and were monitored until delivery were included in this prospective research. Two measurements were made using TPUS: the angle of fetal head descent and the fetal head-perineum distance (FHPD). They showed that, in contrast to the current study, the angle of fetal head advancement might predict vaginal delivery with an area under the curve of 91% (95% CI, 59-99%). A threshold of 115° was used, and 91% of the women gave birth vaginally (sensitivity 93%, specificity 84%, NPV 91%, PPV 87%, positive likelihood ratio (LR) 6.06, negative LR 0.08).

In line with the current study, Minajagi et al. [9]

reported that the cutoff AOP value of 96° calculated from the ROC curve indicated the chance of vaginal birth among nulliparous women, and the area under the ROC curve for the prediction of vaginal delivery was 0.818 (P < 0.001). When evaluated before to the commencement of labor, an AOP of 96° exhibited an 85% sensitivity, 86% specificity, 94.7% positive predictive value, and 54.53% negative predictive value for predicting vaginal birth at term in nulliparous women.

In agreement with the current study, Gillor et al. [10] reported that women who finally had a CD had a considerably shorter median AOP than those who delivered vaginally. In 87.5% of cases, a successful vaginal delivery following CD was linked to an AOP >980 (calculated from a receiver operating characteristic curve).

During a protracted second stage of labor, Chan et al. [13] evaluated the use of transperineal ultrasound to measure the angle of advancement in order to forecast successful instrumental and cesarean births. Women with delayed second stage labor who were singleton term pregnant and receiving care at Kwong Wah Hospital in Hong Kong, China, participated in a prospective observational research. Positions of the fetal head and the area of the pelvis were measured using transabdominal and transperineal ultrasonography, respectively, both at rest and when the uterus was contracting while being pushed. They disapproved of our findings and claimed that the instrumental group's median AoP was 153.0° at rest compared to 139.0° in the cesarean group (P<0.001) and 182.5° during contraction compared to 156.5° in the cesarean group (P<0.001). Due to possible differences in research methodology, the best predicted cut-off AoP for successful instrumental delivery was 160.9° during contraction (sensitivity 87.1%, specificity 74.1%) and 138.7° at rest (sensitivity 86.2%, specificity 51.9%).

In contrast to the current study, Pérez et al. [11] reported that the average angle of advancement was 129,40 (SD 19.9).It was 107.50 for cesarean sections versus 131.90 for vaginal births (p<0.001). While there were no differences between aided vaginal delivery (142.4°, SD 13) and spontaneous vaginal birth (141.4°, SD 15.4), the current study did not include any instrumental deliveries. The area under the curve (AUC) for the descending angle for vaginal delivery on the ROC curve was 0.85 (95% confidence interval [CI], 0.77-0.92).The curve is optimized at an angle of descent of 1250 (S 67.1%, E 100%). Not a single cesarean section had an angle higher than 125°.

The AUC was assessed to be 90.2% (P=0.003), according to Marsoosi et al. [6], who conducted a different study. Based on this curve, the women were divided into two groups: <113° and \geq 113°. With a sensitivity of 90.8% and a false positive rate of 40%, the cut-off may have been affected by a different sample size than in the current investigation.

The strengths of current study were due to every potential was carried out to guarantee the accuracy of all follow-up data, and data analysis only included information that was fully available. The identical team completed all clinical evaluations, sonographic measurements, delivery, and evaluations of research results.

The limitations of current study were due to COVID 19 pandemic, relatively small sample size and digital and ultrasound examiners should be unaware of each other's results.

CONCLUSION

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In prediction of progress of spontaneous vaginal delivery

in primiparous women, transperineal ultra-sonographic angle of progression with cutoff value ≥97.0° had highest predictive and diagnostic value, followed by station of fetal head ≥ 0.0 followed by cervical dilatation ≥ 5 cm and cervical effacement \geq 75%. On the other hand rupture of amniotic membranes, maternal age, BMI, fetal gestational age and fetal weight had no significance in delivery progress prediction.

- REFERENCES 1. Ciaciura-Jarno M, Cnota W, Wójtowicz D, et al. Evaluation of Brunelli E, Youssef A, Soliman EM, et al. The role of the angle of 8. selected ultrasonography parameters in the second stage of labor progression in the prediction of the outcome of occiput posterior in prediction mode of delivery. Ginekol Polska. 2016; 87(6):448-53. position in the second stage of labor. Am J Obstet Gynecol 2021; 81-89. 2. Molina FS, Nicolaides KH. Ultrasound in labor and delivery. Fetal Diagn Ther. 2010; 27(2): 61-67. 9. Minajagi PS, Srinivas SB, Hebbar S. Predicting the mode of delivery by angle of progression (AOP) before the onset of labor 3. Gillor M, Vaisbuch E, Zaks S, et al. Transperineal sonographic by transperineal ultrasound in nulliparous women. Curr Women's assessment of angle of progression as a predictor of successful Health Rev. 2020; 16(1):39-45. vaginal delivery following induction of labor. Ultrasound Obstet Gynecol. 2017; 49(2): 240-45. 10. Gillor M, Levy R, Barak O, et al. Can assessing the angle of progression before labor onset assist to predict vaginal birth after Kameyama S, Sato A, Miura H, et al. Prediction of spontaneous cesarean?: A prospective cohort observational study. J Matern Fetal vaginal delivery by transperineal ultrasound performed just after Neonatal Med. 2020: 1-8 full cervical dilatation is determined. J Med Ultrason. 2016; 43(2): 243-48. 11. Pérez SP, Seguer JJ, Pujadas AR, et al. Role of intrapartum transperineal ultrasound: angle of progression cut-off and Bibbo C, Rouse CE, Cantonwine DE, et al. Angle of progression on correlation with delivery mode. Clin Obstet Gynecol Reprod Med. ultrasound in the second stage of labor and spontaneous vaginal 2017: 3(4):1-4. delivery. Am J Perinatol. 2018; 35(04):413-20. 12. Solaiman SA, Atwa KA, Gad AA, et al. Transperineal ultrasound 6. Marsoosi V, Pirjani R, Mansouri B, et al. Role of 'angle of of fetal head progression in prolonged labor: women's acceptance progression'in prediction of delivery mode. J Obstet Gynaecol Res. and ability to predict the mode of delivery. Egypt J Radiol Nucl Med. 2015; 41(11): 1693-99: 2020; 51(1):1-9. Kamel R, Negm S, Montaguti E, et al. Reliability of transperineal 7. ultrasound for the assessment of the angle of progression in labor
 - 13. Chan VY, Lau WL, So MK, et al. Measuring angle of progression by transperineal ultrasonography to predict successful instrumental using parasagittal approach versus midsagittal approach. J Matern and cesarean deliveries during prolonged second stage of labor. Int J Gynaecol Obstet. 2019; 144(2):192-98.